

**UNIVERSITY OF THE PHILIPPINES MANILA
COLLEGE OF ARTS AND SCIENCES
DEPARTMENT OF PHYSICAL SCIENCES AND MATHEMATICS**

**WASMS:
Web-based Application for Soccer Motivation using Simulations
applying Artificial Neural Network**

**A Special Problem in partial fulfillment of the requirements for the degree of
Bachelor of Science in Computer Science**

Submitted by:

Carl Renstein A. Rollon

2008-01285

ACCEPTANCE SHEET

The Special Problem entitled “**WASMS: Web-based Application for Soccer Motivation using Simulations applying Artificial Neural Network**” prepared and submitted by **Carl Renstein A. Rollon** in partial fulfillment of the requirements for the degree of **Bachelor of Science in Computer Science** has been examined and is recommended for acceptance.

Vincent Peter C. Magboo, M.D., M.S.
Adviser

EXAMINERS:	Approved	Disapproved
1. Gregorio B. Baes, Ph.D. (candidate)	_____	_____
2. Avegail D. Carpio, M.S.	_____	_____
3. Richard Bryann L. Chua, Ph.D. (candidate)	_____	_____
4. Aldrich Colin K. Co, M.S. (candidate)	_____	_____
5. Perlita E. Gasmien, M.S. (candidate)	_____	_____
6. Ma. Sheila A. Magboo, M.S.	_____	_____
7. Geoffrey A. Solano, Ph.D. (candidate)	_____	_____
8. Bernie B. Terrado, M.S. (candidate)	_____	_____

Accepted and approved as partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Science.

Avegail D. Carpio, M.S.
Unit Head
Mathematical and Computing Sciences Unit
Department of Physical Sciences
and Mathematics

Marcelina B. Lirazan, Ph.D.
Chair
Department of Physical Sciences
and Mathematics

Reynaldo H. Imperial, Ph.D.
Dean
College of Arts and Sciences

ABSTRACT

Soccer is not yet a renowned sport in the Philippines and we lack efficient ways in introducing it to the people, particularly the youth. In this study, a web-based application for soccer motivation using simulations, or WASMS, is created. It renders both introductory and advanced information about the sport in enticing manners. It features primarily soccer simulations implemented in a Java applet. These simulations are incorporated in a highly graphical and smoothly animated game to provide a more effective encouragement for the target users. The simulations are inspired by the RoboCup Simulation League, a testbed for developing new methods of artificial intelligence and machine learning. In these simulations, an artificial neural network is applied to the decision-making process of AI players when trying to score a goal. The trained neural net is capable of answering two classification problems: when to shoot the ball and where to shoot it.

Keywords: Soccer Motivation, Simulations, Neural Network, Machine Learning, Classification Problem

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1 INTRODUCTION

1.1 Background of the Study

If we will consider the estimated number of fans, soccer (or football) is the most popular sport in the world [1]. It is the national sport of most European and Latin-American countries and of many other nations giving it more international acclaim than any other sport. Millions of people in more than 140 countries play soccer. In fact, the 2006 survey from Federation Internationale de Football Association (FIFA) found out that 265 million male and female players in addition to 5 million referees and officials making a grand total of 270 million people – or 4% of the world’s population – have been actively involved in the game of football [2].

Unfortunately, soccer is still in its infancy stage here in our country. Soccer is a sport best suited for Filipinos mainly because the ball is on the ground, unlike basketball where the ball is on the air, hence giving the tall players undue advantage. But why isn’t it more popular than basketball? Why isn’t popular at all? Several reasons account for this. First, it is not that accessible for most of us because of the lack of space. A soccer field is almost ten times larger than a basketball court – not counting the fact that basketball is frequently played using a single rim and a court less than half of its normal field. Another reason is U.S. colonialism; the Philippines is indeed one of the most US-centered culture in the world. It is basketball but not football which is our colonizer’s favorite game [3]. In addition to that, we lack nationwide soccer matches. Metro manila, which is our capital and therefore sets most of the trends in the country, lacks space for the development of soccer fields making it impractical to hold football leagues. Soccer matches also suffer from the lack of sponsors. A typical soccer game lasts for 90 minutes, nonstop; there is just no time for advertising. Lastly, soccer is not being taught in primary and

secondary education. Nearly all schools do not include it in their curriculum, making it a foreign concept to the youth. Most children do not know how to play the sport; they don't even know what it is.

Apparently, now we have a group of soccer players who have once again rekindled the interest on soccer. Our national team, the Azkals, has been recently showing successful results in different Asian cups [4]. But the Azkals' feat is more than just bringing honor to the country. With this development, soccer is getting the much needed pinch in the arm and may yet get the proper support it needs to make it one of the country's marquee sports. Nevertheless, introducing soccer to most Filipinos, the young ones in particular, and motivating them into playing the sport are still necessary. Watching real soccer games is not an effective way to achieve this. Actual matches are often boring especially to those without basic knowledge about the sport. Most of our local schools are also not helping with soccer motivation. They won't introduce football because it is not included in their curriculum and they usually do not have sufficient space for the field. On the other hand, computers and the internet can feasibly achieve the essential introductions and motivations for soccer because children nowadays spend more time on using computers than playing outdoors. Websites, especially with plug-ins support, could be useful in giving them the basic understanding on football and provoke them to start playing the sport.

Besides providing the basic knowledge and information about soccer, soccer learning sites should also have simulations of the sport. These help in enticing the children to learn football [5]. These simulations must be sensible and realistic to be effective but, at the same time, simple to be easily understood and absorbed. In relation to this, for the past decade, there has been an ongoing research domain about soccer simulations. The *RoboCup* or Robotic Soccer has been the new standard problem in the field of Artificial Intelligence(AI) [6]. Basically, it is a soccer league in which the participants are all robots, real or virtual. Soccer simulations in this study are motivated by RoboCup.

A good soccer simulation should have intelligent virtual players. Since a soccer scenario is difficult and complex to simulate, proper AI tools must be used. As an example, consider the *Optimal Scoring Problem* in soccer which can be stated as follows: find the point in the goal where the probability of scoring is the highest when the ball is shot to this point in a given situation [7]. Basically, it is the decision-making situation that the *strikers* (players who usually shoot the ball to the goal) always faced every time they attempt to score. Deciding what action to take in soccer simulation can be thought of as a *classification problem* where a game situation is classified according to the best next action [8]. Machine learning techniques are suitable for classification problems such as this, and for the simulations in this study, an *artificial neural network* is implemented.

1.2 Statement of the Problem

Currently, soccer is not a renowned sport here in the Philippines. Billions of people around the world have been watching the World Cup 2010 games, and surprisingly, we're not [4]. Filipinos are so obsessed with basketball, and, to an extent, boxing. In every corner of our streets, you'll probably see an improvised hoop with people, of all ages, playing basketball. But sadly, this is not the case with soccer. And it is a game we Filipinos can dream of excelling in some day, unlike the tall man's game, basketball, in which we are genetically handicapped so that we'll never stand out.

Interest in the youth level must be encouraged. Most schools do not incorporate soccer in their curriculum even it is feasible. In physical education, schools in basic education teach basketball, volleyball, badminton, table tennis and other sports, but not soccer. Majority of the youth is not even familiar with game. Thus, motivational tools are necessary for the introduction and appreciation of soccer. However, we lack software resources that may introduce soccer to children. Available applications are too advanced for those who are ignorant to soccer and are mostly proprietary.

1.3 Objectives

This study aims to develop a web-based tool that teaches the users the basic information about soccer and motivates them to play the sport. It will have the following functionalities:

- 1) To provide a basic understanding about soccer:
 - a) Provide a quick overview of the sport by defining what is soccer, showing screenshots from soccer matches and stating the objectives of the game.
 - b) Provide a brief comparison between soccer and other sports in the Philippines, basketball in particular.
 - c) Discuss the soccer culture of different countries and the role of the youth, and then relate it to the state of soccer here in the local setting.
- 2) To teach the user the mechanics of a soccer match:
 - a) Different positions in a soccer team and their respective roles.
 - b) General rules of a soccer match based from Federation Internationale de Football Association (FIFA).
- 3) To allow the user to evaluate herself by means of an interactive quiz. The quiz is all about the information present in the motivation tool and consists of:
 - a) True or False questions.
 - b) Multiple Choice questions.
 - c) Identification questions.
- 4) To develop a Java applet that shows simulations on certain shooting scenarios (shooting the ball to goal) of soccer.
 - a) One striker against a goalkeeper (the player defending the goal line). The AI striker tries to find a shooting position and attempts to kick the ball to the goal.

- b) Two strikers against a goalkeeper. The strikers are allowed to pass the ball to each other or find a shooting position for themselves as they attempt to kick the ball to the goal.
 - c) Two strikers against a goalkeeper and a defender. Similar to the previous scenario with the addition of a defender (a player assigned to the team's defense) to help the goalkeeper.
- 5) To implement a neural network approach to the optimal scoring problem of soccer.
- a) Develop a fully trained feedforward network to be used in decision making of a simulated soccer player when attempting to shoot the ball to the goal.
 - b) Classify the shooting attempts of a soccer player against a goalkeeper as "shootable" (a goal is possible) or "don't shoot" (a goal is not possible) situations based on positions. If it is shootable, the network further predicts the optimal point in the goal for scoring.
 - c) Apply the trained network in the above simulations.
- 6) To teach the user the basic soccer actions in the above simulations – show the simulation tutorial for action then allow the user to control the player in the simulation.
- a) Dribble.
 - b) Pass.
 - c) Shoot.
 - d) Goalkeep.
- 7) To provide an interactive versions of the above simulations.
- a) The user playing the striker (offense).
 - b) The user playing the goalkeeper (defense).

1.4 Significance of the Study

The Philippines sticks out like a sore thumb, together with its mentor the United States, for not being passionate about soccer. It is continuously pursuing the impossible dream of excelling in basketball. It would probably be better if it is the other way around, but currently, we Filipinos are just not interested in the beautiful sport of soccer. Having said that, the primary purpose of this study is to serve as a motivational tool for soccer here in the local setting.

Watching real soccer games is not that helpful in introducing the sport to the children. Being lengthy in nature of a soccer match, it becomes boring for the viewers, especially if they don't have enough background in soccer. Actual matches won't be able to introduce the sport enticingly. And if added here the fact, from the previous paragraph, that soccer is not being taught in schools, how will soccer be introduced to the children? This tool, being web-based since children nowadays spend lot of hours surfing the internet, will provide them that necessary push to learn and love soccer.

The target users of this motivational tool will be the Filipino youth, those below undergraduate level, that are often unfamiliar to the sport because it is not included in their school's curriculum. The application will be child-friendly and Filipino-friendly unlike most available learning software for soccer. The application could teach them the basic knowledge about soccer and show them simulations of interesting soccer scenarios; prerequisites for building their own passion for the sport.

Lastly, looking from a different perspective, this study can add to the researches in the Artificial Intelligence domain, particularly in the implementation of Neural Networks. The study is motivated from RoboCup which is a new standard problem in AI. RoboCup researches are very scarce, if there's any, here in the Philippines. The soccer simulations used in the study may serve as a reference for future researches in Artificial Intelligence particularly in RoboCup, and the implementation of Neural Networks as a Machine Learning technique.

1.5 Scope and Limitations

- 1) The soccer tool is only motivational and introductory. It is not a training tool; it is not developed for the purpose of teaching how to improve one's soccer skills.
- 2) The web-based motivation tool is static.
- 3) The Java applet does not cover a simulation of a complete soccer game, only shooting scenarios.
- 4) Simulations are 2-dimensional. 3D features such as height are ignored.
- 5) Only one neural network is applied in all the simulations involving shooting to goal.
 - a) It is a multi-layer feedforward network.
 - b) It has 6 input neurons, composed by the parameters for a scoring situation: the distance and angle of the ball with respect to the goal, the position of the ball, and also the position of the goal keeper. It has 6 output neurons: one for predicting success or failure of the scoring attempt, and the other five for determining the optimal location in the goal to shoot the ball.
 - c) The activation function for the first layer is tan-sigmoid and log-sigmoid for the second.
 - d) Backpropagation algorithms are used to adjust the weights.
 - e) Data sets are generated from a separate but similar simulation environment.
 - f) Training is supervised and off-line.
 - g) The performance function to be used is mean square error (MSE) and the hypothetical performance goal is 0.05.
 - h) Once trained, the network will never be trained again.

2 REVIEW OF RELATED LITERATURE

Kitano *et al.* (1995) proposed a new standard problem for Artificial Intelligence (AI) research: the Robot World Cup Initiative or RoboCup [6]. It was a proposal to use soccer game as a platform for a wide range of AI and robotics research, such as design principles of autonomous agents, multi-agent collaboration, strategy acquisition, real-time reasoning, and sensor fusion. The goal of RoboCup was to develop a team of fully autonomous humanoid robots that can win against the human world soccer champion team by the year 2050. They designed it to meet the need of handling real world complexities, though in a limited world, while maintaining an affordable problems size and research cost.

They viewed a soccer game as a specific but very attractive real-time multi-agent environment and regarded a soccer team as a multi-agent system, thus arousing lot of interesting research issues. They discussed several research issues involved in realizing real robots for RoboCup such as design of RoboCup players and their control, vision and sensor fusion, learning robot behaviors, task representation and environment modeling. They described the rules for RoboCup, which at that time consisted of three sections: real robot section, simulation section and special skill section. They also developed a network-based graphical simulation environment: the RoboCup Simulator – MARS [6]. Their paper served as an invitation to other researchers for their participation to the initiative.

Veloso *et al.* (1999) introduced an action-selection algorithm that allows for a teammate to anticipate the needs of other teammates. Anticipation is critical for maximizing the probability of successful collaboration in teams of agents [8]. It has two categories: single-agent anticipation and anticipation for team collaboration. In single-agent anticipation, a complete intelligent agent cycle is as follows: to sense the environment, to reason about and select their actions, and to act in the real world.

Individual agents act autonomously during the games and their communications are limited. On the other hand, probability of a successful collaboration of an active agent with a passive agent is computable as a function of the dynamic world.

They formalized a strategic positioning algorithm: the Strategic Positioning with Attraction and Repulsion (SPAR). SPAR maximized the repulsion from other agents and minimized attraction to the ball and to the goal [8]. They viewed this as an optimization problem and solved numerically under constraints which were specific to each team environment. Their algorithm was tested during real RoboCup-98 games. Their successful results showed anecdotal evidence of the good performance of their algorithm.

RoboCup simulated soccer presented many challenges to reinforcement learning methods, including a large state space, hidden and uncertain state, multiple agents, and long and variable delays in the effects of actions [9]. Stone and Sutton (2001) began to scale reinforcement learning up to RoboCup simulated soccer. They considered a subtask of soccer involving 5-7 players rather than the full 22. This is the task of keepaway, in which one team, the keepers, is trying to maintain possession of the ball within a limited region, while another team, the takers, is trying to gain possession [9]. Whenever the takers take possession or the ball leaves the region, the episode ends and the players are reset for another episode (with the keepers being given possession of the ball again).

Keepaway was mapped onto a discrete-time, episodic, reinforcement-learning framework (Stone & Sutton, 2001). Skills of the learners (keepers and takers) were defined: *HoldBall()*, *PassBall(k)*, *GetOpen()*, *GoToBall()* and *BlockPass(k)* [9]. Because of time step difficulties, the problem was treated as a semi-Markov decision process, or SMDP. In here, the keepers were being rewarded for each time step in which they keep possession while the takers, on the other hand, were being penalized. They used the SMDP version of the Sarsa algorithm with linear tile-coding function approximation (also known as

CMACs). Each player learned independently from its own actions and its own perception of the state. Their experiments focused first on learning by keepers in 3 vs. 2 keepaway in a 20x20 region. Then they generalized by increasing the field size and the number of players.

RoboCup simulated soccer has been used as the basis for successful international competitions and research challenges. It presented many challenges to machine learning (ML) methods, including a large state space, hidden and uncertain state, multiple agents, and long and variable delays in the effects of actions. But there was a problem, these machine learning approaches to RoboCup were all embedded within disparate systems, and often address different subtasks of the full soccer problem [10]. So Stone and Sutton (2002) put forth keepaway soccer as a domain suitable for directly comparing different machine learning approaches to robotic soccer. It was complex enough that it can't be solved trivially, yet simple enough that complete machine learning approaches were feasible.

Whiteson and Stone (2002) hypothesized that there are situations where layered learning, a hierarchical paradigm that relies on learning the various subtasks necessary for achieving the complete high level goal, would work better if the lower layers were allowed to keep learning concurrently with the training of subsequent layers. They called this approach concurrent layered learning [11]. Their implementation of layered learning used neuro-evolution ML algorithm – a machine learning technique that uses genetic algorithms to train neural networks. Their experiments were all in the keepaway subtask of robotic soccer implemented within the SoccerBots environment. SoccerBots was a simulation of the dynamics and dimensions of a regulation game in the RoboCup small size robot league. They examined if the effects of such imperfect training environments can be mitigated or eliminated by allowing the lower layer to continue to evolve. Their results showed that concurrent layered learning outperformed traditional layered learning on the keepaway task.

Since the main purpose of a soccer game is to score goals, it is important for a robotic soccer agent to have a clear policy about whether he should attempt to score in a given situation, and if so, which point in the goal he should aim for. The optimal scoring problem can be stated as follows: find the point in the goal where the probability of scoring is the highest when the ball is shot to this point in a given situation [7].

Kok *et. al* (2002) described the implementation of a scoring policy that was used by the agents of the UvA Trilearn 2001 soccer simulating team during the RoboCup-2001 robotic soccer world championship [12]. In a given situation this policy enabled agents to determine the best shooting point in the goal together with an associated probability of scoring when the ball was shot to this point. Their policy was implemented as follows: From different shooting points, compute first the probability that the ball enters the goal. Next, determine the probability of the ball passing the goalkeeper. Assumption of independence among the two probabilities gives the total probability as the product of the two values. This total probability is a bell-shaped function and its maximum value determines the best shooting point. If the probability here is higher than a specific threshold, the agent tries to score. Otherwise she tries different alternative options, like passing or dribbling.

Kaviani *et al.* (2005) developed a RoboCup team – the RoboSina – for their thesis. Like any participating teams, the different models (visual, aural, movement, etc.) were defined for Robosina [13]. It was the first RoboCup team to implement artificial neural networks to train the shooting skill of their agents. A 2-layer feedforward network was used; it has six input neurons, six output neurons and five hidden neurons. Tan-sigmoid transfer function was applied in the first layer and log-sigmoid transfer function in the second layer. The space before the goal was divided into 16 regions. In the training phase, the agent tried to shoot at each region more than 5000 times. According to the relative distance and relative direction of the ball to the goal and the position of the opponent goalie, the agent was

either successful or unsuccessful in scoring. Their results showed that for all shooting attempts made, at least 70% were classified as successful scorings.

They have divided their application into three phases: providing the appropriate data and optimal target values for the supervised neural network, creating a suitable network and analyzing the data using the network, and finally evaluating the performance of the network after training procedure. The results from their experiments showed that observational learning using neural networks delivers a promising performance in comparison to a computational model.

Arrabal et al. (2006) presented SIF, an Intelligent Soccer Simulator whose objective is for the user to have the sensation that the simulator plays intelligently. In order to achieve this they have designed a technique called "Field Interaction" that can be used in different kinds of games to give intelligence [14]. It is based on the influence that each object of the game can have on the others in order to take a decision. Field Interaction models the physical environment providing an easy way to take decisions such as the movement of players [14]. We also have a rule based system that searches real game situations like: long pass, centered pass, shoot to goal, clearance due to opponent pressure, dribbling, attempt to gain possession of the ball, simple pass, etc.

Lentz (2010) developed Sebbot, a robocup team, in his master thesis. It used java client for its architecture. He focused on a soccer case study: the ball capture. He solved it using two different learning algorithms. The first one, "Q-iteration", is based on the computation of a so-called value function and uses a grid as function approximator [15]. The second one is from the class of (direct) policy search algorithms and operates with cross-entropy optimization. The two methods were integrated in Sebbot. A comprehensive set of benchmarks have been run and the numerical results were presented.

3 THEORETICAL FRAMEWORK

3.1 Soccer Preliminaries

Soccer is played by teams of eleven players on a pitch (field) of a maximum of 120 yards long and 80 yards wide [16]. The aim is to pass the ball among team members who use the feet or other parts of the body except the hands and arms to propel it into the opposing team's goal. The goals are eight feet high and eight yards wide, spanned by a crossbar and fitted with a net to receive the ball once it has crossed the goal line. Each team has a goalkeeper who is the only player allowed to use her hands, she covers the entire penalty area of the field. Four to six defenders are responsible for preventing the other team from scoring and are grouped across the first third of the field in front of their goalkeeper. In front of the defenders are three or four midfield players, the number and placement of players are decided upon by coaches and managers. Midfielders are chosen for their ability to pass the ball upfield to their attackers while still defending their end of the field. The three or two attackers/strikers are primarily there to score goals.

Goals are uncommon in soccer, most games end with the teams only having 0 or 1 score. A drawn match can be decided by penalty kicks from a point twelve yards away from the center of the goal [16]. Infringements of the rules within the penalty area result in penalty kicks; free kicks are given from where infringements occur in other parts of the pitch. When the ball goes out of bounds, the game is restarted with a throw-in from the sides or by a goal-kick (when the attacking team has shot wide of the goal). If the defending team sends the ball past their own goal-line, then the attacking team takes a corner kick from the corner of the pitch. The rules of the game are upheld by a referee and two assistants. A soccer game lasts for ninety minutes and the teams change ends after the first half.

3.2 RoboCup Simulation League

The RoboCup simulation league is implemented on the RoboCup simulator called the soccer server [17], a physical soccer simulation system. All games are visualized by displaying the field of the simulator by the soccer monitor on a computer screen. The soccer server is written to support competition among multiple virtual soccer players in an uncertain multi-agent environment, with real-time demands as well as semi-structured conditions. One of the advantages of the soccer server is the abstraction made, which relieves the researchers from having to handle robot problems such as object recognition [12], communications, and hardware issues, e.g., how to make a robot move. The abstraction enables researchers to focus on higher level concepts such as co-operation and learning.

Since the soccer server provides a challenging environment, i.e., the intentions of the players cannot mechanically be deduced, there is a need for a referee when playing a match. The included artificial referee is only partially implemented and can detect trivial situations, e.g., when a team scores. However, there are several hard-to-detect situations in the soccer server, e.g., deadlocks, which brings the need for a human referee. All participating teams are also obliged to play according to a gentlemen's agreement, e.g., not to use loopholes.

3.3 Optimal Scoring Policy

Since the main purpose of a soccer game is to score goals, it is important for a soccer AI player to have a clear policy about whether he should attempt to score in a given situation, and if so, which point in the goal he should aim for.

The optimal scoring problem can be stated as follows: *find the point in the goal where the probability of scoring is the highest when the ball is shot to this point in a given situation* [7]. This is not a

straightforward problem. The reason for this is that the total number of possible situations is extremely large and that different variables can be decisive for different situations. Furthermore, the problem depends on many uncertain factors. For example, the noise in the ball motion can never be exactly predicted and will be different for different distances that the ball travels. For finding the optimal scoring point by iterating over all possible points in the goal, one will thus have to take many different functions into account, since the distance from the shooting position to the scoring point will be different for each point in the goal. On top of this, the behavior of the opponent goalkeeper cannot be easily predicted but is an important factor for solving the problem. As a result, no simple analytical solution to the problem exists and one has to look for different methods.

3.4 Artificial Neural Networks

An artificial neural network consists of a pool of simple processing units which communicate by sending signals to each other over a large number of weighted connections. A set of major aspects of a parallel distributed model can be distinguished [18]:

- a set of processing units, or neurons;
- a state of activation y_k for every unit, which is equivalent to the output of the unit;
- connections between the units, or the set weights w_{jk} ;
- a propagation rule, which determines the effective input s_k of a unit from its external inputs;
- an activation function \mathcal{F}_k , which determines the new level of activation based on the effective input $s_k(t)$ and the current activation $y_k(t)$;
- an external input (a.k.a. bias or offset) θ_k for each unit;
- a method of information gathering, or the learning rule;

- an environment within which the system must operate, providing input signals and – if necessary – error signals.

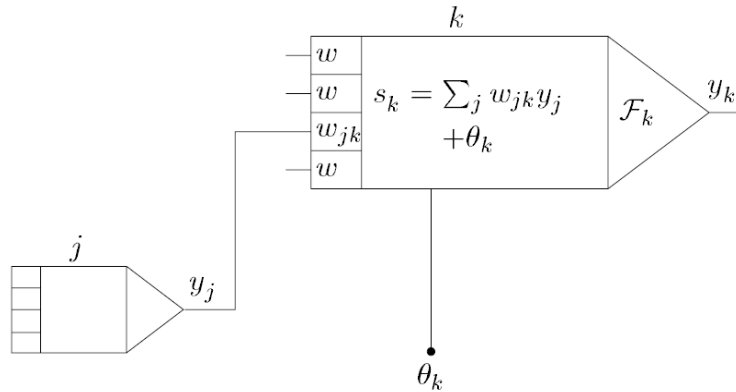


Figure 3.1 – The basic components of an artificial neural network. The propagation rule used here is the ‘standard’ weighted summation.

Each processing unit performs a relatively simple job: receive input from neighbors or external sources and use this to compute an output signal which is propagated to other units. Apart from this processing, a second task is the adjustment of the weights. The system is inherently parallel in the sense that many units can carry out their computations at the same time. A unit can be of three types: an *input* unit i which receives data from outside the neural network, an *output* unit o which sends data out of the neural network, or a *hidden* unit h whose input and output signals remain within the neural network. During operation, units can be updated either *synchronously* or *asynchronously* [19].

The total input to a unit k is simply the weighted sum of the separate outputs from each of the connected units plus a *bias* or *offset* term θ_k :

$$s_k(t) = \sum_j w_{jk}(t)y_j(t) + \theta_k(t) \quad (1)$$

A rule which gives the effect of the total input on the activation of the unit is also needed [20]. A function \mathcal{F}_k which takes the total input $s_k(t)$ and the current activation $y_k(t)$ and produces a new value of the activation of the unit k :

$$y_k(t + 1) = \mathcal{F}_k(y_k(t), s_k(t)) \quad (2)$$

Often, the activation function is a nondecreasing function of the total input of the unit:

$$y_k(t + 1) = \mathcal{F}_k(y_k(t), s_k(t)) = \mathcal{F}_k(\sum_j w_{jk}(t)y_j(t) + \theta_k(t)) \quad (3)$$

Generally, some sort of threshold function is used: a hard limiting threshold function (a sgn function), or a linear or semi-linear function, or a smoothly limiting threshold, as shown in Figure 3.2. For this smooth function often a sigmoid (S-shaped) function like

$$y_k = \mathcal{F}_k(s_k) = \frac{1}{1+e^{-s_k}} \quad (4)$$

is used. In some applications a hyperbolic tangent is used, yielding output values in the range $[-1, +1]$.

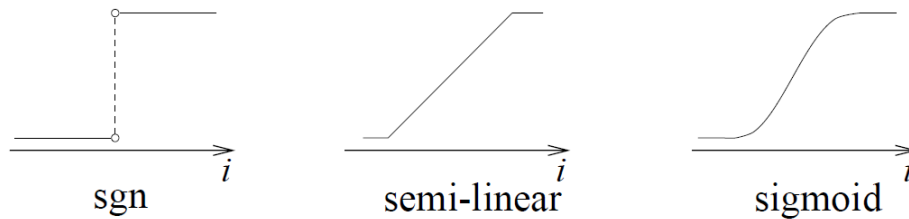


Figure 3.2 – Various activation functions for a unit.

3.5 Feedforward Neural Networks

Feedforward networks are topologies where the data flow from input to output units is strictly feed-forward [20]. The data processing can extend over multiple layers of units but no feedback connections are present, that is, connections extending from outputs of units to inputs of units in the same layer or previous layers.

A feedforward network has a layered structure. Each layer consists of units which receive their input from units from a layer directly below and send their output to units in a layer directly above the unit. There are no connections within a layer. The N_i inputs are fed into the first layer of $N_{h,1}$ hidden

units. The input units are merely ‘fan-out’ units; no processing takes place in these units. The activation of a hidden unit is a function \mathcal{F}_i of the weighted inputs plus a bias, as given in eq. 3. The output of the hidden units is distributed over the next layer of $N_{h,2}$ hidden units, until the last layer of hidden units, of which the outputs are fed into a layer of N_o output units. (See Figure 3.3)

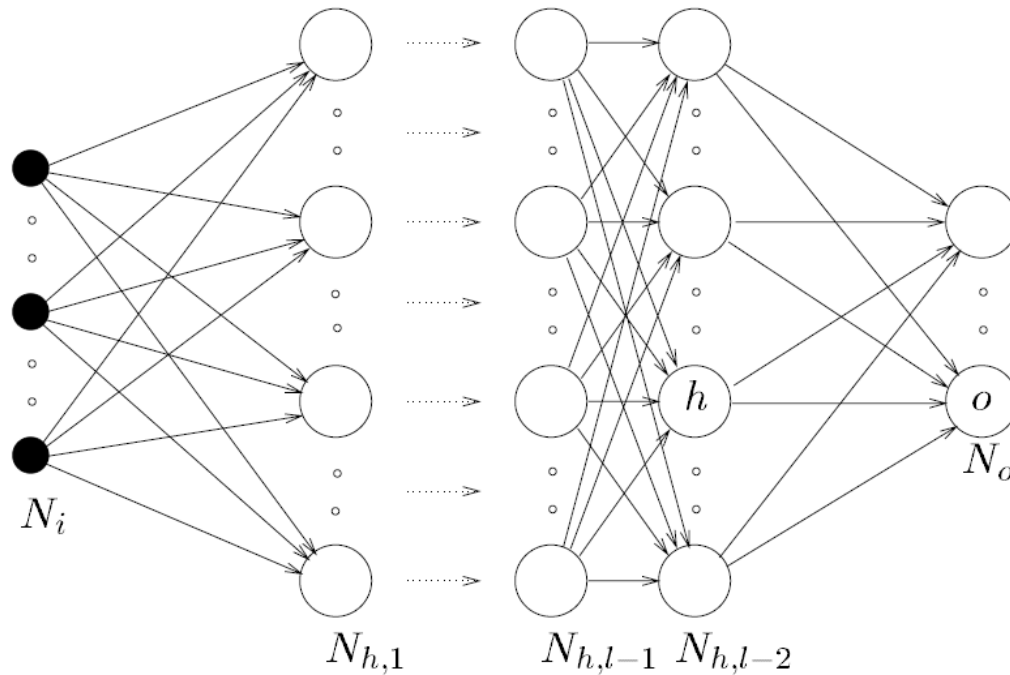


Figure 3.3 – Multi-layer feedforward network with l layer of units

Although back-propagation can be applied to networks with any number of layers, just as for networks with binary units it has been shown [21] that only one layer of hidden units suffices to approximate any function with finitely many discontinuities to arbitrary precision, provided the activation functions of the hidden units are non-linear (*the universal approximation theorem*). In most applications a feed-forward network with a single layer of hidden units is used with a sigmoid activation function for the units.

Suppose we want to train the network such that a hyperplane is fitted as well as possible to a set of training samples consisting of input values x^p and desired (or *target*) output values d^p . For every

given input sample, the output of the network differs from the target value d^p by $(d^p - y^p)$, where y^p is the actual output for this pattern. The delta-rule, a learning rule that uses the net output without further mapping into output values -1 or +1, uses a cost- or error-function based on these differences to adjust the weights [20].

To adjust the weights using sigmoid activation functions, we need these three equations:

- The weight of a connection is adjusted by an amount proportional to the product of an error signal δ , on the unit k receiving the input and the output of the unit j sending this signal along the connection:

$$\Delta_p w_{jk} = \gamma \delta_k^p y_j^p \quad (5)$$

where γ is the constant of proportionality

- If the unit is an output unit, the error signal is given by

$$\delta_o^p = (d_o^p - y_o^p) \mathcal{F}'(s_o^p) \quad (6)$$

Take the activation function \mathcal{F} as the sigmoid function as defined in eq. (4)

$$y^p = \mathcal{F}(s^p) = \frac{1}{1 + e^{-s^p}}$$

In this case the derivative is equal to

$$\begin{aligned} \mathcal{F}'(s^p) &= \frac{\partial}{\partial s^p} \frac{1}{1 + e^{-s^p}} \\ &= y^p(1 - y^p) \end{aligned} \quad (7)$$

such that the error signal for an output unit can be written as:

$$\delta_o^p = (d_o^p - y_o^p) y_o^p (1 - y_o^p) \quad (8)$$

- The error signal for a hidden unit is determined recursively in terms of error signals of the units to which it directly connects and the weights of those connections. For the sigmoid activation function:

$$\delta_h^p = \mathcal{F}'(s_h^p) \sum_{o=1}^{N_o} \delta_o^p w_{ho} = y_{oh}^p (1 - y_h^p) \sum_{o=1}^{N_o} \delta_o^p w_{ho} \quad (9)$$

The learning procedure requires that the change in weight is proportional to $\partial E^p / \partial w$. True gradient descent requires that infinitesimal steps are taken. The constant of proportionality is the learning rate γ . For practical purposes we choose a learning rate that is as large as possible without leading to oscillation. One way to avoid oscillation at large γ , is to make the change in weight dependent of the past weight change by adding a *momentum* term:

$$\Delta w_{jk}(t + 1) = \gamma \delta_k^p y_j^p + \alpha \Delta w_{jk}(t) \quad (10)$$

where t indexes the presentation number and α is a constant which determines the effect of the previous weight change [20].

The approximation of a network is not perfect; the resulting approximation error is influenced by:

1. The learning algorithm and number of iterations. This determines how good the error on the training set is minimized.
2. The number of learning samples. This determines how good the training samples represent the actual function.
3. The number of hidden units. This determines the 'expressive' power of the network. For 'smooth' functions only a few number of hidden units are needed, for wildly fluctuating functions more hidden units will be needed.

All neural network training algorithms try to minimize the error of the set of *learning samples* which are available for training the network [20]. The average error per learning sample is defined as the *learning error rate*:

$$E_{learning} = \frac{1}{P_{learning}} \sum_{p=1}^{P_{learning}} E^p \quad (11)$$

in which E^p is the difference between the desired output value and the actual network output for the learning samples:

$$E^p = \frac{1}{2} \sum_{o=1}^{N_o} (d_o^p - y_o^p)^2 \quad (12)$$

This is the error which is measurable during the training process.

It is obvious that the actual error of the network will differ from the error at the locations of the training samples. The difference between the desired output value and the actual network output should be integrated over the entire input domain to give a more realistic error measure. This integral can be estimated if we have a large set of samples: the test set. We now define the *test error rate* as the average error of the test set:

$$E_{test} = \frac{1}{P_{test}} \sum_{p=1}^{P_{test}} E^p \quad (13)$$

The average learning and test error rates as a function of the learning set size are given in Fig. 3.4. Note that the learning error increases with an increasing learning set size, and the test error decreases with increasing learning set size. A low learning error on the (small) learning set is no guarantee for a good network performance! With increasing number of learning samples the two error rates converge to the same value. This value depends on the *representational power* of the network: *given the optimal weights, how good is the approximation*. This error depends on the number of hidden units and the activation function. If the learning error rate does not converge to the test error rate the learning procedure has not found a global minimum.

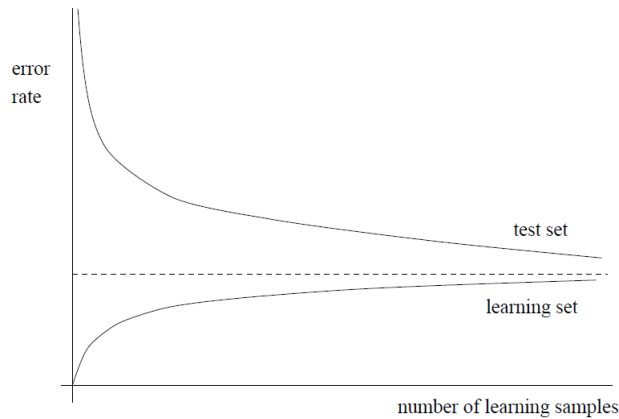


Figure 3.4 – Effect of learning set size on the error rate. The average error rate and the average test error rate as a function of the number of learning samples.

Adding hidden units will always lead to a reduction of the $E_{learning}$. However, adding hidden units will first lead to a reduction of the E_{test} , but then lead to an increase of E_{test} . This effect is called the *peaking effect*. The average learning and test error rates as a function of the learning set size are given in figure. If there is too much number of hidden units, *overtraining* occurs. The network fits exactly with the learning samples, but because of the large number of hidden units the function which is actually represented by the network is far wilder than the original one. Particularly in case of learning samples which contain a certain amount of noise (which all real-world data have), the network will ‘fit the noise’ of the learning samples instead of making a smooth approximation.

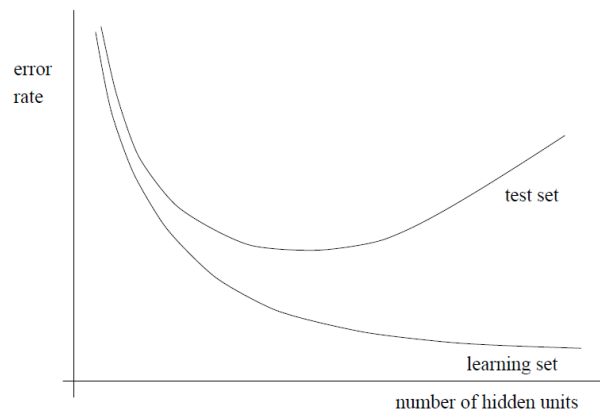


Figure 3.5 – The average learning error rate and the average test error rate as a function of the number of hidden units.

3.6 Precision, Recall and F-score

Recall or sensitivity (as it is called in Psychology) is the proportion of real positive cases that are correctly predicted positive [22]. This measures the coverage of the real positive cases by the +P (predicted positive) rule. Its desirable feature is that it reflects how many of the relevant cases the +P rule picks up. Recall tends to be neglected or averaged away in Machine Learning and Computational Linguistics (where the focus is on how confident we can be in the rule or classifier)[23]. Recall is defined, with its various common appellations, by the equation

$$Recall = \frac{True\ Positives}{True\ Positives + False\ Negatives} \quad (14)$$

Conversely, *precision* or confidence (as it is called in Data Mining) denotes the proportion of predicted positive cases that are correctly real positives [22]. This is what Machine Learning, Data Mining and Information Retrieval focus on, but it is totally ignored in ROC analysis [23]. Precision is defined as

$$Precision = \frac{True\ Positives}{True\ Positives + False\ Positives} \quad (15)$$

These two measures and their combinations focus only on the positive examples and predictions, although between them they capture some information about the rates and kinds of errors made. However, neither of them captures any information about how well the model handles negative cases [23]. Recall relates only to the +R column (real positives) and precision only to the +P row (predicted positives). Neither of these takes into account the number of true negatives. This also applies to their harmonic mean: the *F-score*. The F-score is a combination of the precision and recall rates and is a method for calculating a value without bias. [22]. F-score is defined as

$$F = \frac{2*(Precision \times Recall)}{(Precision + Recall)} \quad (16)$$

4 DESIGN AND IMPLEMENTATION

4.1 Use Case Diagram

The Use Case Diagram is depicted in Figure 4.1. The user can view basic tutorial on soccer that includes an overview, the rules, and the fundamentals like soccer skills, strategies, etc. The user can also watch and learn from the soccer videos. The user can read the articles about the state of soccer here in the Philippines. Also, the user can take an interactive quiz about the information in the tool.

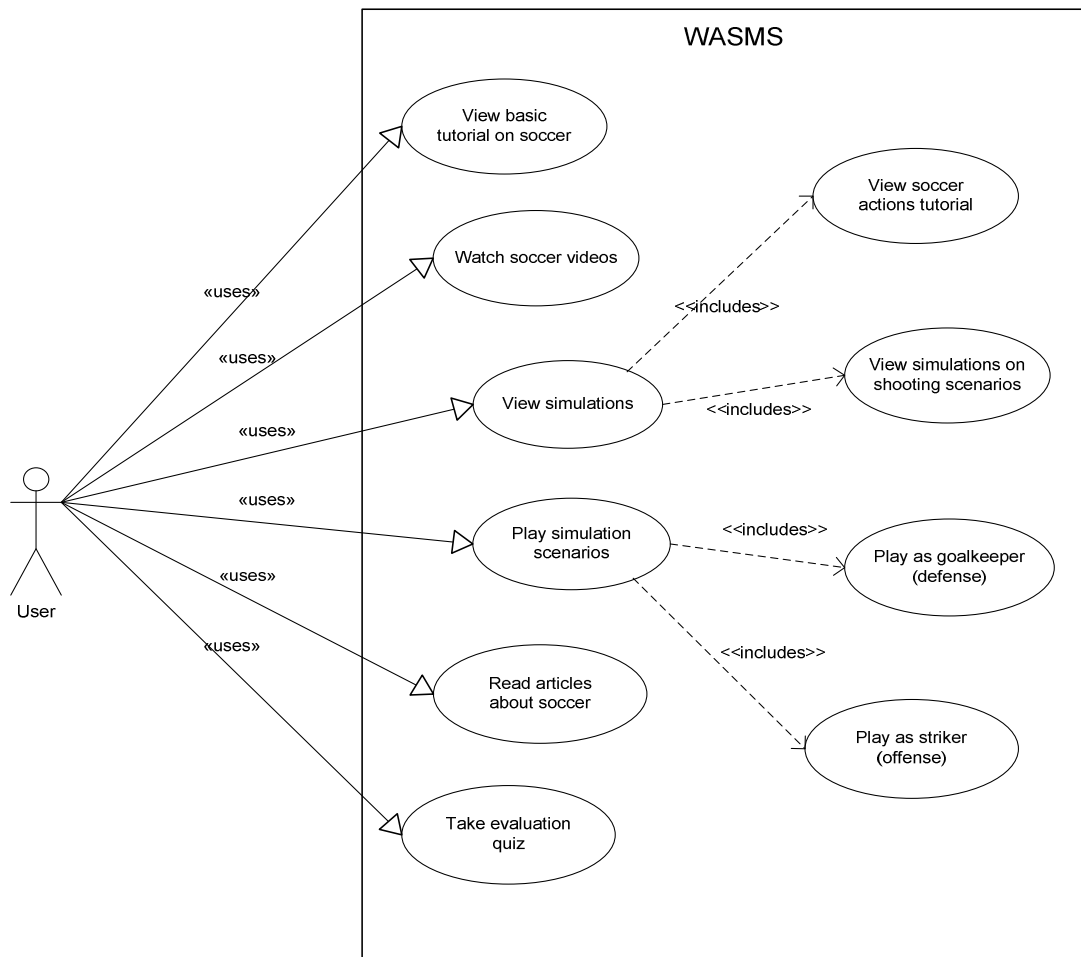


Figure 4.1 – Use Case Diagram of WASMS

View simulations include short tutorials on soccer actions and simulations of shooting scenarios. Being a motivational tool, the user can play the simulation scenarios: either as the striker or as the goalkeeper.

4.2 Simulation Designs

Since soccer simulations are very dynamic, it is necessary to create a model that will represent a moving object. This is the *MobileObject* abstract class [15], as shown in Figure 4.2. It has the following attributes: *position*, *speed*, *direction* and *rect*. Position is used to determine current location. It is an instance of *Coordinate* class, which serves as the coordinate system in the simulations. Attributes speed and direction comprise the velocity of the mobile object. Rect is used for the determining collisions. Lastly, the class has the defining method *move()*.

MobileObject class is inherited by the *Ball* class and the *Player* abstract class. The *Ball* class represents the soccer ball while the *Player* class represents the players. The *Player* class could be any of the two instances: *Attacker* or *Goalkeeper*. For the scope of the simulations in this study, an *Attacker* instance is a representation of a normal soccer player, who is not allowed to catch the ball by the hands. The *Goalkeeper* is a special type of *Player* instance and is the only one that can catch the ball. The ball is being updated for each timestep in the simulation by the method *update()*. The players are being updated by their method *execute()* which is overloaded to allow polymorphism of possible inheritors.

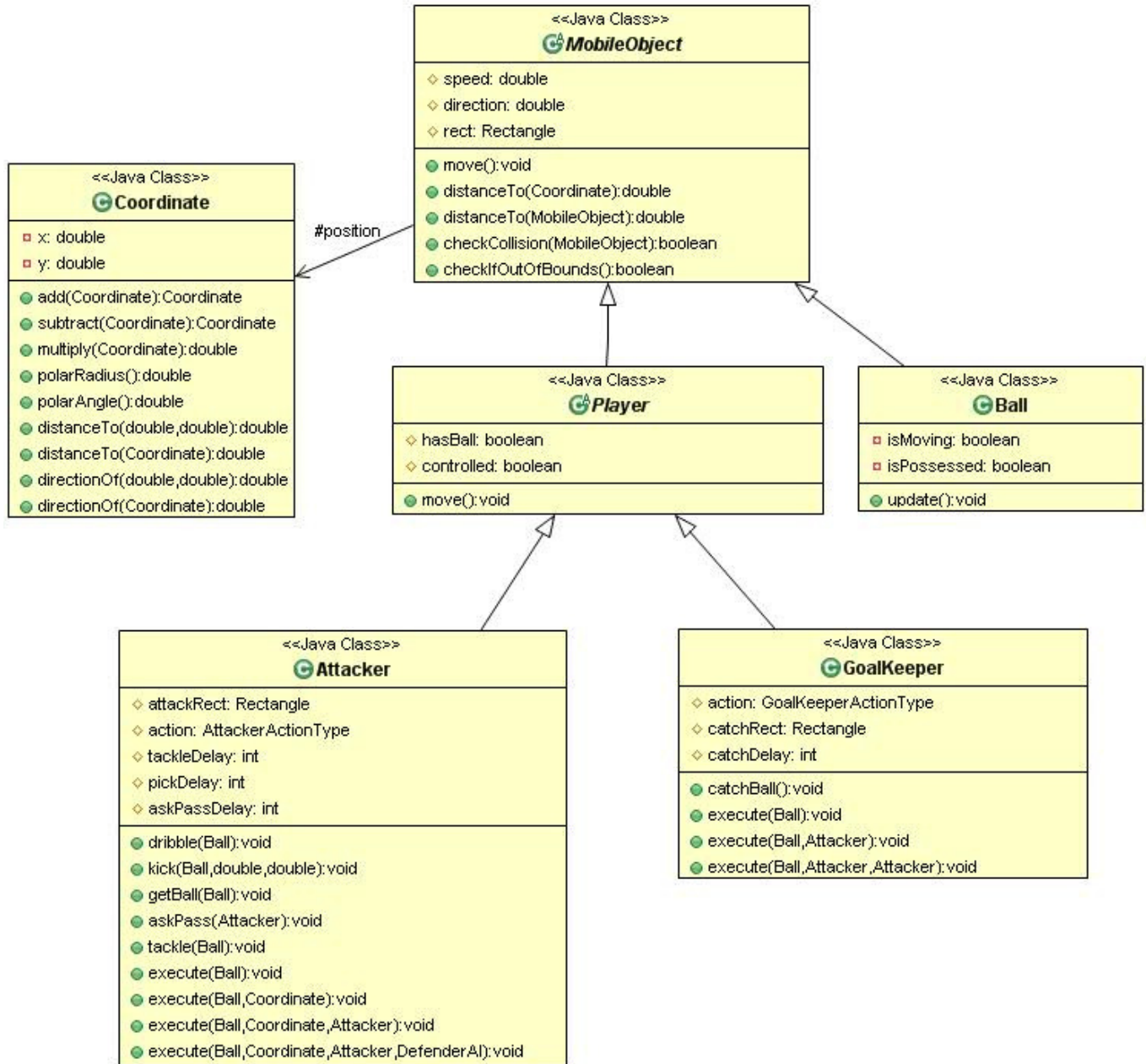


Figure 4.2 – MobileObject Class Diagram, WASMS

The sub-explosion of Goalkeeper’s class diagram is shown in Figure 4.3. Goalkeeper’s actions are defined in the enum class *GoalKeeperActionType*. To handle Goalkeeper instances that are not controlled by the user, the *GoalKeeperAI* subclass is created. The action-decisioning algorithm of an instance of this class is facilitated by the *aiCycle()* method. It returns a *GoalKeeperActionType* value for every timestep in the simulation. (See Figure 4.4)

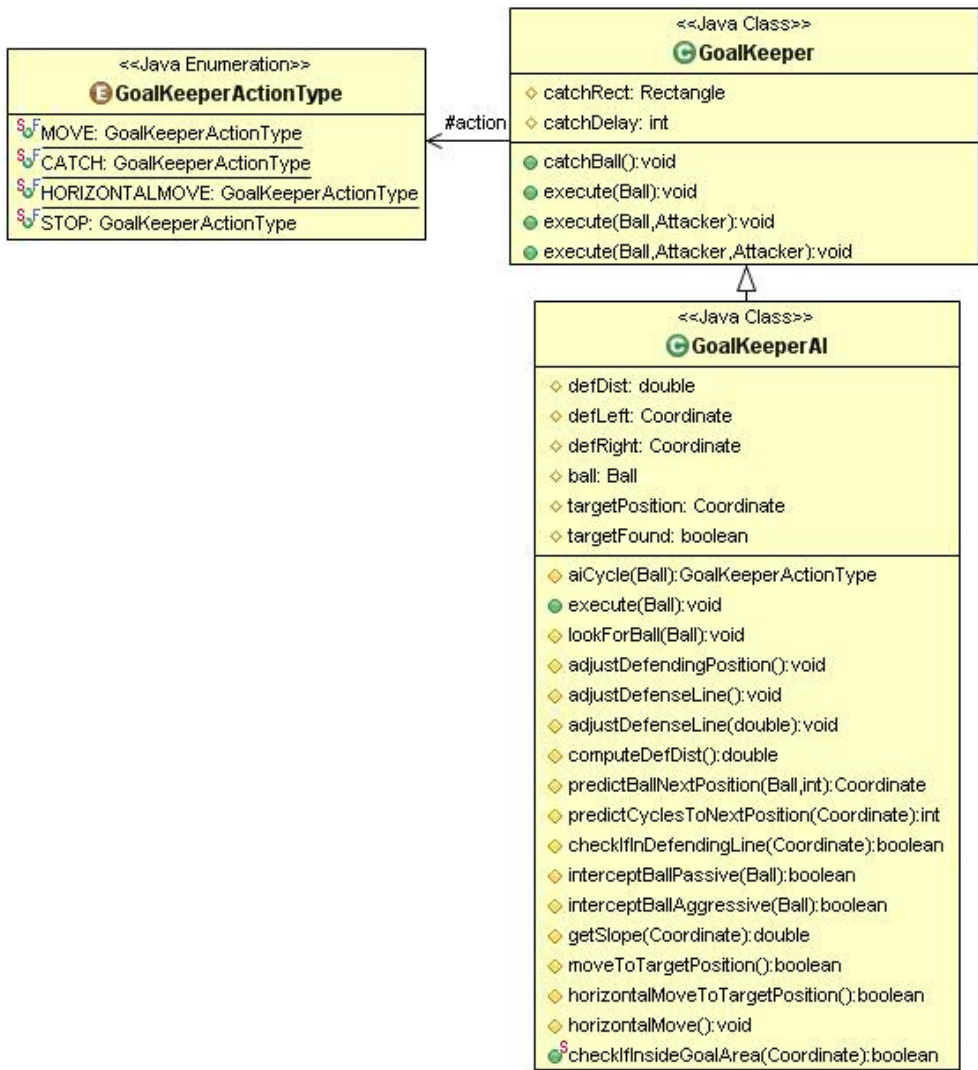


Figure 4.3 – GoalKeeper Class Diagram, WASMS

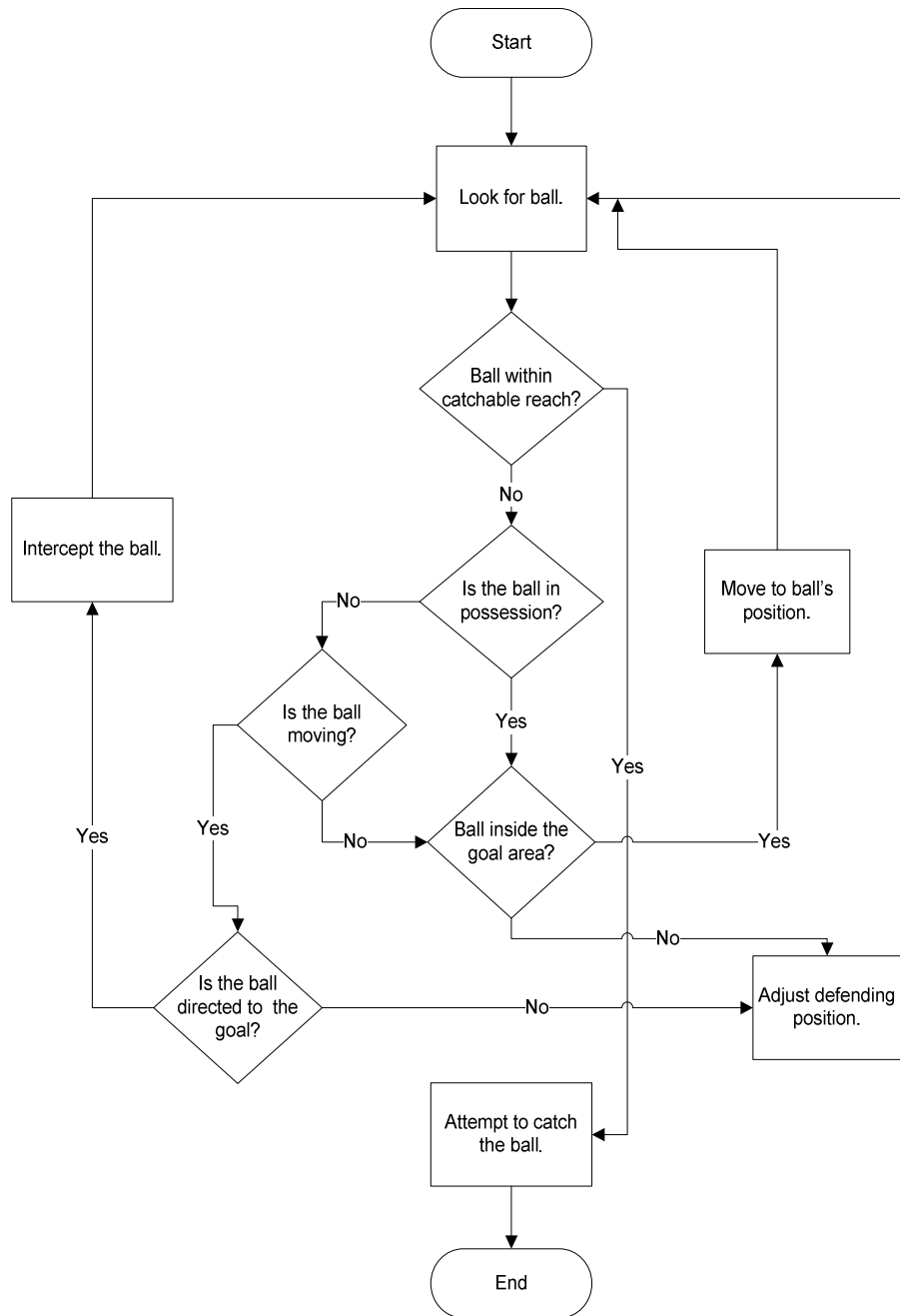


Figure 4.4 – GoalKeeperAI Decision Flowchart, WASMS

Similarly, the Attacker's actions are defined by an enum class *AttackerActionType*. It also has a subclass for handling the AI: the *AttackerAI* class. An *AttackerAI* instance uses the static class *NeuralNetwork* in its decision-making process for shooting. *AttackerAI2* is a type of *AttackerAI* that is used when another attacker instance, a teammate, is present. A *DefenderAI* instance facilitates the

player who helps the goalkeeper in defending the goal during 2 vs. 2 simulations. *AttackerAI3* is a subclass of *AttackerAI* used whenever a *DefenderAI* is present. (See Figures 4.5 - 4.7)

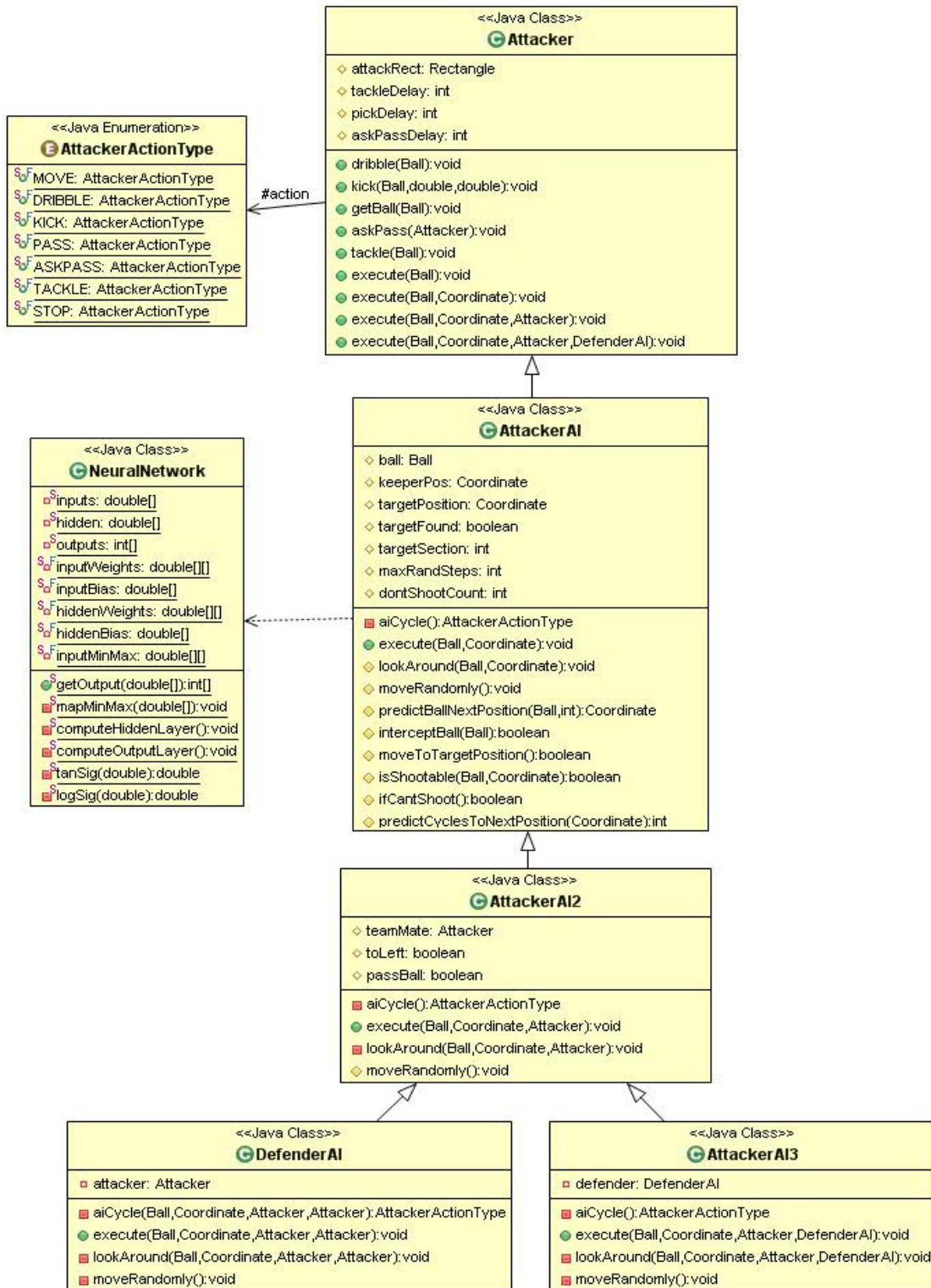


Figure 4.5 – Attacker Class Diagram, WASMS

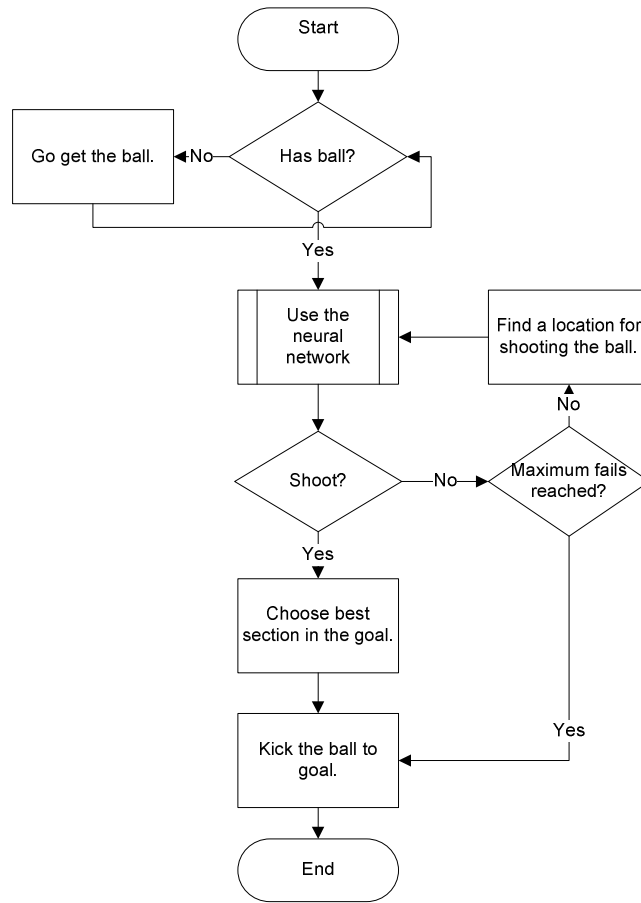


Figure 4.6 – AttackerAI Decision Flowchart, WASMS

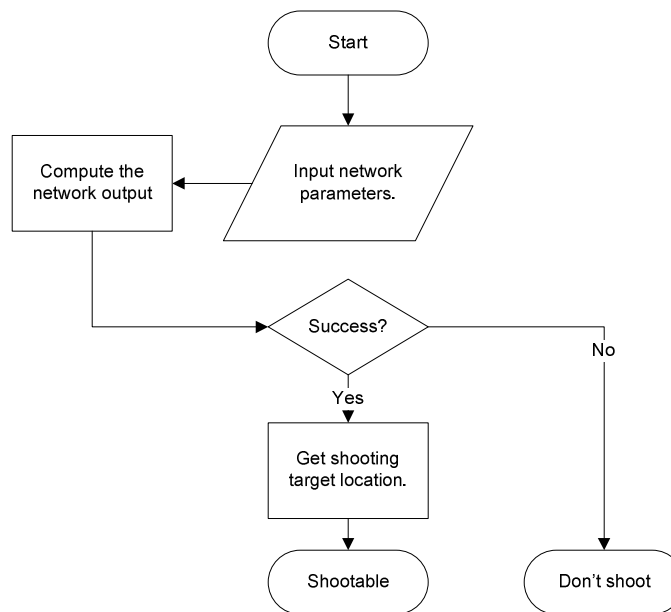


Figure 4.7 – Sub-explosion of Using the Neural Network in decision-making process for shooting, WASMS

If a teammate (another Attacker instance) is present, the decision algorithm of an attacker would be different, as seen in Figure 4.8. This is because, for one, passing is now an option. Also, there are now two of them capable of shooting the ball to the goal. The AI still uses the neural network even though the ball is possessed by his teammate. If the network outputs a “shootable” case on his position, he will ask for the ball to be passed on him instead.

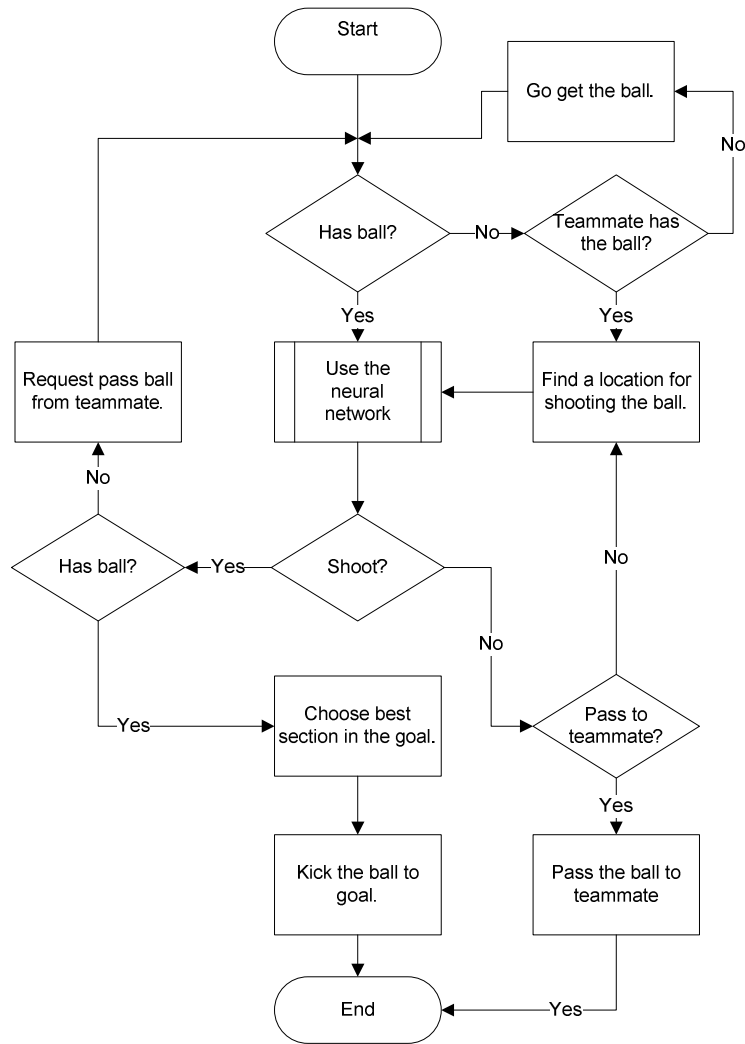


Figure 4.8 – AttackerAI Decision Flowchart when a team mate is present, WASMS

The DefenderAI decision algorithm is relatively simple. If he has the ball, give it to the goalkeeper to finish the simulation. If he does not have it, go to the ball. If the ball is possessed by an attacker, tackle the attacker to try to steal the ball. (See Figure 4.9)

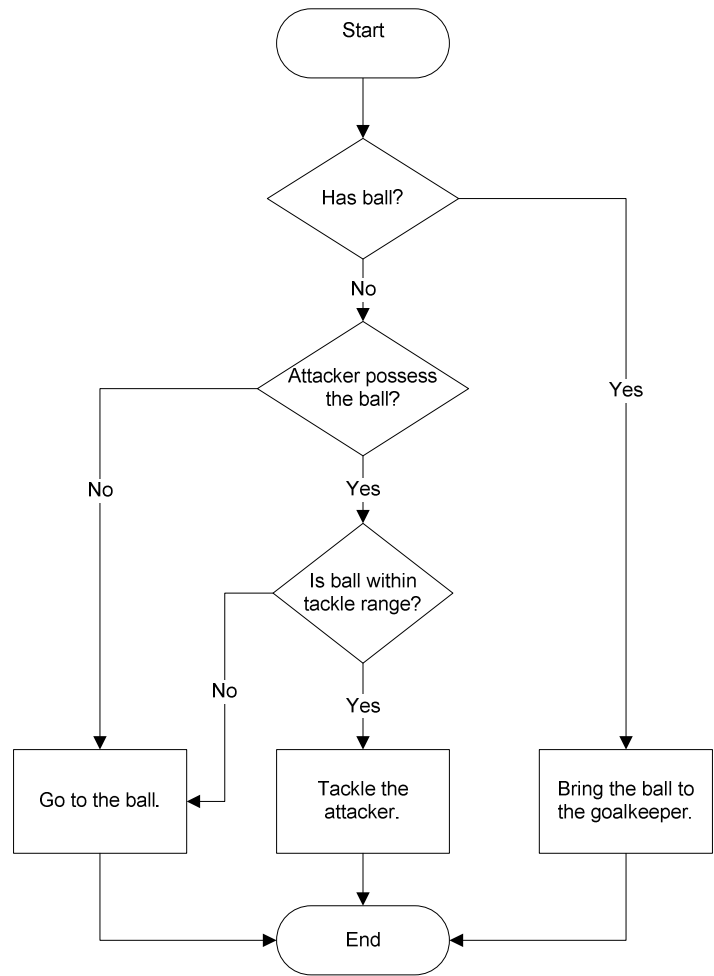


Figure 4.9 – DefenderAI Decision Flowchart, WASMS

To model the simulation of shooting scenarios, *Soccer* class is created. It has the necessary mobile objects: an attacker, the ball, and the goalkeeper. It also has attributes *gameTime* that facilitates the time left in the game, and the *goal* attribute which determines if a goal occurred. It uses the *Constants* class for the constant values being used in a simulation. It is being inherited by subclass

Soccer2, which is used in 2 vs. 1 simulation. Similarly, Soccer3 inherits Soccer2 and is being used in 2 vs. 2 simulations. (See Figure 4.10)

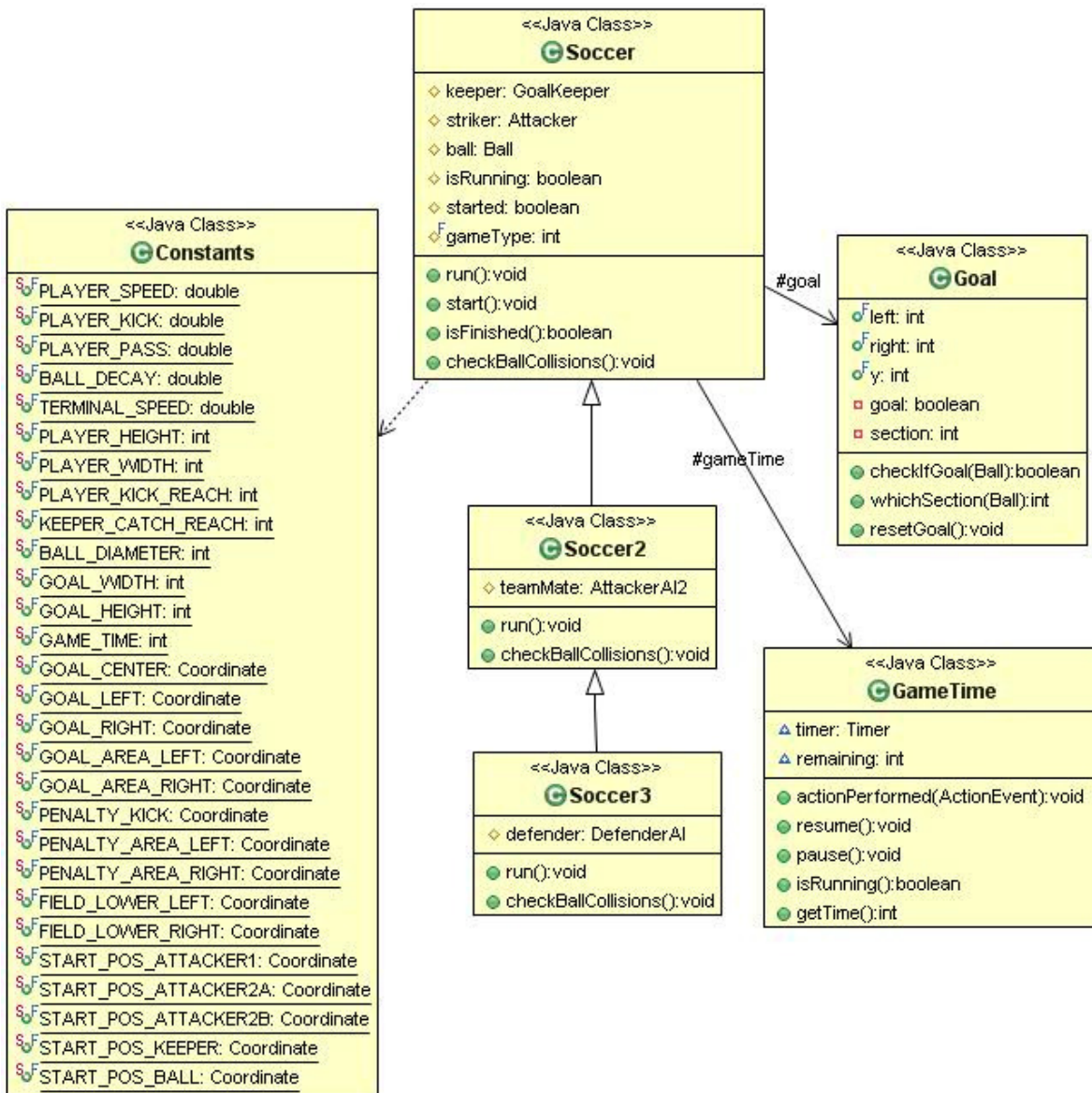


Figure 4.10 – Soccer Class Diagram, WASMS

Lastly, the *Main* class is the applet being used by the user. It has a game attribute for running the simulations on shooting scenarios and a tutorial attribute for running the tutorial simulations. (See Figure 4.11)

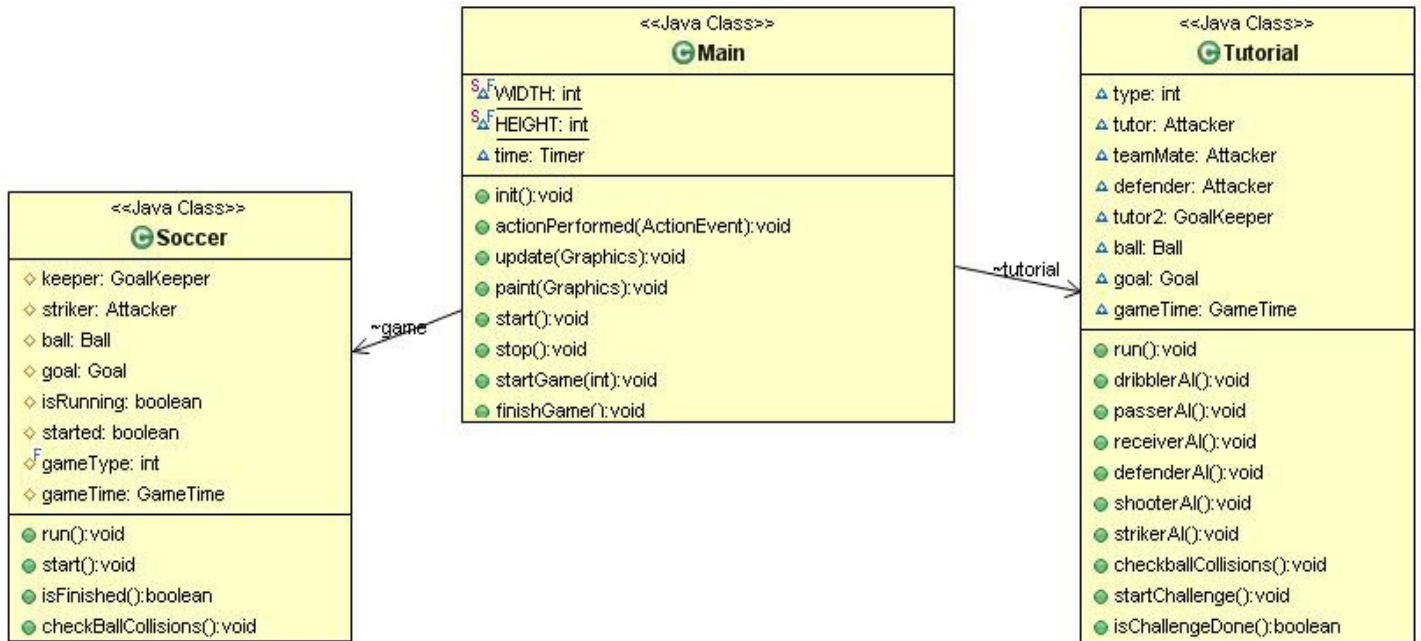


Figure 4.11 – Main (applet) Class Diagram, WASMS

On a separate package, one that will never be used by the user, are the classes developed for the training of the neural network. (See Figure 4.12) The *Episode* class runs the shooting situation, as defined by Kaviani *et. al* (2005). It uses an instance of the *AttackerTrainer* class to shoot the ball to each of the 30 goal sections. The *SampleCollector* class generates episodes (amount is equal to sample size) and collects the inputs and outputs of a training sample by the *DataSample* class. The training samples collected are exported to an excel file.

When the neural network is already trained, it is tested by using the *NeuralNetTester* class. It inherits the *SampleCollector* class to be able to use the same way of generating episodes and data samples. It has an enum class *ResultType* for the possible results of a test: a true positive, a false positive, a true negative and a false negative.

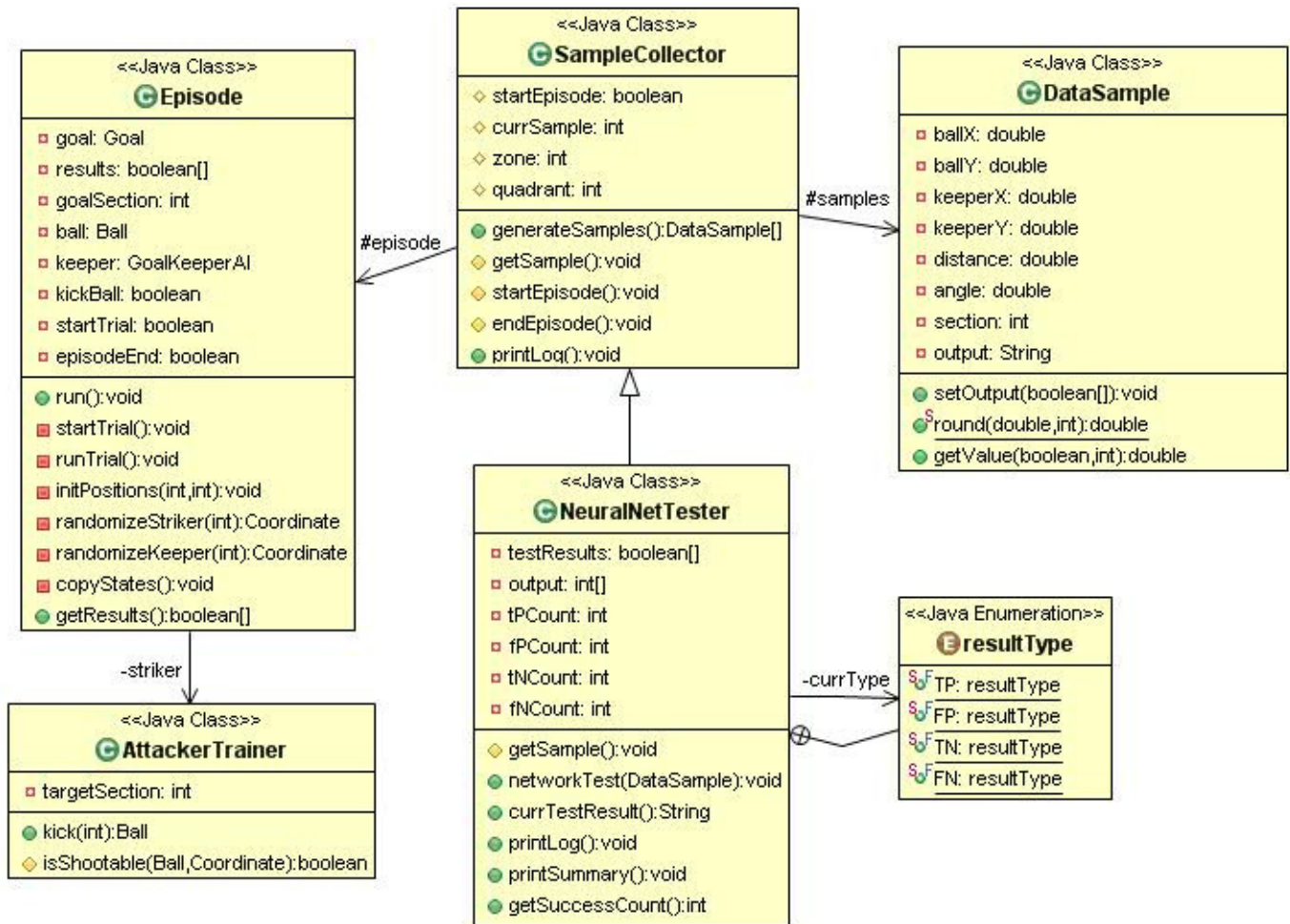


Figure 4.12 – Neural network training Class Diagram, WASMS

4.3 Application of Neural Network

The neural network being used by the soccer AIs is the chosen approach to the Optimal Scoring Problem. The network is capable of classifying shooting situations whether it is a “shootable” case or a “don’t shoot” case. If it is “shootable”, the network further predicts the best section in the goal to shoot the ball.

4.3.1 Data gathering

We generate *episodes*, which could be easily handled, to gather the training samples. An episode is defined as a shooting situation, where in the striker attempts to shoot the ball in each of the 30 sections of the goal while the goalkeeper attempts to block it [13].

At the start of an episode, the positions of the mobile objects are randomly initialized. These positions are saved so the mobile objects can be reinitialized similarly for every attempt of the striker to shoot the ball in the goal sections. If it is a goal in a certain goal section, the result in that section would be TRUE. If it isn't, the result would be FALSE.

The x and y coordinates of the ball, the x and y coordinates of the goal keeper, and the distance and angle of ball from the goal are the input parameters of a training sample. The target outputs are 6-bit binaries: the sixth value determines if the situation is "shootable" or "don't shoot" case. If a situation is "shootable", the value of the sixth output would be 1 and the first five output values would be the binary equivalent of the *best section* in the goal. The best section is defined as the median of the largest successful group of sections in the goal. For example, sections 1, 2 and 3 are the only successful sections. Thus, section 2 is the best section. On the other hand, if sections 25, 26, 27, 28, 29 and 30 are also successful, then the best section would be section 27. If a situation is a "don't shoot" case, the value of the sixth output would be 0 and the first five output values would be regarded as *don't cares*, meaning they are insignificant. The inputs and outputs will be obtained from the episode's parameters and results, respectively. (See Figures 4.13 - 4.15)

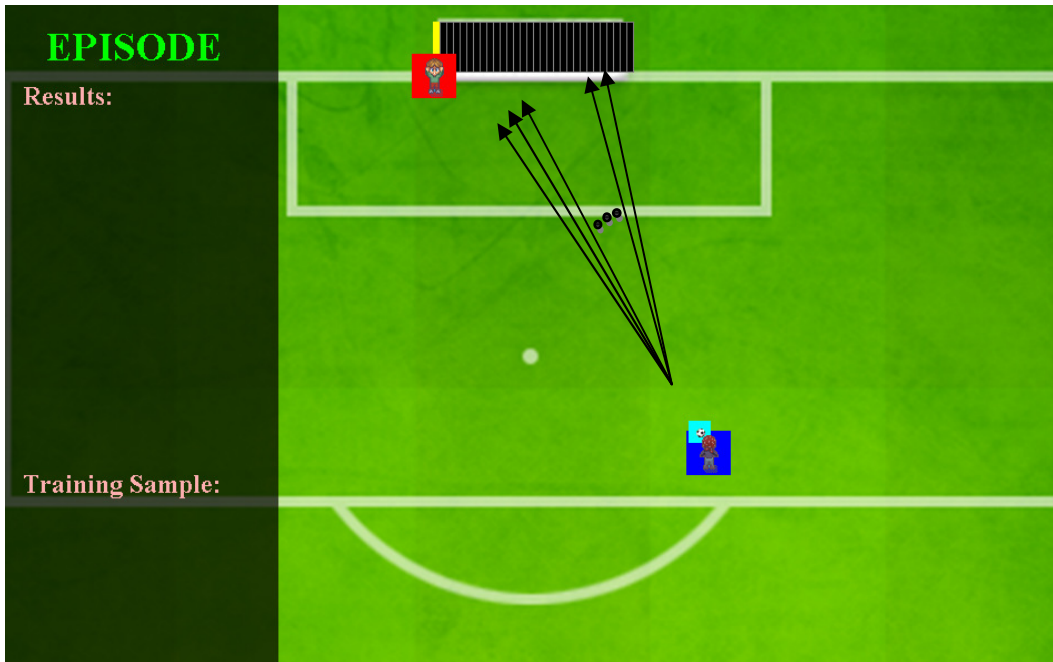


Figure 4.13 – Episode Start, WASMS

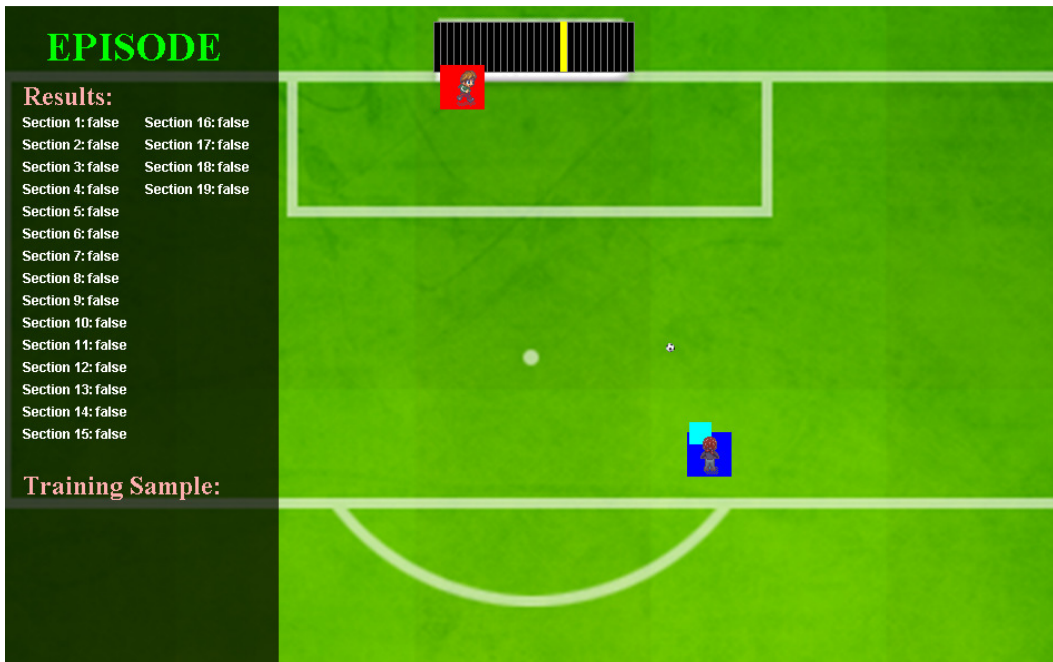


Figure 4.14 – Episode Simulation, WASMS

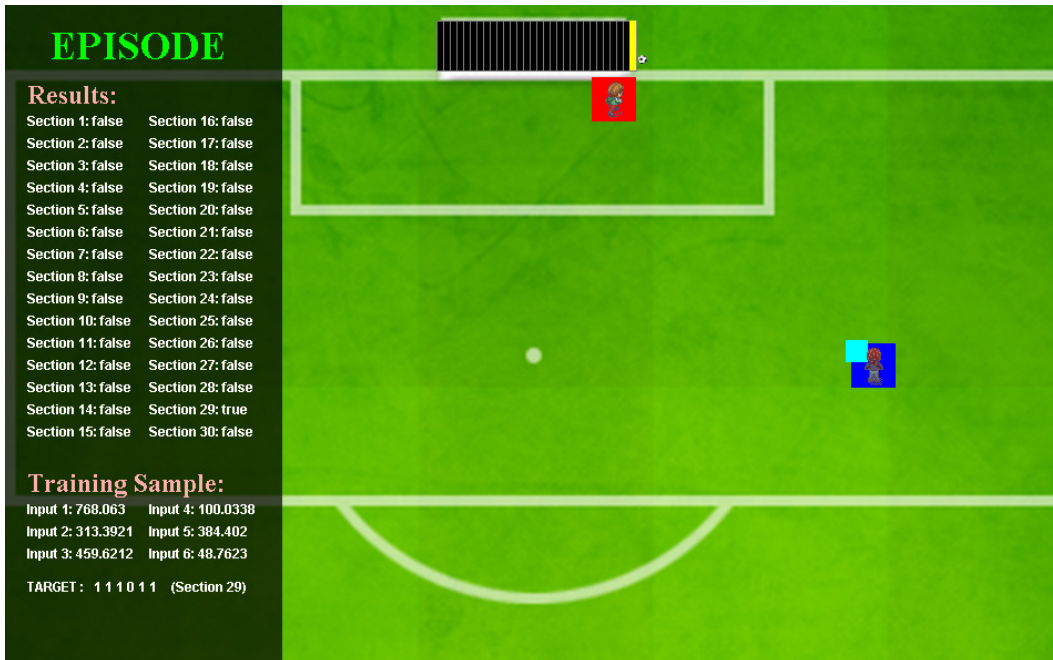


Figure 4.15 – Episode Results, WASMS

5600 training samples [13] are to be generated by cluster sampling method, as shown in Figure 4.16. For the first half of the samples, the population is divided into 8 clusters. A cluster is defined by the quadrant in which the ball was positioned and the side of the goal area where the goalkeeper resided. There are four quadrants in the field for the possible positions of the ball, and there are two sides of the goal area – the left and the right, thus mapping them gives us 8 clusters. For each cluster, 300 training samples are to be obtained by random sampling. This is to be repeated for the second half of the samples, except that the left and the right of the goal area are reduced to include only the left and right front of the goal. This is to be done to increase the distribution of the coordinates of the goalkeeper in front of the goal where he is usually found. (See Figure 4.16)

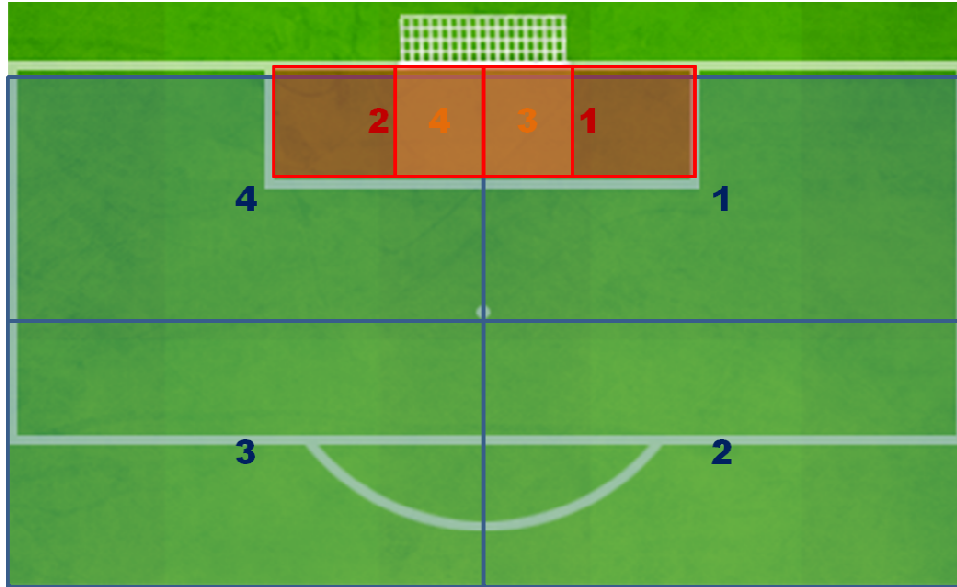


Figure 4.16 – Cluster Sampling, WASMS

4.3.2 Training

Matlab's Neural Network Toolbox is to be used to create and train the neural network [24]. The network to be trained is a backpropagation feedforward neural net having the following topology: 6 neurons, a single hidden layer with 5 hidden neurons, and 6 output neurons [13]. The activation functions to be used in the layers are tan-sigmoid and log-sigmoid, respectively. (See Figure 4.17)

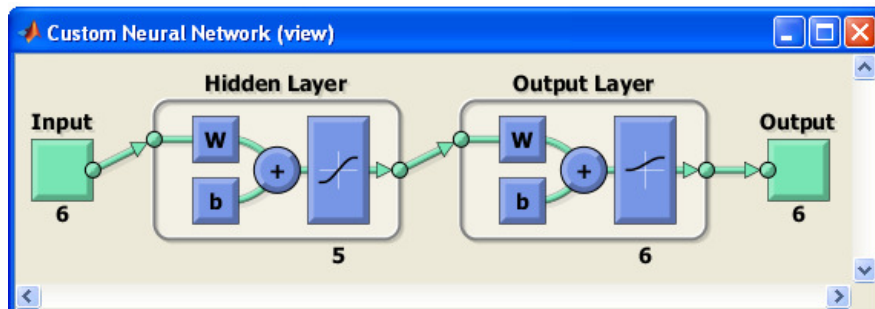


Figure 4.17 – Neural Network Topology, WASMS

The input data is to be normalized to the range $[-1, 1]$ using MinMax normalization [25]. The output data will be coded to 0.1 and 0.9 instead of the binaries 0 and 1[26]. The weights and biases are to be initialized randomly to the interval $[-0.5, 0.5]$. These preprocessing techniques are done to improve the convergence rate of the training. Gradient Descent with Momentum (GDM) is used as the training algorithm [24]. The learning rate is set to 1, while the momentum is fixed at 0.9.

4.3.3 Testing

The neural network is to be tested using the same simulation environment in the data gathering, as seen in Figure 4.18. At the start of an episode, the positions of the mobile objects are initialized. The input parameters are feed to network then the network's output is noted.

When the network classifies the situation as "shootable" (the value from the 6th output neuron is a 1), the *target section* of the goal (which is computed based on the values from the first five output neurons of the network) classified by the network is to be compared to that section's result in the episode. If it is a goal in that section, the prediction is *true positive*. If it is not a goal in that particular section, the prediction is *false positive*. (See Figures 4.19 - 4.20)

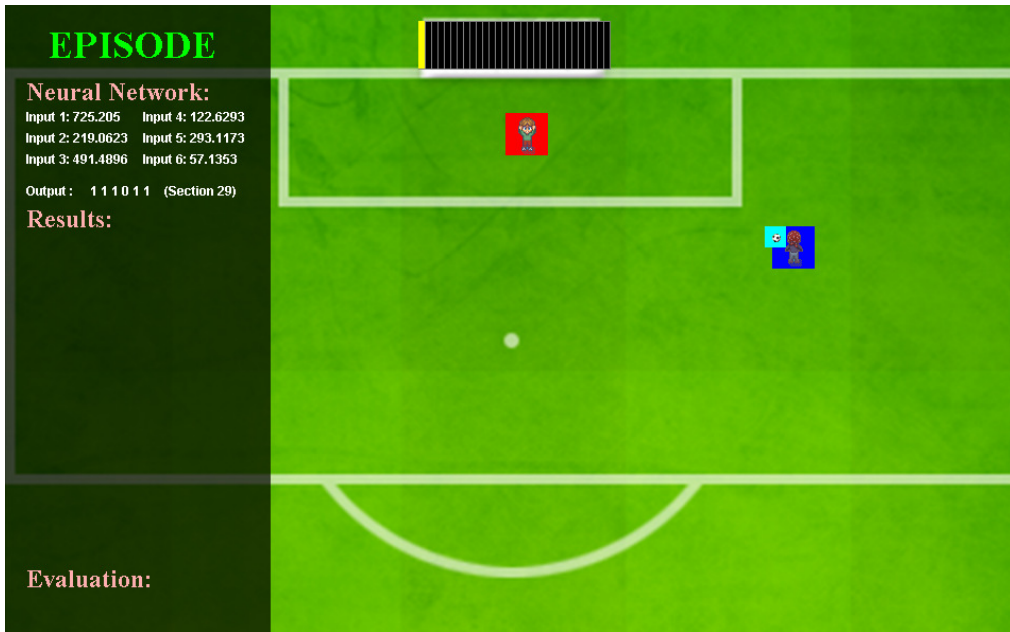


Figure 4.18 – Episode Start (Testing), WASMS

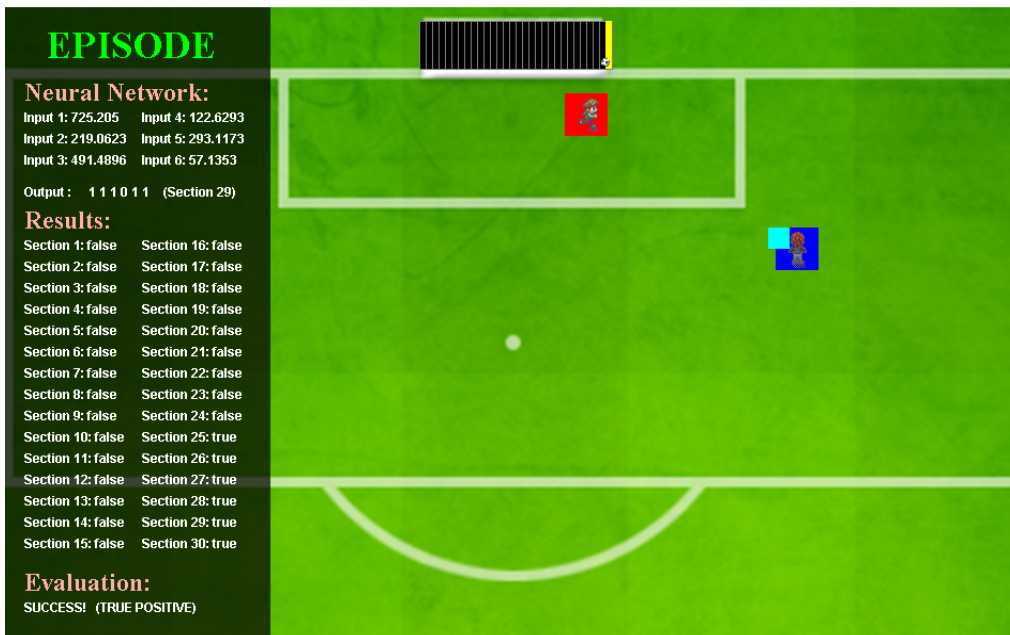


Figure 4.19 – True Positive Prediction, WASMS

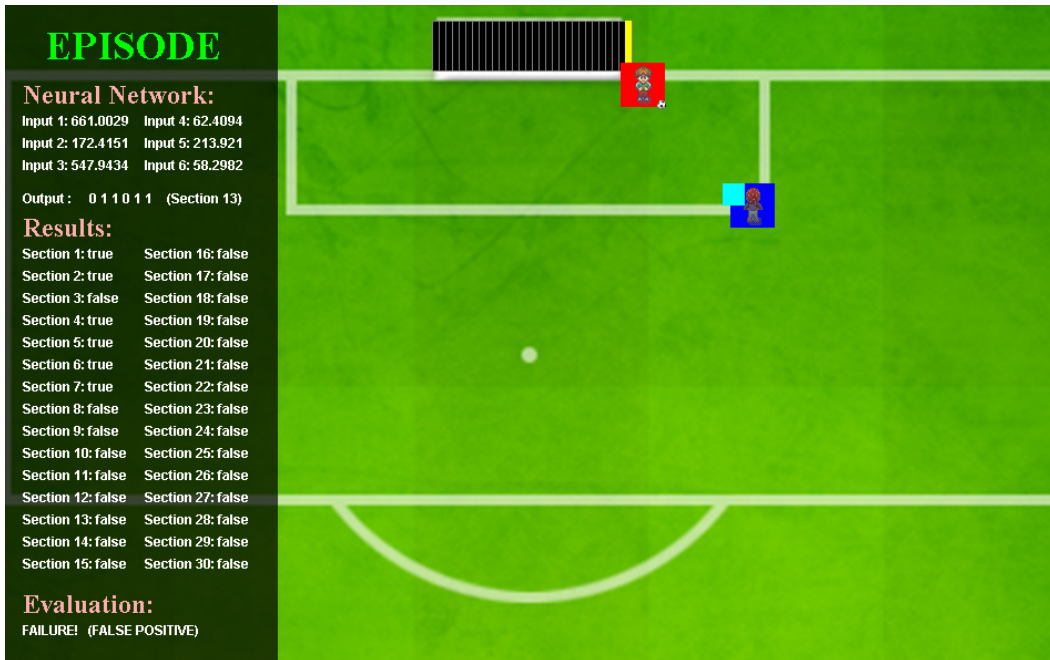


Figure 4.20 – False Positive Prediction, WASMS

When the network classifies the situation as “don’t shoot” (the value from the 6th output neuron was a 0), the predicted target section of the goal is no longer needed. The episode’s results are checked if there was no goal from any of the sections in the goal (all false). If there is no goal, the prediction is *true negative*. If there was at least one goal, the prediction is *false negative*. (See Figures 4.21 - 4.22)

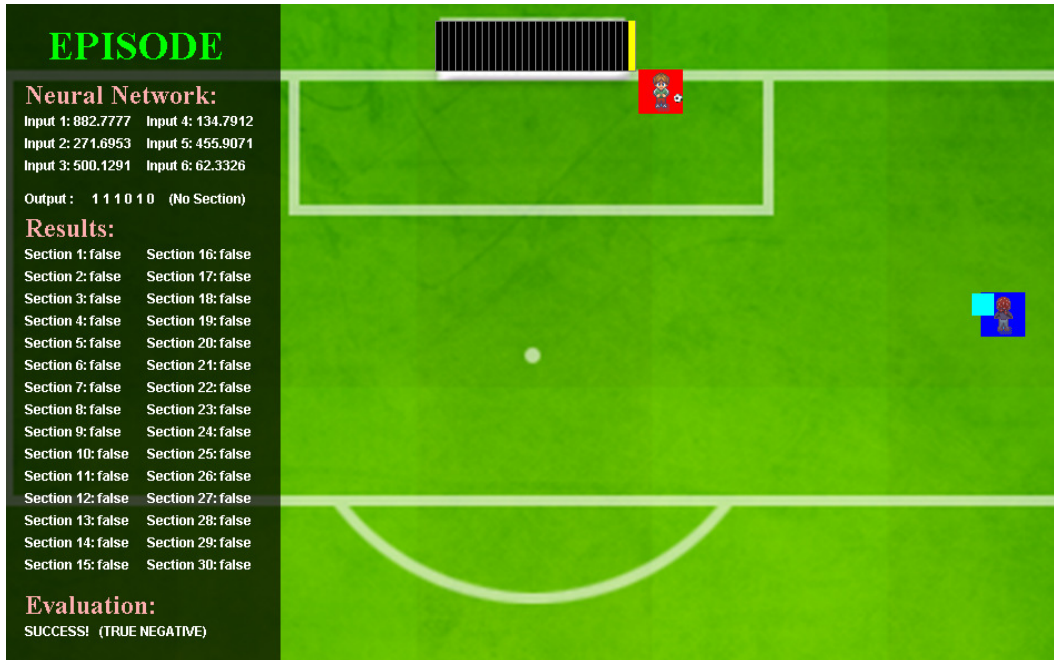


Figure 4.21 – True Negative Prediction, WASMS

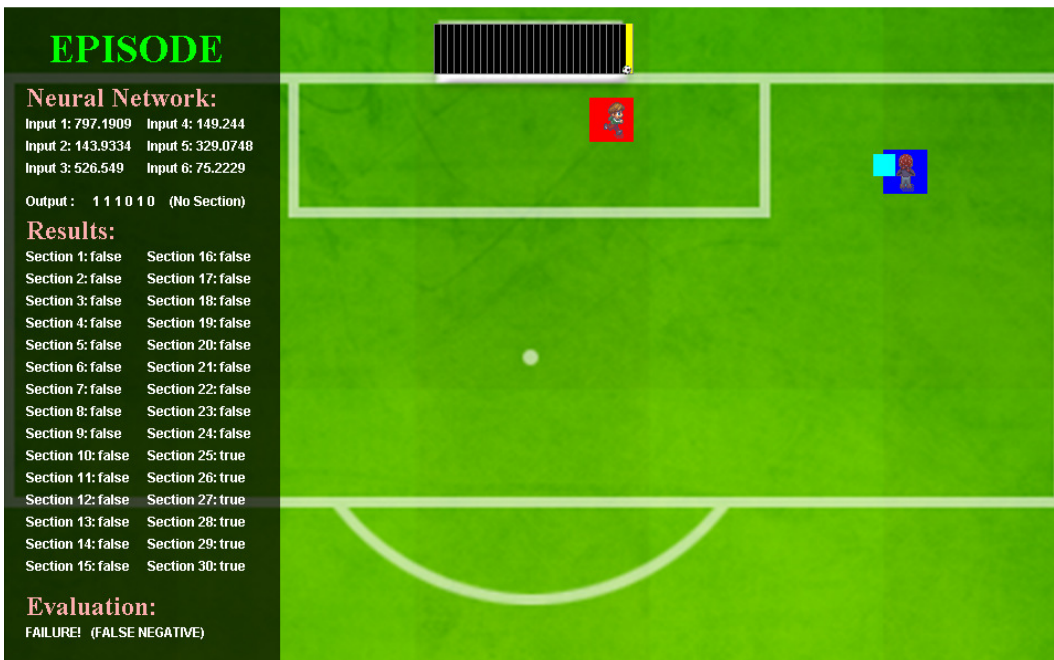


Figure 4.22 – False Negative Prediction, WASMS

True positives and true negatives indicate *successful* network predictions, while false positives and false negatives indicate *failed* predictions, as shown in Figure 4.23. Similar to the generation of

episodes from the data gathering, cluster sampling is to be used to generate 1600 testing samples [13].
The network's prediction capability is to be evaluated in these samples.

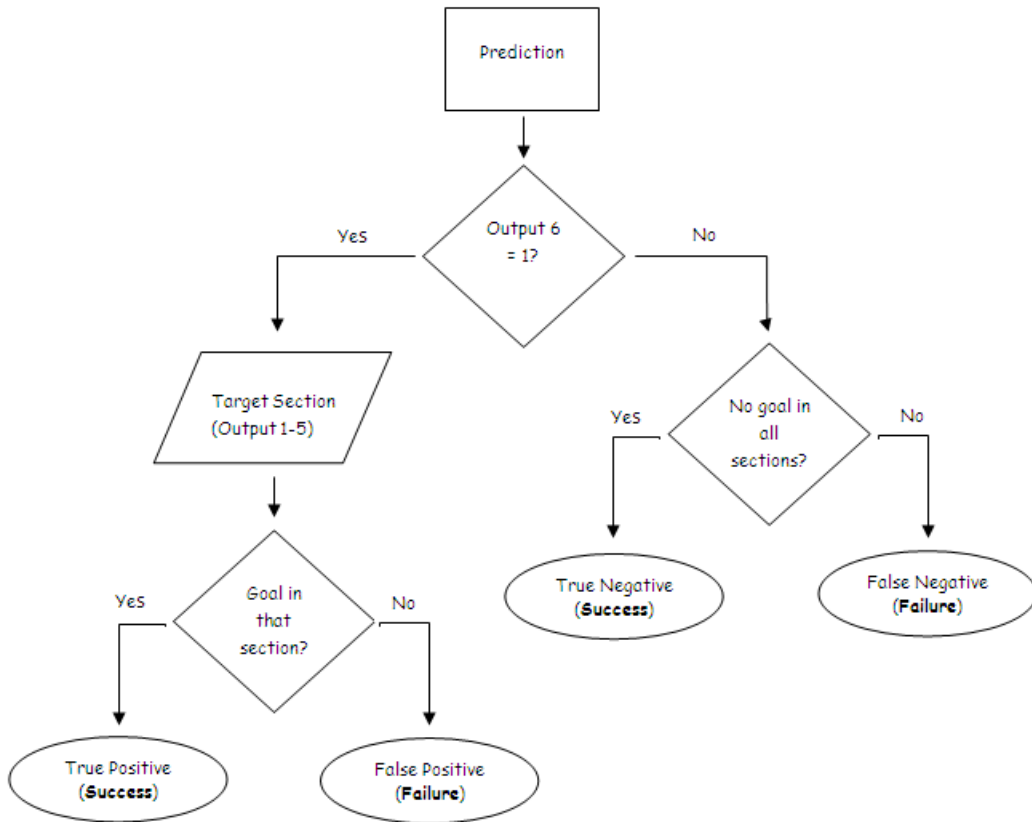


Figure 4.23 – Decision Flowchart for evaluation of network's prediction, WASMS

4.4 Technical Architecture

WASMS has been tested to run on a machine with the following specifications:

1. At least 350 MB of hard disk space
2. At least 1024 MB RAM
3. At least 1.60 GHz processor
4. At least 1024x768 pixels screen resolution
5. Windows XP/Vista/7 operating systems

Being web-based, the system needs the following (or their later versions) to be installed:

6. HTML5-compatible web browser (i.e. Google Chrome Ver. 23, Mozilla Firefox Ver. 16)
7. Java Platform, Standard Edition 6
8. Adobe Flash Player 11

5 RESULT

5.1 The Neural Network

Figure 5.1 shows the generation of the data set by applying the methodology described in Chapter 4. The data is exported to an excel file for easy accessibility in Matlab. But before the actual training of the network, the generated data is analyzed.

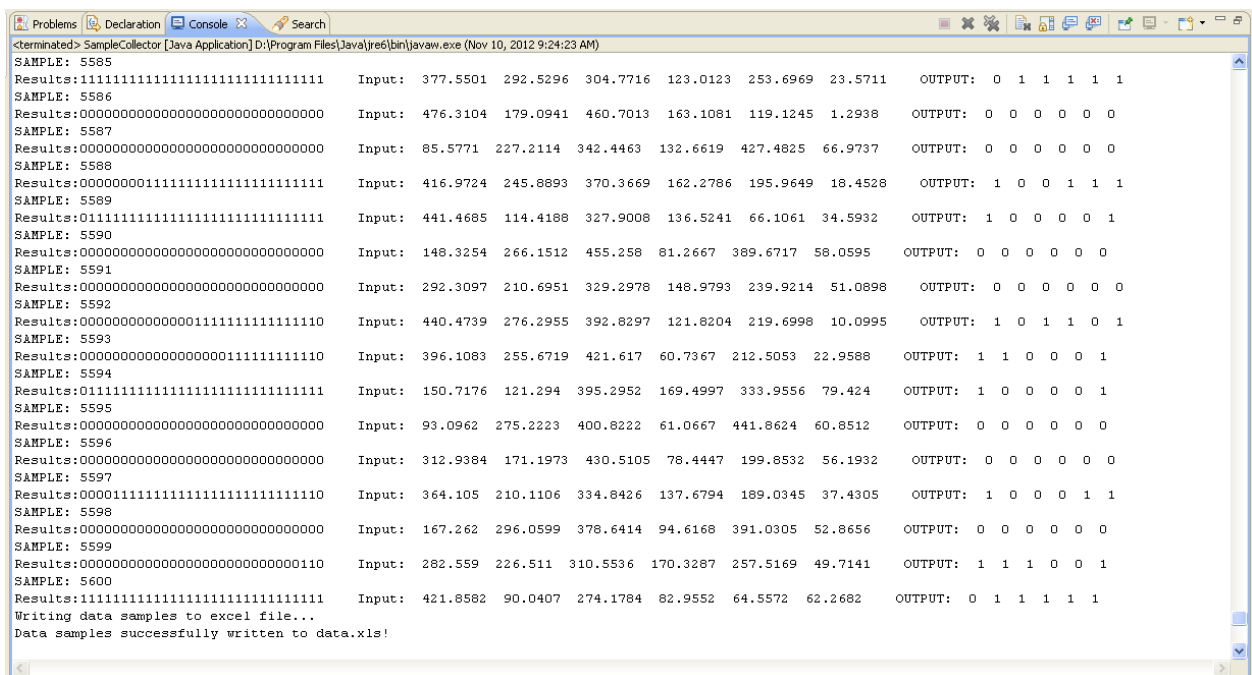


Figure 5.1 – Generation of 5600 training samples, WASMS

First, histograms are plotted to visualize and better understand the data [28]. The plots, as seen in Figure 5.2, show that the coordinates of the ball are uniformly distributed. The y coordinates of the goalkeeper are also uniformly distributed while the x coordinates are denser in the middle, which is where front of the goal is. The distances and angles of the ball from the goal follow normal distribution. It can also be seen that there are no outliers present in any of the input data.

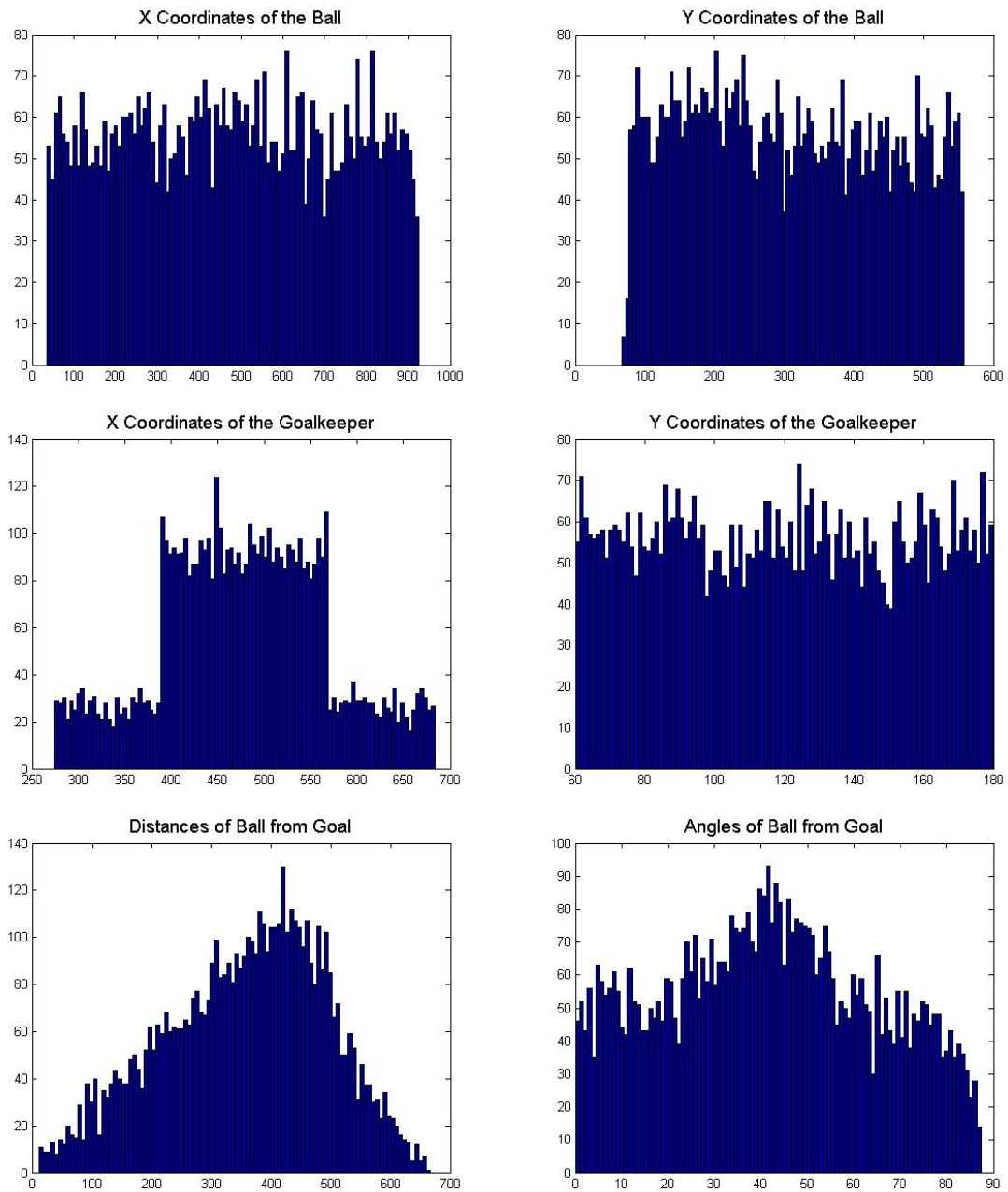


Figure 5.2 – Histograms of the inputs, WASMS

To plot the histogram of the outputs, a value of -1 was assigned to “don’t shoot” situations while the “shootable” situations are given the values 1-30, the decimal equivalent of the first 5 output binaries. Around 38% of the output data are “don’t shoot” cases, represented by the leftmost bar in Figure 5.3 (left). On the other hand, it can be seen that the “shootable” cases have the highest frequency in the middle section of the goal, as seen in Figure 5.3 (right). This is expected since the best

section in the goal is defined to be the median of the largest group of successful goal sections [13]. Thus, in situations where all the goal sections are successful, section 15 is always selected as the best section.

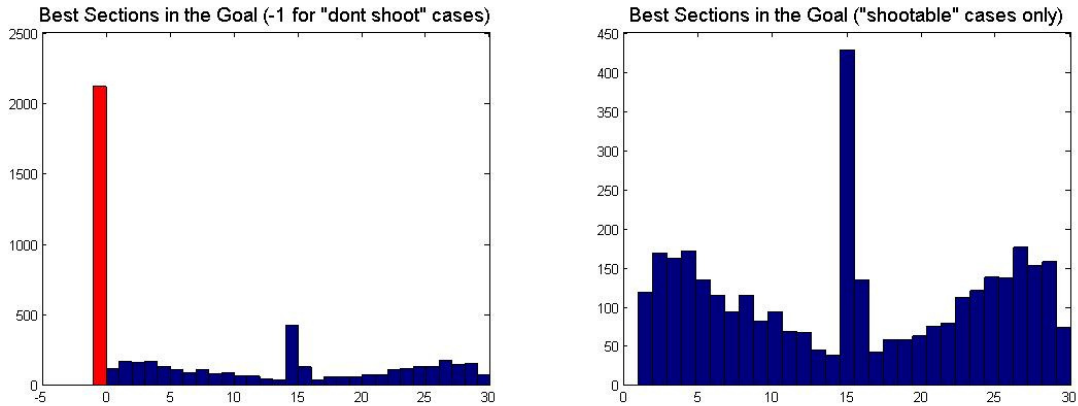


Figure 5.3 – Histograms of the target outputs, WASMS

Scatter plots of the input data are also plotted against the output data to observe the possible relationships present [28]. Again, the output values are converted to their decimal equivalents and -1 values are assigned to “don’t shoot” cases.

From the x coordinate vs. best section plot shown in Figure 5.4, lower values of the output are more concentrated when the x coordinates are low. This indicates that when the ball is on the left side of the field, best sections of the goal would most probably be located on the left side of the goal (lower section numbers). Likewise, when the ball is on the right, best sections would most probably be on the right also. Additionally, the plot also shows that “don’t shoot” cases are less concentrated when the ball is located in the middle meaning that “shootable” cases are more frequent in this area. The y coordinates of the ball have a less direct relationship with the best sections. Although, it can be seen from Figure 5.5 that as the y coordinates of the ball increases (farther from goal), the best sections are less concentrated in the middle of the goal.

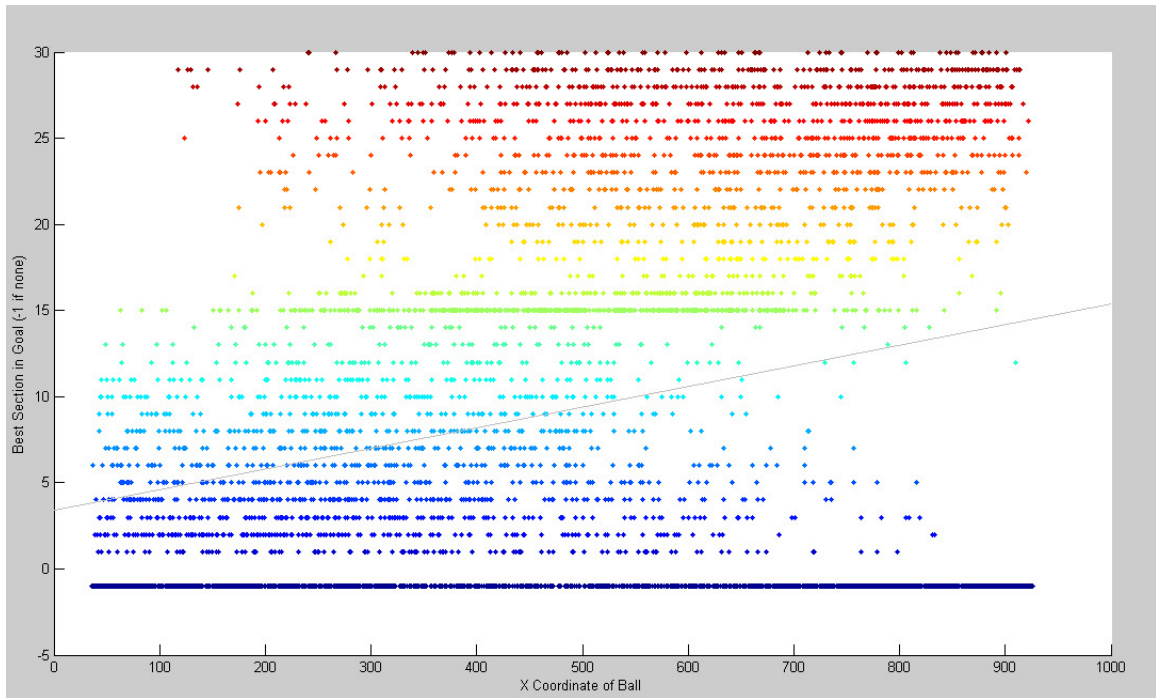


Figure 5.4 – Scatter plot of the x coordinates of the ball vs. the target outputs, WASMS

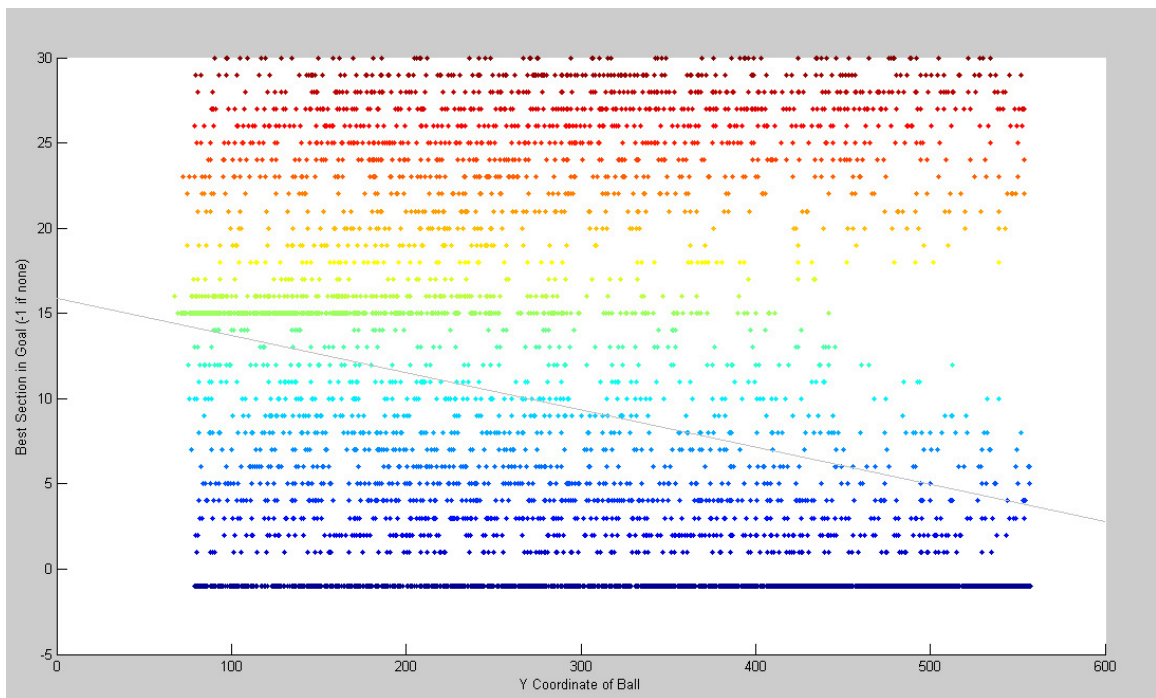


Figure 5.5 – Scatter plot of the y coordinates of the ball vs. the target outputs, WASMS

The values of best sections are high when x coordinates of the goalkeeper are low, as shown in Figure 5.6. This is logical since when the x coordinates are low, the goal keeper is located on the left of the goal's center, which results to having the best sections located on the right side of the goal. And the opposite is true when the keeper is located on the right. Figure 5.7 shows that the best sections are denser in the middle (15-16) when the y coordinates of the keeper are high. This is because the higher the y coordinates, the farther from the goal line.

The values of the best sections are more concentrated in the middle of the goal when the ball is near the goal. The values are more concentrated on the left and right corners of the goal when the ball is far. Also, the “don't shoot” cases become more concentrated as the ball's distance increases. Surprisingly, the angles of the ball from the goal don't indicate any relationship with the best sections. (See Figures 5.8 - 5.9)

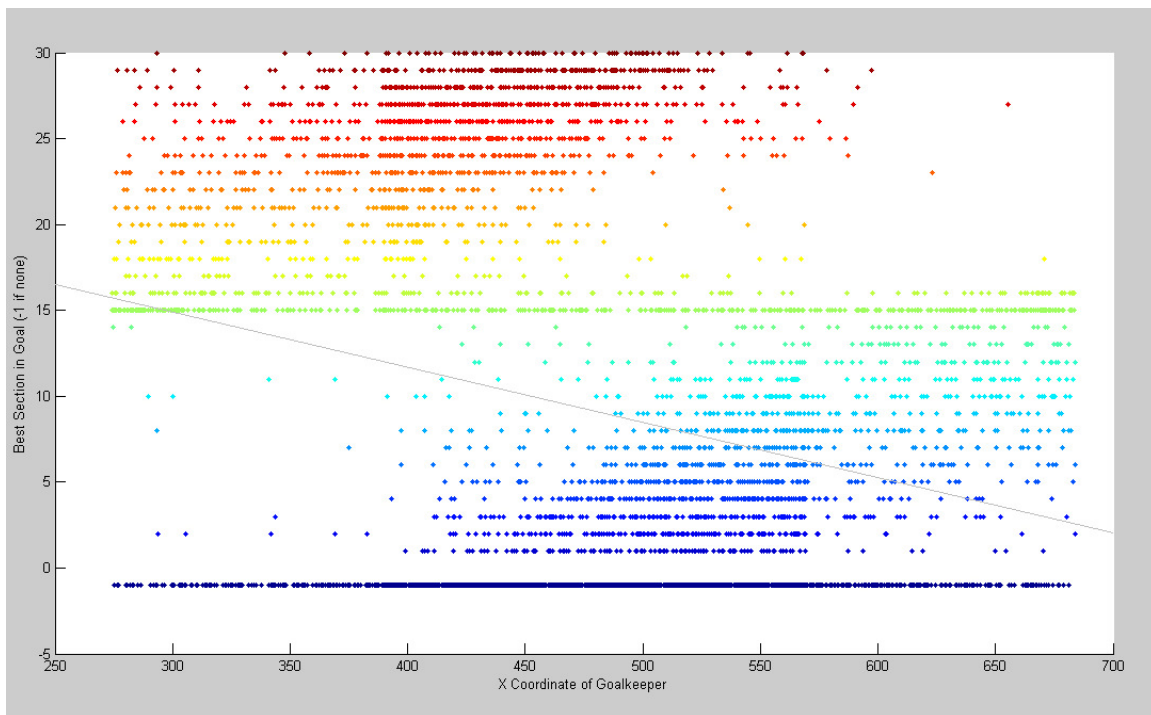


Figure 5.6 – Scatter plot of the x coordinates of the goalkeeper vs. the target outputs, WASMS

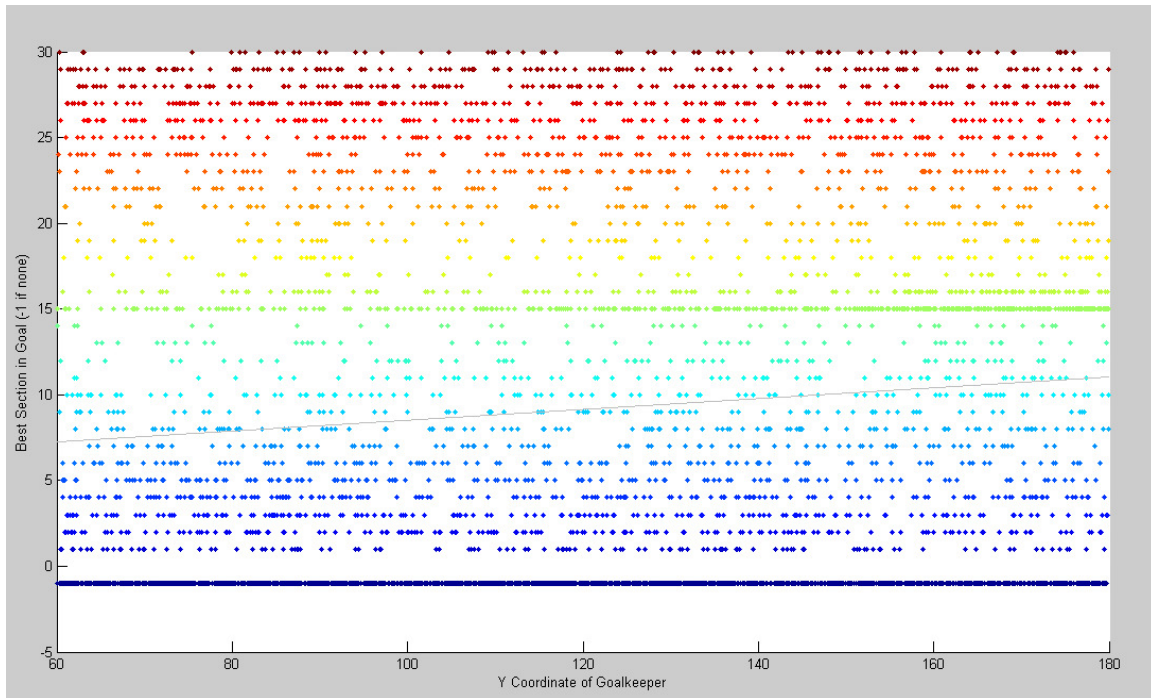


Figure 5.7 – Scatter plot of the y coordinates of the goalkeeper vs. the target outputs, WASMS

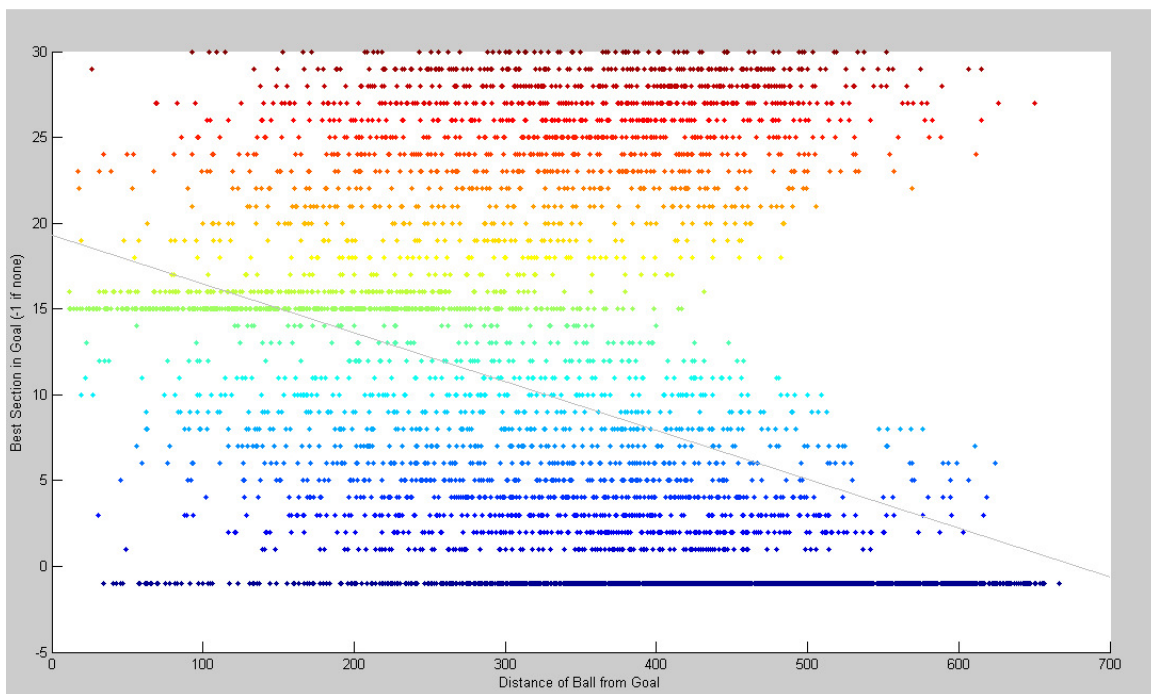


Figure 5.8 – Scatter plot of the distances of the ball from goal vs. the target outputs, WASMS

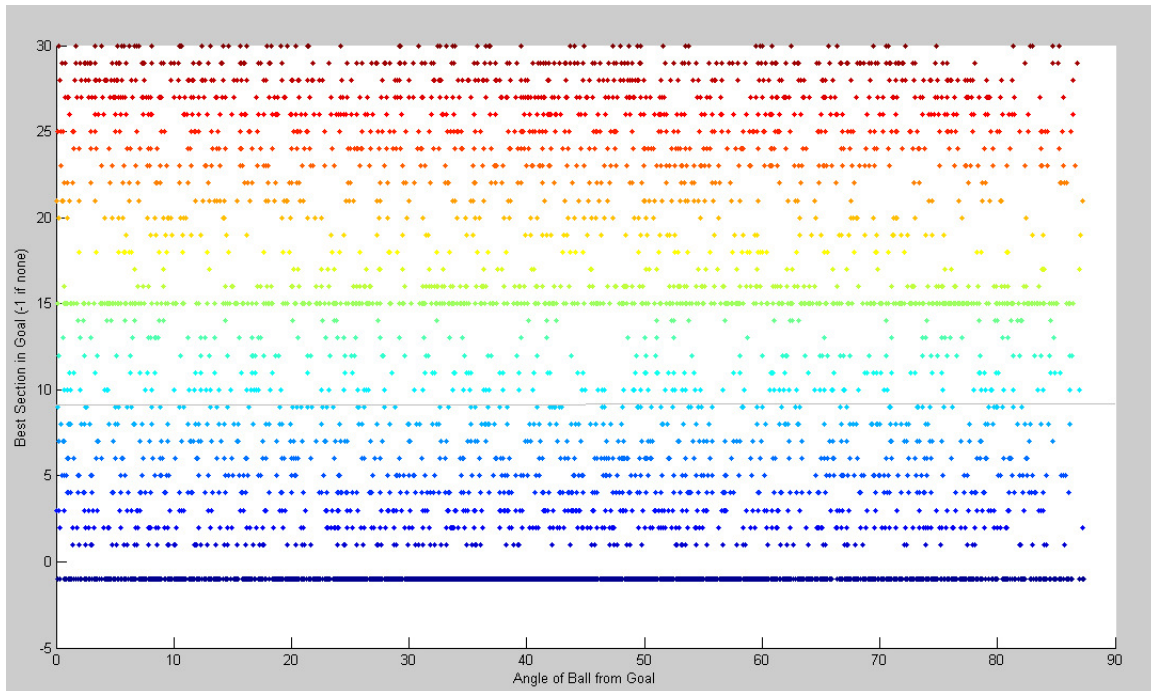


Figure 5.9 – Scatter plot of the angles of the ball from goal vs. the target outputs, WASMS

To investigate the relevance of the inputs [28], the correlations between inputs and between inputs and outputs are computed. The correlation coefficients are tabulated in Table 5.1.

Inputs	1	2	3	4	5	6
1	1.0000	-0.0049	0.0099	-0.0065	-0.0017	0.0031
2	-0.0049	1.0000	-0.0124	0.0075	0.7635	-0.6262
3	0.0099	-0.0124	1.0000	-0.0084	-0.0024	0.0022
4	0.0122	0.0075	-0.0084	1.0000	-0.0100	-0.0273
5	-0.0065	0.7635	-0.0024	-0.0100	1.0000	-0.0385
6	-0.0017	-0.6262	0.0022	-0.0273	-0.0385	1.0000

Table 5.1 – Pearson correlation matrix between inputs, WASMS

The correlation matrix shows that most of the inputs have no undesirably high correlations (>.9) with the other inputs [29]. However, input 2 (y coordinate of the ball) shows strong (>.7) positive correlation with the input 5 (distance of the ball from goal). Input 2 also shows a negative moderate (>.3 but <.7) correlation with input 6 (angle of ball from goal). These are not good indications since high

correlations between inputs are undesirable; they may significantly degrade the learning of the network [28]. To further test if the input matrix is *rank deficient*, we compute its *condition number*. The computed condition number is 79.0210. This is far below 100, which means that input correlations are not that high and therefore, input dimensionality reduction is not warranted [28].

To investigate nonlinear relationships between each of the inputs and each of the outputs, *Point-biserial correlation coefficient* is used. The Point-biserial correlation coefficient is designed to measure the degree of relation for two variables when one variable is quantitative (interval or ratio) and the other variable is binary or dichotomous [30]. (See Table 5.2)

	Output 1	Output 2	Output 3	Output 4	Output 5	Output 6
Input 1	0.5960	0.2279	0.0226	-0.0453	0.0470	-0.0090
Input 2	0.0932	-0.0720	-0.0649	-0.0767	-0.0912	-0.3980
Input 3	-0.5446	0.0381	0.0255	-0.0063	-0.0317	-0.0091
Input 4	-0.0298	0.0882	0.0498	0.0495	0.0330	0.1162
Input 5	0.1040	-0.0816	-0.1006	-0.0896	-0.1027	-0.5009
Input 6	0.0262	0.0007	-0.0147	0.0216	0.0214	0.0991

Table 5.2 – Point-biserial correlation coefficients between inputs and outputs, WASMS

Most of the inputs are weakly correlated to the outputs. Only inputs 2 and 5 have moderate correlations (negative) with output 6, the most significant output which classifies the situation into “shootable” or “don’t shoot” cases. Output 4 has the lowest correlations with the inputs while input 6 has the lowest correlations with the outputs. In most cases, these are not good and may slow down the training [28]. However, in this case, some of the correlations with output 4 and with output 6 could still be considered as significant (almost 0.1). Thus, all the inputs and outputs are relevant and are still included to the training.

Preprocessing methods are also applied in training the network. The input data is normalized using Minmax, the target data is recoded from binary values into 0.1 and 0.9 values, and the network’s

weight and biases are randomly initialized to the interval [-0.5, 0.5]. The effect of these methods to the training can be seen from Table 5.3.

GDM: after 1000 epochs	Performance (MSE)	Gradient
Original Data	0.33048	0.044253
w/ MinMax normalization	0.31543	0.004779
w/ 0.1 and 0.9 recoding of targets	0.13528	0.003754
w/ [-0.5,0.5] weights and bias init	0.12629	0.003093

Table 5.3 – Effects of the preprocessing functions to the training, WASMS

As seen in Figure 5.10, the training is stopped when the maximum epoch (50000) is reached. The best performance achieved is 0.101 MSE. It converges smoothly and there are no fluctuations, indicating that the network has learned [27]. Thus, lower learning rates are not tried anymore since they will just result to a much slower convergence. The descent of the gradient is also smooth and not fluctuating.

```

Command Window
File Edit Debug Desktop Window Help
Epoch 46500/50000, Time 4268.563, Performance 0.10123/0.01, Gradient 7.5841e-005/1e-010, Validation Checks 0/50
Epoch 46600/50000, Time 4277.344, Performance 0.10123/0.01, Gradient 7.5592e-005/1e-010, Validation Checks 0/50
Epoch 46700/50000, Time 4286.094, Performance 0.10123/0.01, Gradient 7.5344e-005/1e-010, Validation Checks 0/50
Epoch 46800/50000, Time 4294.829, Performance 0.10123/0.01, Gradient 7.5098e-005/1e-010, Validation Checks 0/50
Epoch 46900/50000, Time 4303.579, Performance 0.10123/0.01, Gradient 7.4854e-005/1e-010, Validation Checks 0/50
Epoch 47000/50000, Time 4312.297, Performance 0.10123/0.01, Gradient 7.4611e-005/1e-010, Validation Checks 0/50
Epoch 47100/50000, Time 4321.047, Performance 0.10123/0.01, Gradient 7.4369e-005/1e-010, Validation Checks 0/50
Epoch 47200/50000, Time 4330.141, Performance 0.10123/0.01, Gradient 7.4129e-005/1e-010, Validation Checks 0/50
Epoch 47300/50000, Time 4339.454, Performance 0.10122/0.01, Gradient 7.389e-005/1e-010, Validation Checks 0/50
Epoch 47400/50000, Time 4348.266, Performance 0.10122/0.01, Gradient 7.3653e-005/1e-010, Validation Checks 0/50
Epoch 47500/50000, Time 4356.985, Performance 0.10122/0.01, Gradient 7.3417e-005/1e-010, Validation Checks 0/50
Epoch 47600/50000, Time 4365.75, Performance 0.10122/0.01, Gradient 7.3183e-005/1e-010, Validation Checks 0/50
Epoch 47700/50000, Time 4375.188, Performance 0.10122/0.01, Gradient 7.295e-005/1e-010, Validation Checks 0/50
Epoch 47800/50000, Time 4384.172, Performance 0.10122/0.01, Gradient 7.2718e-005/1e-010, Validation Checks 0/50
Epoch 47900/50000, Time 4393.657, Performance 0.10122/0.01, Gradient 7.2488e-005/1e-010, Validation Checks 0/50
Epoch 48000/50000, Time 4402.469, Performance 0.10122/0.01, Gradient 7.2259e-005/1e-010, Validation Checks 0/50
Epoch 48100/50000, Time 4411.219, Performance 0.10122/0.01, Gradient 7.2031e-005/1e-010, Validation Checks 0/50
Epoch 48200/50000, Time 4420.016, Performance 0.10122/0.01, Gradient 7.1805e-005/1e-010, Validation Checks 0/50
Epoch 48300/50000, Time 4429.157, Performance 0.10122/0.01, Gradient 7.158e-005/1e-010, Validation Checks 0/50
Epoch 48400/50000, Time 4437.985, Performance 0.10122/0.01, Gradient 7.1357e-005/1e-010, Validation Checks 0/50
Epoch 48500/50000, Time 4446.719, Performance 0.10122/0.01, Gradient 7.1134e-005/1e-010, Validation Checks 0/50
Epoch 48600/50000, Time 4455.469, Performance 0.10122/0.01, Gradient 7.0913e-005/1e-010, Validation Checks 0/50
Epoch 48700/50000, Time 4464.157, Performance 0.10122/0.01, Gradient 7.0694e-005/1e-010, Validation Checks 0/50
Epoch 48800/50000, Time 4472.938, Performance 0.10122/0.01, Gradient 7.0475e-005/1e-010, Validation Checks 0/50
Epoch 48900/50000, Time 4481.688, Performance 0.10122/0.01, Gradient 7.0258e-005/1e-010, Validation Checks 0/50
Epoch 49000/50000, Time 4490.438, Performance 0.10122/0.01, Gradient 7.0042e-005/1e-010, Validation Checks 0/50
Epoch 49100/50000, Time 4499.172, Performance 0.10122/0.01, Gradient 6.9828e-005/1e-010, Validation Checks 0/50
Epoch 49200/50000, Time 4507.875, Performance 0.10122/0.01, Gradient 6.9614e-005/1e-010, Validation Checks 0/50
Epoch 49300/50000, Time 4516.594, Performance 0.10121/0.01, Gradient 6.9402e-005/1e-010, Validation Checks 0/50
Epoch 49400/50000, Time 4525.329, Performance 0.10121/0.01, Gradient 6.9191e-005/1e-010, Validation Checks 0/50
Epoch 49500/50000, Time 4534.079, Performance 0.10121/0.01, Gradient 6.8981e-005/1e-010, Validation Checks 0/50
Epoch 49600/50000, Time 4542.813, Performance 0.10121/0.01, Gradient 6.8772e-005/1e-010, Validation Checks 0/50
Epoch 49700/50000, Time 4551.579, Performance 0.10121/0.01, Gradient 6.8565e-005/1e-010, Validation Checks 0/50
Epoch 49800/50000, Time 4560.719, Performance 0.10121/0.01, Gradient 6.8359e-005/1e-010, Validation Checks 0/50
Epoch 49900/50000, Time 4569.454, Performance 0.10121/0.01, Gradient 6.8154e-005/1e-010, Validation Checks 0/50
Epoch 50000/50000, Time 4578.36, Performance 0.10121/0.01, Gradient 6.795e-005/1e-010, Validation Checks 0/50
Training with TRAININGDM completed: Maximum epoch reached.

```

Figure 5.10 – End of training (max epoch reached), WASMS

For comparison purposes, other training algorithms – Gradient Descent without momentum, Scaled Conjugate Gradient (SCG) and Resilient Backpropagation (RP) – available at Matlab are also tried. SCG and RP are chosen since they are widely used for pattern recognition networks [31]. The performances (MSE), the classification confusions and correlations (only with output 6, the most significant) are recorded in Tables 5.3 - 5.6.

GDM	Performance (MSE)	Confusion	Correlation (Phi)
50000 Epochs	.101	91.5%	0.8179

Table 5.3 – Results from the earlier trained network (using GDM), WASMS

GD	Performance (MSE)	Confusion	Correlation (Phi)
50000 Epochs	.103	90.4%	0.8011

Table 5.4 – Results from the trained network using Gradient Descent with no momentum, WASMS

SCG	Performance (MSE)	Confusion	Correlation (Phi)
Trial 1	.102	91.1%	0.8111
Trial 2	.102	91.3%	0.8144
Trial 3	.101	90.8%	0.8046

Table 5.5 – Results from the trained network using Scaled Conjugate Gradient, WASMS

RP	Performance (MSE)	Confusion	Correlation (Phi)
Trial 1	.103	90.6%	0.8012
Trial 2	.102	90.4%	0.7957
Trial 3	.110	90.8%	0.8034

Table 5.6 – Results from the trained network using Resilient Backpropagation, WASMS

The network trained with the GDM algorithm is still the one picked since it shows better results than the other algorithms. Additionally, its outputs' histogram has the most resemblance to the original data's.

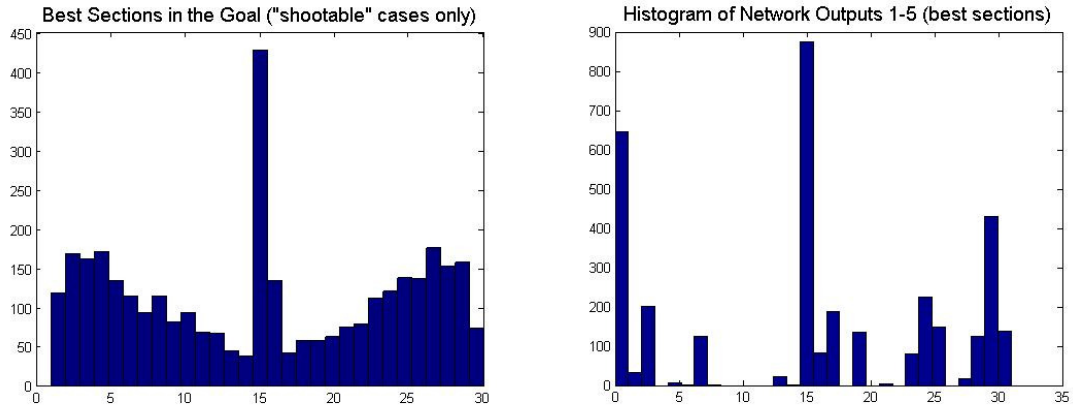


Figure 5.11 – Best sections histogram of the original data (left) and of the network outputs (right), WASMS

From the confusion matrix of target-6 values with the output-6 values, the network was able to classify correctly 91.5% of the data into “don’t shoot” and “shootable” situations, as seen in Figure 5.12. To test the ability of the network to classify correctly the best sections in the goal, whenever the case is “shootable”, we remove all the “don’t shoot” cases (target 6 is 0) from the data. 3484 (62%) training samples are left and these are used to check the classification confusion of the network towards the first five (less significant) target outputs.

Target-Output 6: Confusion Matrix

	0	1	
0	1859 33.2%	221 3.9%	89.4% 10.6%
1	257 4.6%	3263 58.3%	92.7% 7.3%
	0	1	91.5% 8.5%
	Target Class		

Figure 5.12 – Classification confusion matrix of the 6th target-output pairs, WASMS

For the target-output 1 (1st output neuron), the network was able to classify the data correctly 93.4% of the time. This output is the most significant out of the five since it represents a decimal value of 16 (these five represents the binary coding of the best section in the goal). Basically, it determines if the best section is located on the left or on the right side of the goal. Target output 2 has a value of 8, output 3 has a value of 4, output 4 has a value of 2, and output 5 has a value of 1. These mean that a misclassification in target output 5 will cause a deviation of 1 section from the correct best section. A misclassification in target output 4 will cause a deviation of 2. And so on. From that, we can say that these target outputs are arranged in decreasing significance. (See Figure 5.13)



Figure 5.13 – Classification confusion matrices of the other 5 target-output pairs, WASMS

The confusion plots were satisfactory since it was very high on the most significant target output. The confusion percentage decreases as the target outputs' significance decreases.

To apply the network in a different platform, the weights and biases of the trained network are extracted. It can be seen from Figure 5.14 that the trained weights and biases have only small values.

```
>> net.IW(1)                                >> net.b(1)

ans =                                         ans =

    0.3641   -0.3781   6.3017   0.8094   -2.9085   1.2992   0.4485
    0.9888   -0.1806   -2.7186   0.1918   -1.2615   -0.4529   -1.0944
   -1.9326   0.2571   3.3073   0.5248   -3.2260   -0.3013   -2.0935
   -0.0672   -0.4002   -2.1010   0.4795   -1.2139   -0.0959   -2.0753
    5.4170   -0.6346   -6.3681   0.2424   1.3969   0.1548   0.6996

>> net.LW(2)                                >> net.b(2)

ans =                                         ans =

   -0.7838   1.2097   1.0555   -4.0989   2.1252   -2.3541
   -1.1241   -3.6945   3.0474   1.5120   3.2686   1.8662
   -0.0519   -0.7653   0.4705   1.0193   0.5075   0.8238
   -0.0188   -0.1419   0.2121   1.0068   -0.0198   0.9253
    0.0841   -0.0834   0.1245   0.5864   0.1417   0.5933
    1.7098   6.9551   0.4514   -4.0605   -1.5160   1.4804
```

Figure 5.14 – Weights and biases of the trained network, WASMS

Similar to the generation of episodes from the gathering of data, cluster sampling is used to generate 1600 testing samples [13]. These are used to evaluate the neural network, as shown in Figure 5.15. This is repeated for 5 times. The results are tabulated in Table 5.7.

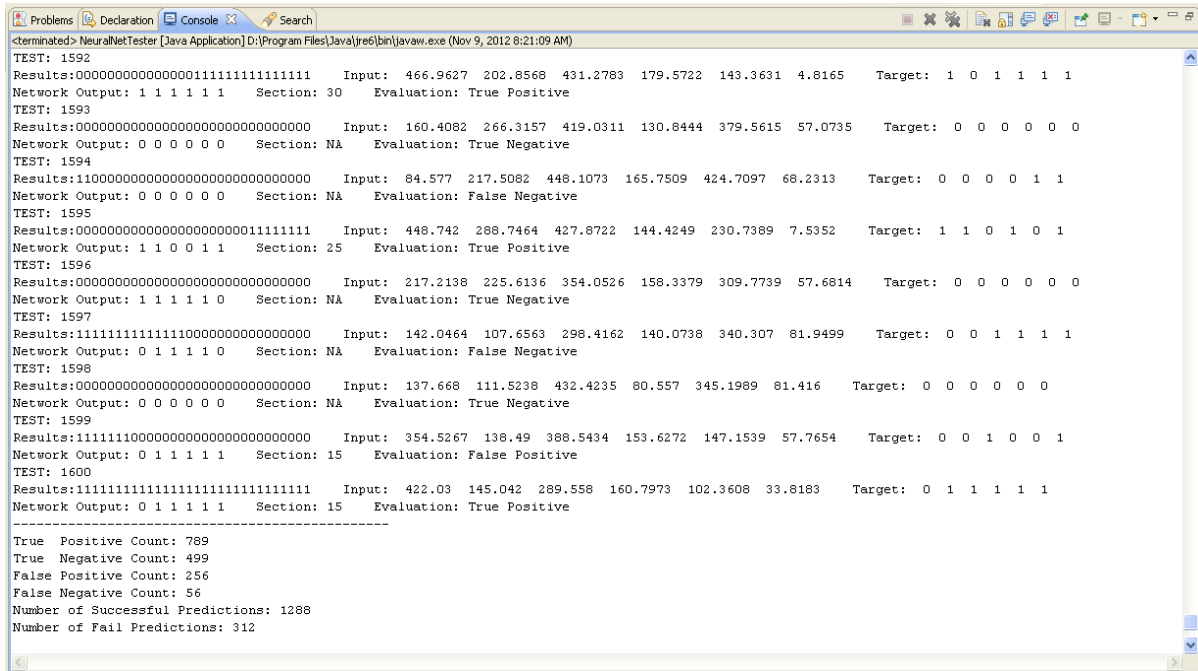


Figure 5.15 – Testing the neural network, WASMS

	True Positive	True Negative	False Positive	False Negative	Success	Success Rate
Test 1	789	499	256	56	1288	80.50%
Test 2	774	518	227	81	1292	80.75%
Test 3	764	543	231	62	1307	81.69%
Test 4	744	553	244	59	1297	81.06%
Test 5	796	511	237	56	1307	81.69%
Mean	773	525	239	63	1298	81.13%

Table 5.7 – Neural network testing results, WASMS

The mean of number of successful predictions is 1298 (81.13%). This is slightly better than the result from Kaviani *et. al*(2005). (See Table 5.8)

Algorithm	Tries	Success	Success %
Computational	1500	923	61.53
Learning	1500	1162	77.46

Table 5.8 – Testing results from Kaviani *et. al*(2005)

Most of the times, the success rate or accuracy of the predictions is not enough as a performance measure. Thus, the neural network’s prediction capability was further evaluated using the well-known measures precision, recall, and the F-score [32]. A contingency table is plotted to better visualize the number of *real positives* and *predicted positives*. (See Table 5.9)

	+R	-R
+P	773	239
-P	63	525

Table 5.9 – Contingency table of the testing results (mean), WASMS

From equation (14) in Chapter 3, the recall is

$$Recall = \frac{TP}{TP+FN} = \frac{773}{773+63} = 0.9246$$

This means that the network was able to classify 92.46% of the positive cases in the testing samples as true positives correctly. On the other hand, the precision, as defined in equation (15), is

$$Precision = \frac{TP}{TP+FP} = \frac{773}{773+239} = 0.7638$$

Out of all the positive predictions of the network, only 76.38% of those were real positive cases. Lastly, from equation (16), the harmonic mean of precision and recall or the F-score is

$$F = \frac{2*(Precision \times Recall)}{(Precision+ Recall)} = \frac{2*(0.7638 \times 0.9246)}{(0.7638+ 0.9246)} = 0.8365$$

Over-all, the network the network is 83.65% correct in “retrieving” the real positive cases.

5.2 The Soccer Applet

When the applet is loaded, the title screen will be displayed, as illustrated in Figure 5.16. From here, five options are available: *arcade*, *custom*, *simulate*, *tutorial* and *scores*. Arcade is a bonus feature where the user can play through consecutive levels and with corresponding scores afterwards. Custom, or custom play, lets the user to play whether as a striker or a goalkeeper, and to choose the mode: a striker against a goalkeeper, two strikers against a goalkeeper, and two strikers against a goalkeeper and a defender. The simulate option allows the user to watch the AIs play the different modes. Tutorial teaches the user about the basic skills – pass, dribble, shoot and goalkeeper – in an interactive way. Scores display the five highest scores from the arcade mode.



Figure 5.16 – Title Screen, WASMS

5.2.1 Tutorial

The tutorial offers the user to learn the four basic moves: dribbling, passing, shooting and goalkeeping, as shown in Figure 5.17. It tells the user the corresponding controls for each move and allows her to perform the test to pass the tutorial.

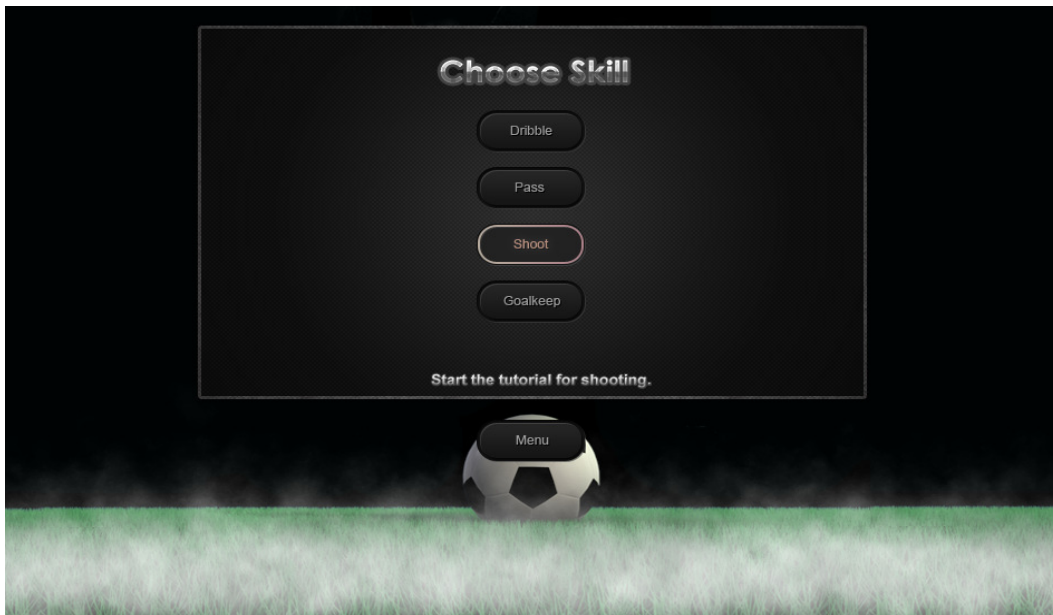


Figure 5.17 – Choose Skill Screen, WASMS

An example skill is dribbling. In the first screen of the tutorial, as shown in Figures 5.18 - 5.19, will be a demonstration on how to dribble. The user will not have any controls yet on any of the players. The demo runs recursively until the user clicks the 'next' button or the 'back' button.

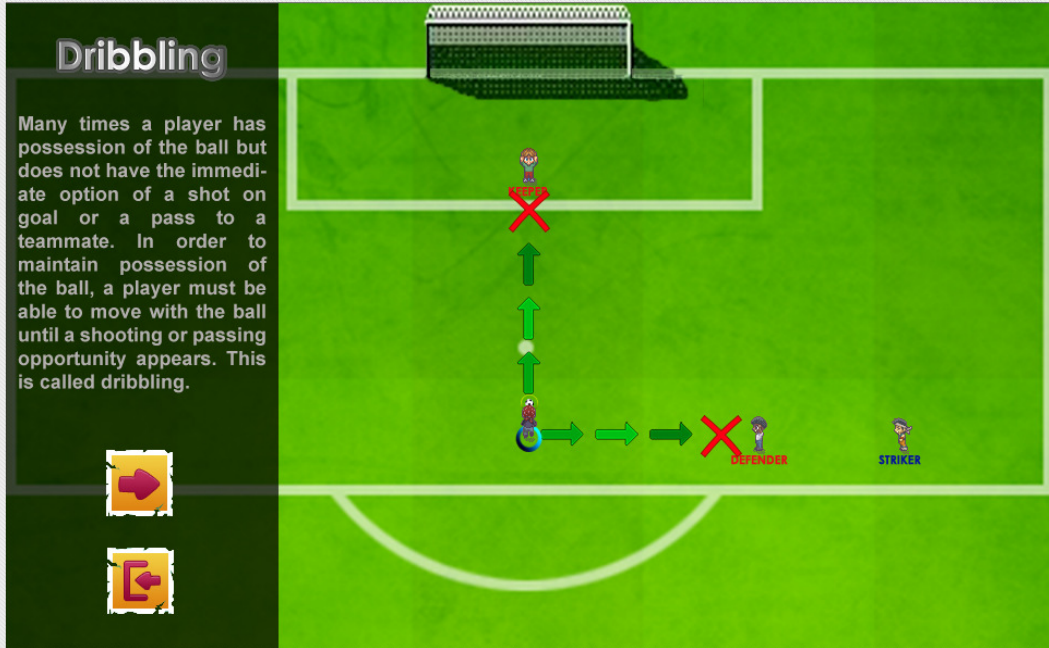


Figure 5.18 – Dribbling Tutorial Demo (part), WASMS

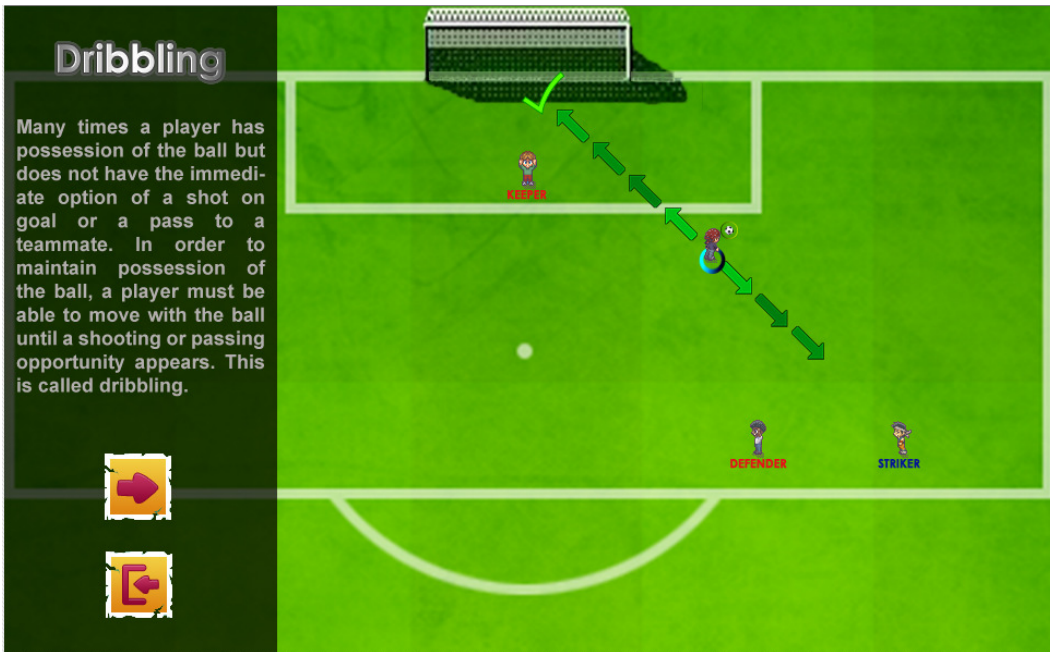


Figure 5.19 – Dribbling tutorial demo (another part), WASMS

When the 'next' button is clicked by the user, the succeeding screen will be the interactive part of the tutorial. It explains the objective, and when the user further clicks the 'next' button, he will gain control of the player. He must perform the objective to finish the tutorial. (See Figures 5.20 - 5.21)



Figure 5.20 – Dribbling Tutorial Interactive (start), WASMS

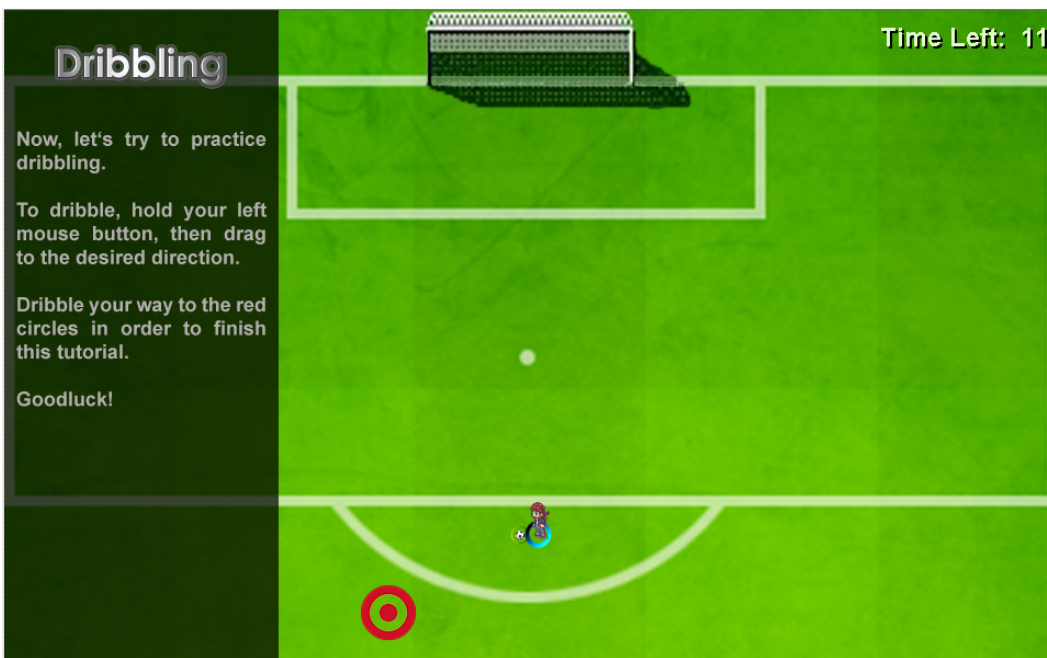


Figure 5.21 – Dribbling Tutorial Interactive (part), WASMS

The tutorial's conclusion will be displayed on the end of the challenge. If it was a failure, the user is allowed to retry the challenge. (See Figures 5.22 – 5.23) Similar results on the other skills (passing, shooting and goalkeeping) are seen in Figures 5.24 - 5.26.

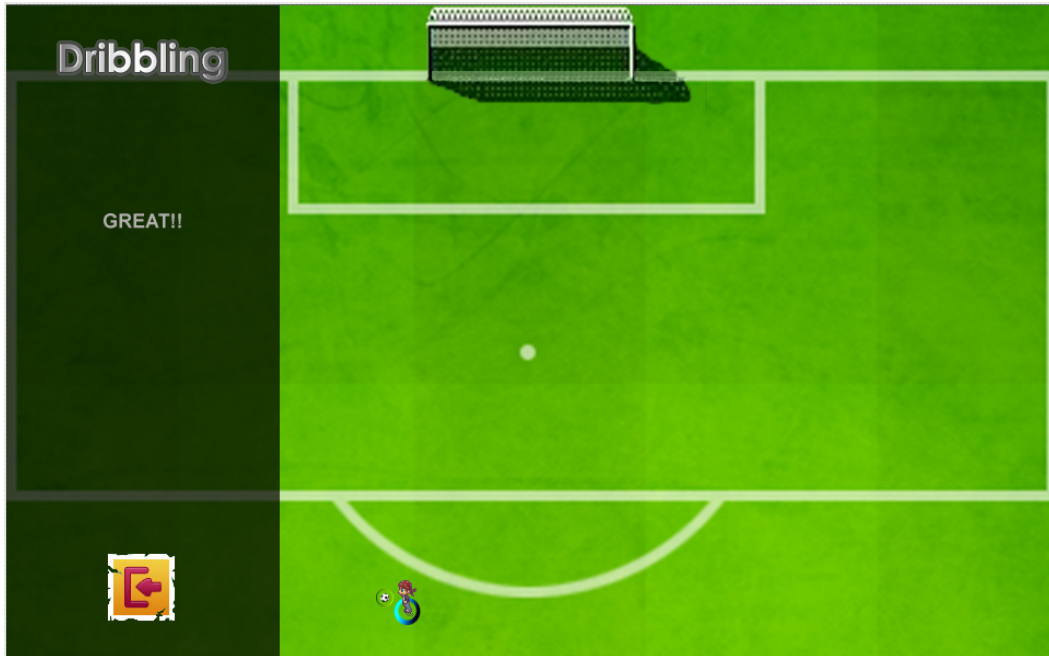


Figure 5.22 – Dribbling Tutorial Conclusion (success), WASMS

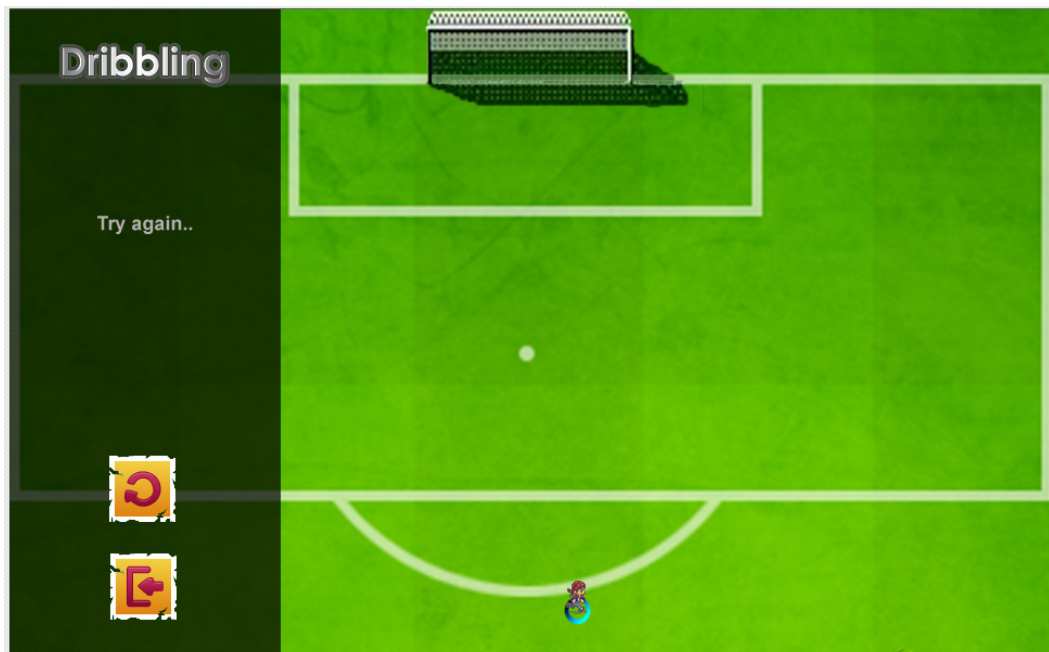


Figure 5.23 – Dribbling Tutorial Conclusion (fail), WASMS

Passing

Good passing is absolutely essential to playing good soccer. Approximately 80% of the game involves the giving and receiving of passes. No matter how talented the dribbler, it is nearly impossible to penetrate an offense without good passing. The art of passing is largely the art of doing simple things quickly and well.



DEFENDER

STRIKER




Passing

Good passing is absolutely essential to playing good soccer. Approximately 80% of the game involves the giving and receiving of passes. No matter how talented the dribbler, it is nearly impossible to penetrate an offense without good passing. The art of passing is largely the art of doing simple things quickly and well.



DEFENDER

STRIKER




Passing

Let's try to pass...

To pass, simply place your cursor to your passing target and then click the left mouse button.

To finish this tutorial, pass the ball to your teammate before the opponent steal the ball from you.

Goodluck!

Time Left: 27



DEFENDER

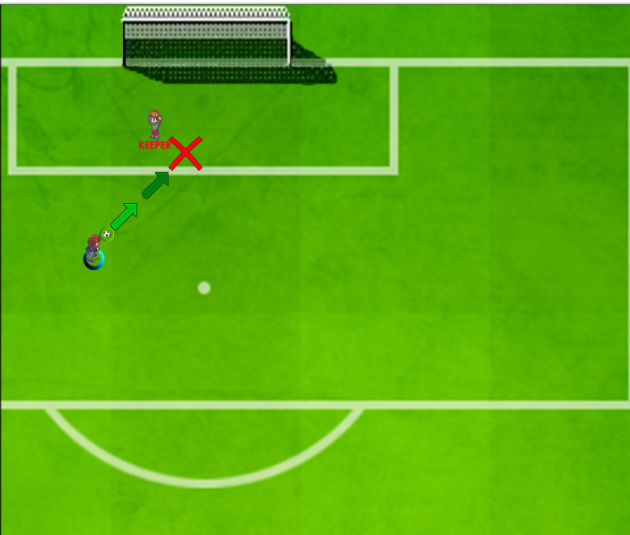
STRIKER


Figure 5.24 – Passing Tutorial, WASMS


Shooting

A shot is when a player kicks the ball at the opponent's net in an attempt to score a goal. It makes up for almost 70% of scoring in soccer.

Strikers are often the best shooters in their team. The keeper's position is a very important aspect to consider when determining where to shoot.



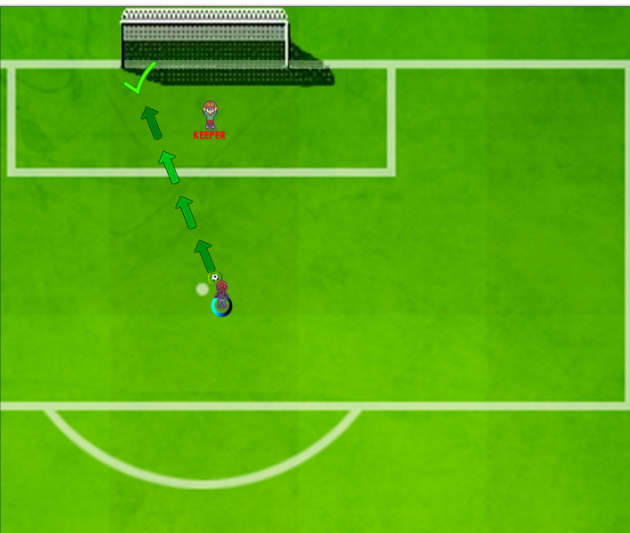





Shooting

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Shooting

One of the easiest situations of shooting the ball is the Penalty Shot (refer to the Laws of the Game) it is the 'free throw' of soccer.

To shoot, right click on your target shooting location. Always try to confuse the goalkeeper.

Goodluck!

Time Left: 28

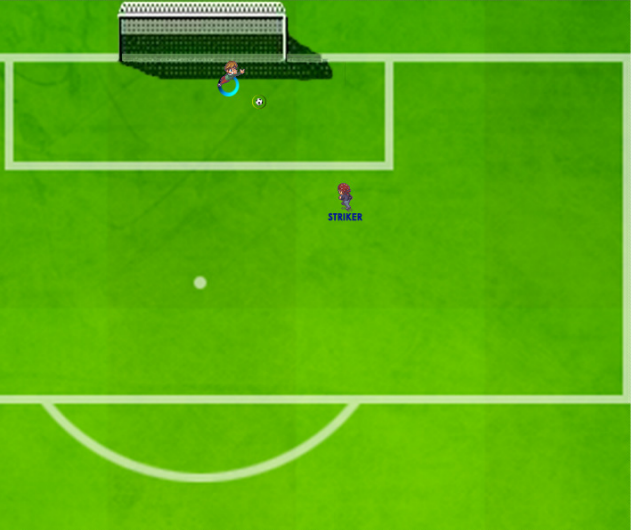




Figure 5.25 – Shooting Tutorial, WASMS

Goalkeeping

The goalkeeper is a specialist who plays the ball with both hands and feet. He is the last line of defense. The team rely heavily on him to make saves during the game.

Soccer goalkeeping technique is focused on the mechanics of catching the ball, or at least deflecting it around the goal.

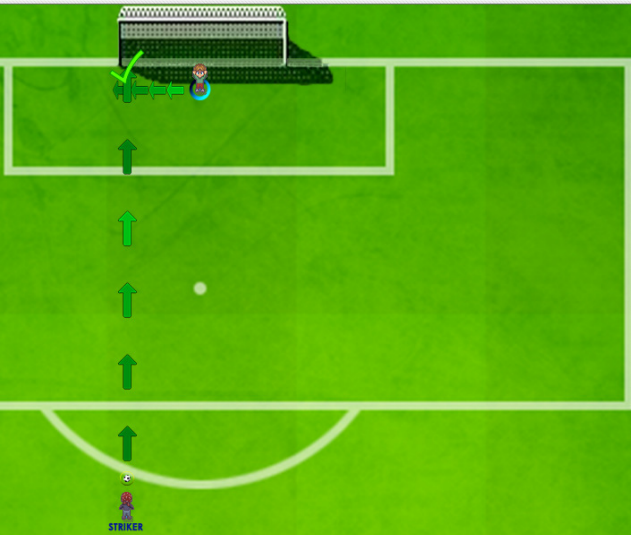




 

Goalkeeping

The goalkeeper is a specialist who plays the ball with both hands and feet. He is the last line of defense. The team rely heavily on him to make saves during the game.

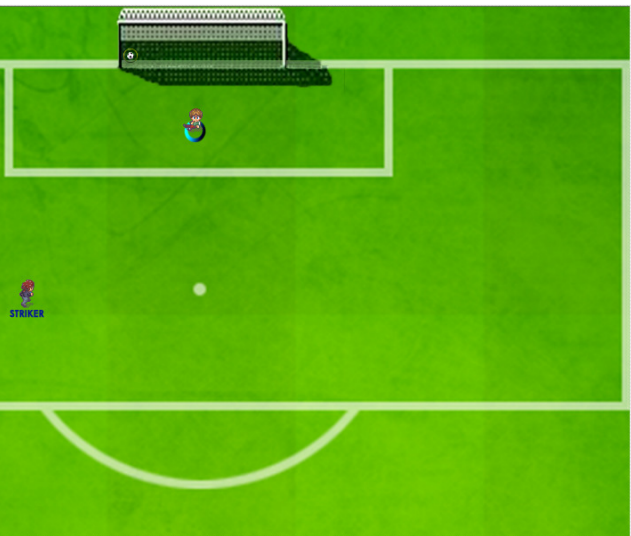
Soccer goalkeeping technique is focused on the mechanics of catching the ball, or at least deflecting it around the goal.



Goalkeeping

Try again..





 

Figure 5.26 – Goalkeeping Tutorial, WASMS

5.2.2 Simulate

This is the section of the game where the user is allowed to watch the AI's play shooting scenarios. The scenarios include: 1 striker against a goalkeeper, 2 strikers against a goalkeeper, and 2 strikers against a goalkeeper and a defender, as seen in Figure 5.27. There is a quick transition screen before the actual simulation. (See Figure 5.28)

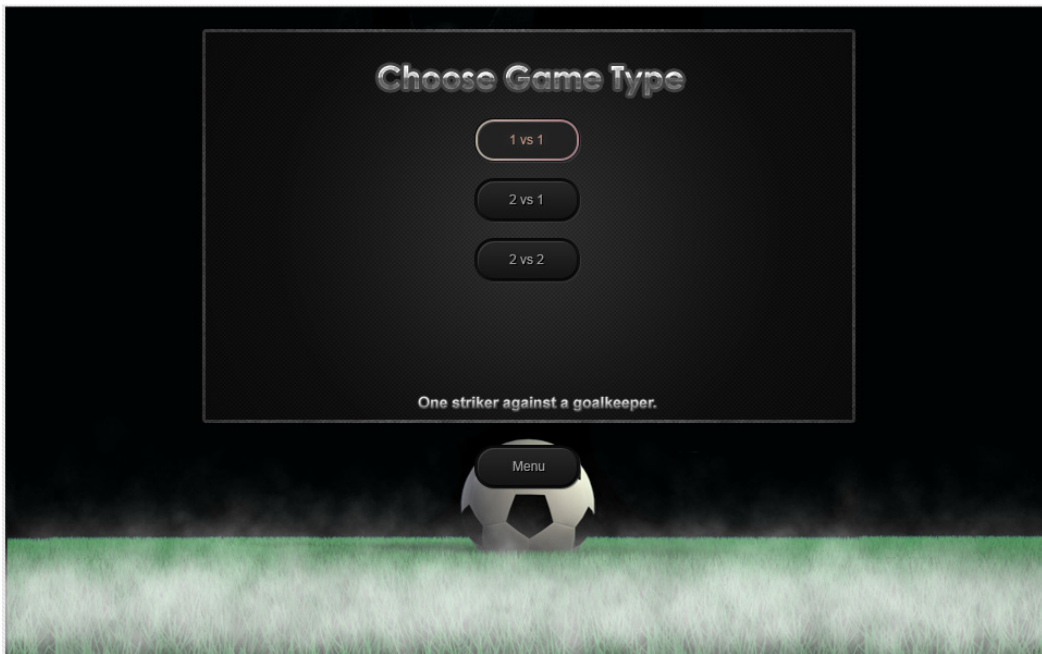


Figure 5.27 – Choose Game Type Screen, WASMS



Figure 5.28 – Pre-Simulation Transition Screens, WASMS

As the scenario starts, the players are initialized to their starting positions. The game time is set to 20 seconds, located in the upper right hand corner of Figure 5.29. The striker/strikers will attempt to shoot the ball to the goal before the times run out. The goalkeeper (and the defender, if any) will try to prevent them from doing so. (See Figure 5.30)



Figure 5.29 – Start of 1 vs. 1 Simulation, WASMS



Figure 5.30 – 1 vs. 1 Simulations, WASMS

The scenario ends when the ball goes out of play, the goalkeeper catches the ball, the time runs out, or a goal is scored. (See Figures 5.31 - 5.34) The simulations for the 2 vs. 1 and 2 vs. 2 situations are seen in Figures 5.35 - 5.36.

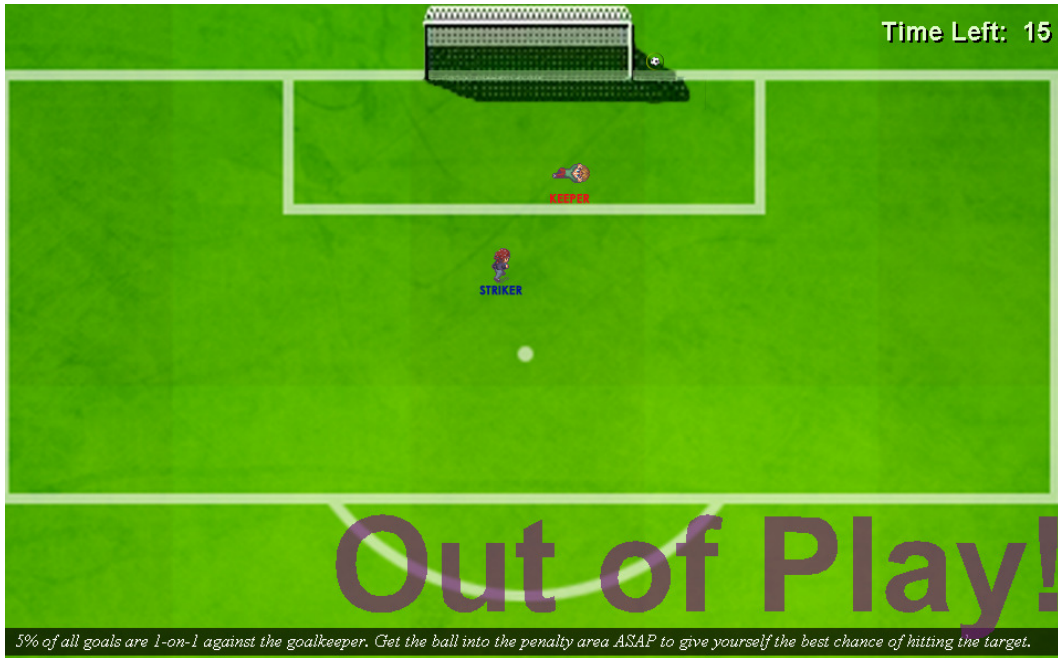


Figure 5.31 – Simulation End (ball goes out of play), WASMS



Figure 5.32 – Simulation End (goalkeeper catches the ball), WASMS



Figure 5.33 – Simulation End (time runs out), WASMS



Figure 5.34 – Simulation End (a goal), WASMS

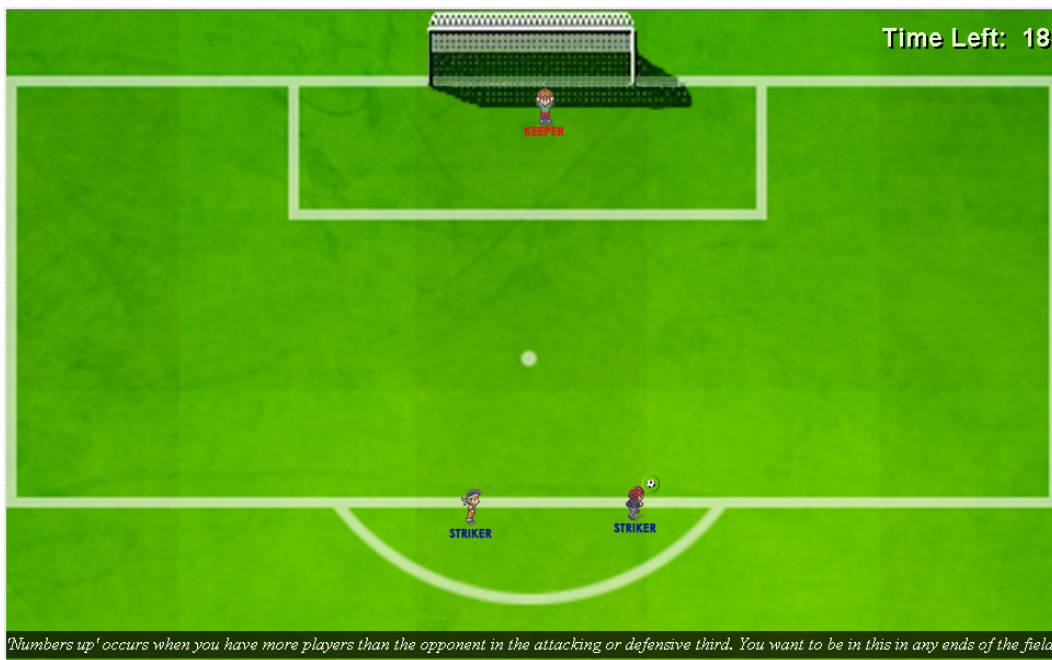
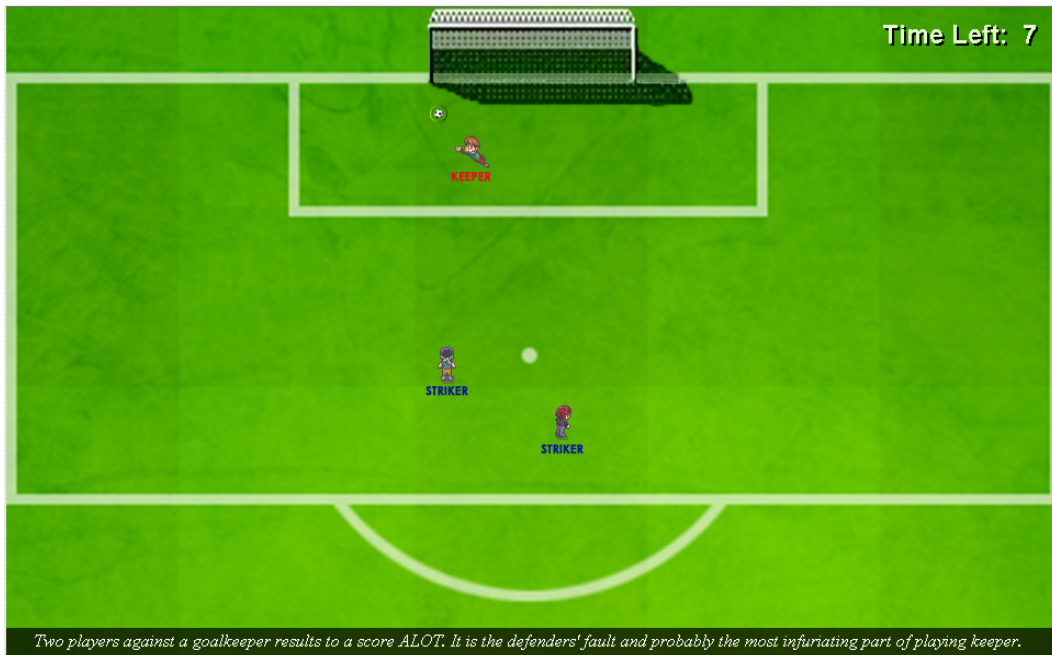


Figure 5.35 – 2 vs. 1 Simulations, WASMS

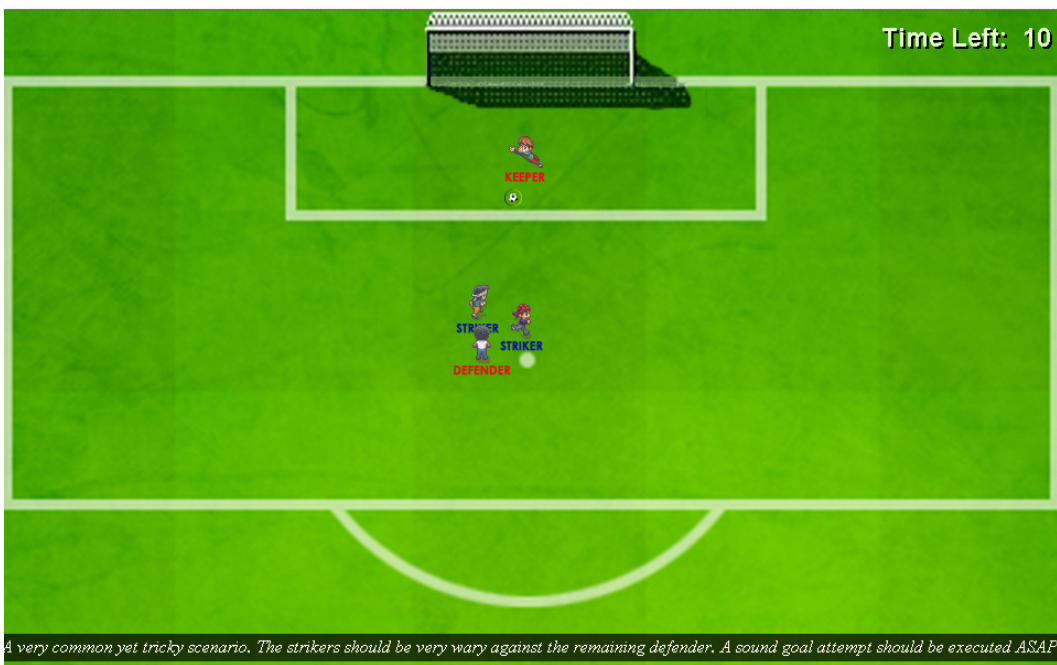


Figure 5.36 – 2 vs. 2 Simulations, WASMS

5.2.3 Custom

This functionality allows the user to control either the striker or the goalkeeper, as shown in Figure 5.37, in the same scenarios in the simulation. If the user is controlling the striker, the objective is to score a goal. On the other hand, if the user is controlling the goalkeeper, the objective is to prevent a goal.

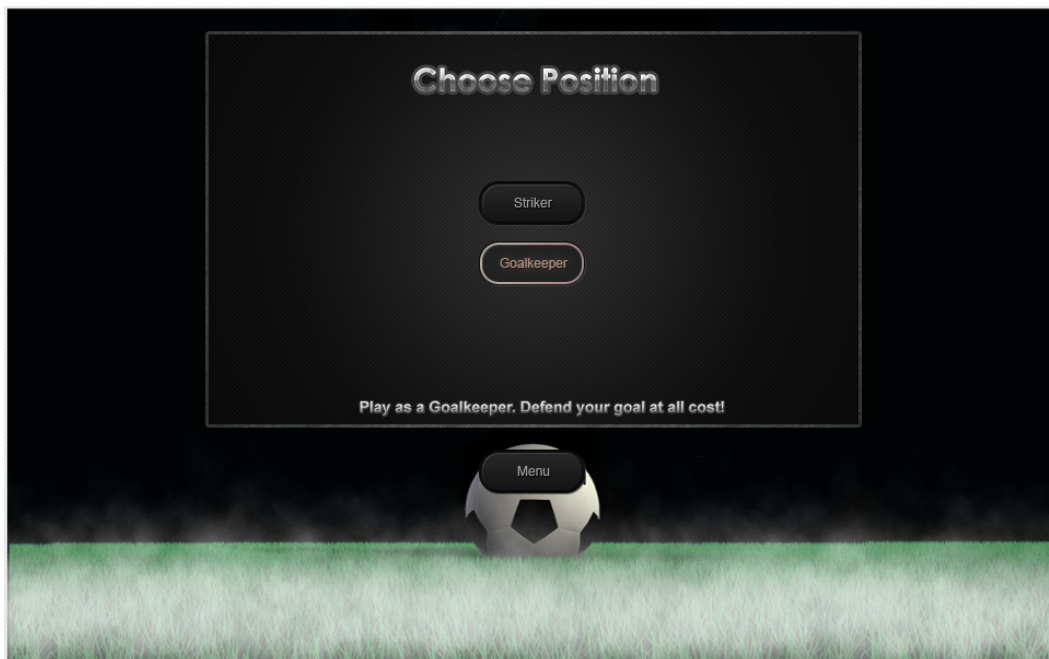


Figure 5.37 – Choose Position Screen, WASMS

The player being controlled by the user in the different simulations will have a circle indication, as seen in Figures 5.38 - 5.43. The game controls for the player's actions are shown in Table 5.10.

	Striker	Goalkeeper
Left-Mouse-Button-Drag	Move / Dribble	Move
Left-Mouse-Button-Click	Ask for Pass / Pass	-
Right-Mouse-Button-Click	Tackle / Shoot	Catch

Table 5.10 – Game Controls, WASMS



Figure 5.38 – User as striker in 1 vs. 1 simulation, WASMS

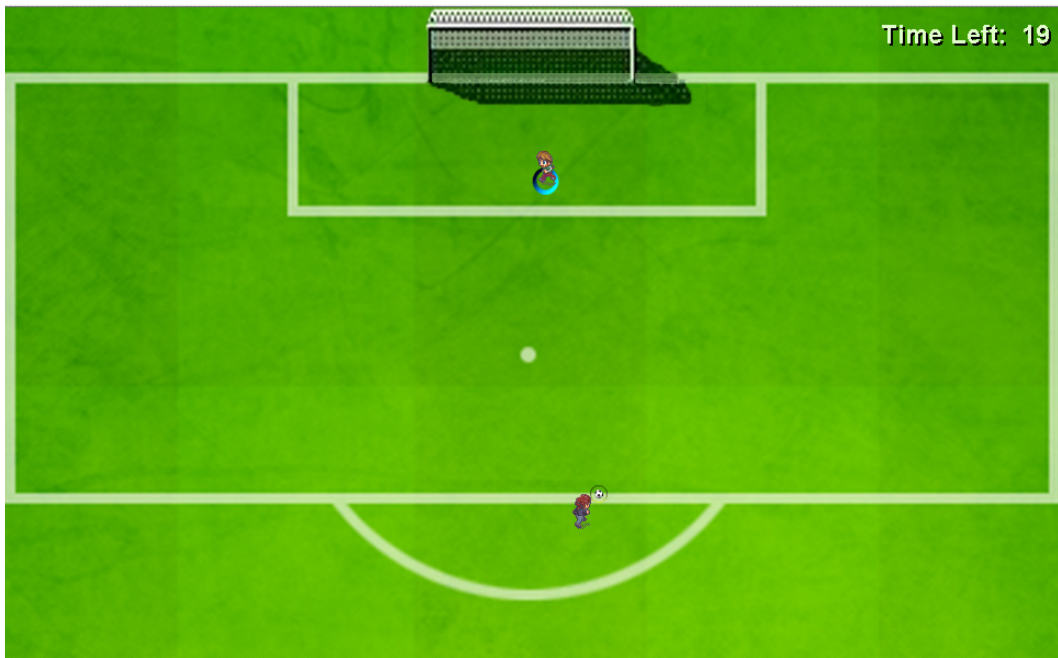


Figure 5.39 – User as goalkeeper in 1 vs. 1 simulation, WASMS



Figure 5.40 – User as striker in 2 vs. 1 simulation, WASMS

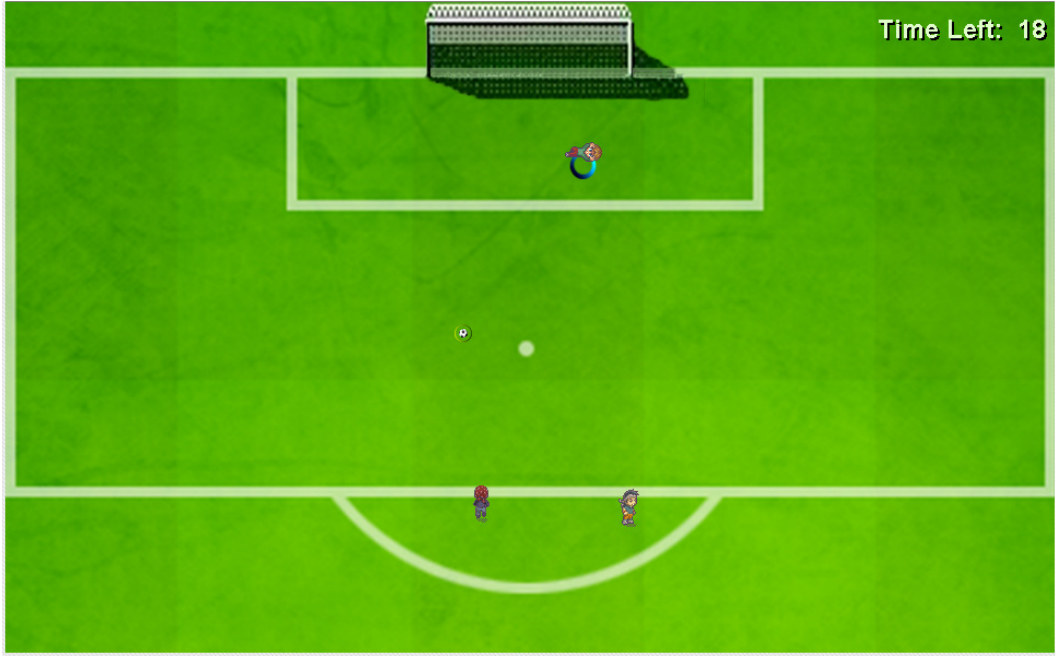


Figure 5.41 – User as goalkeeper in 2 vs. 1 simulation, WASMS

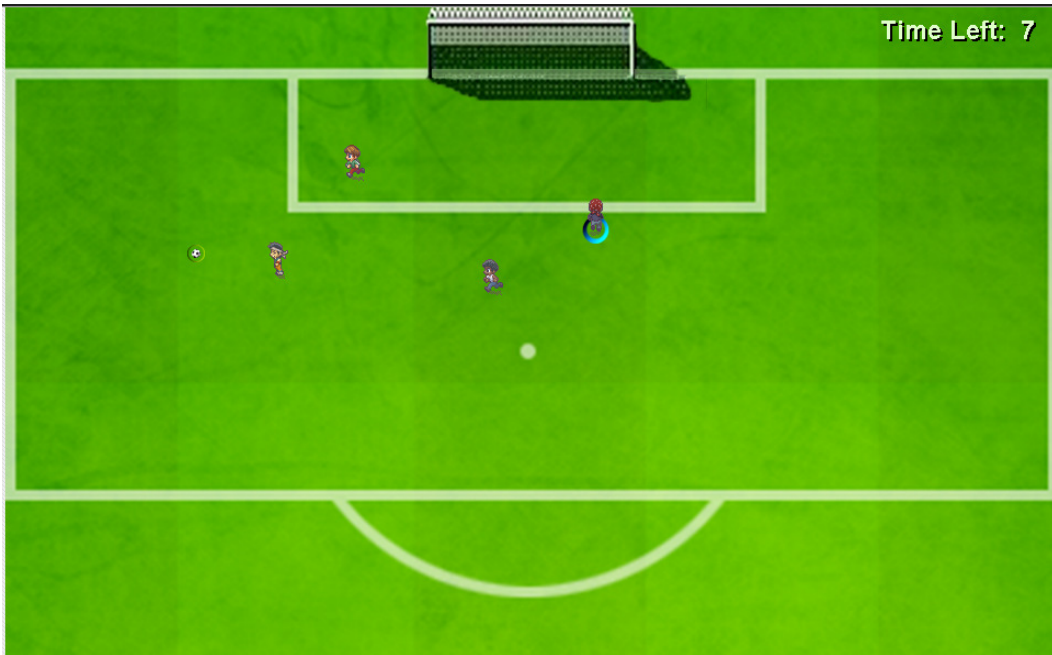


Figure 5.42 – User as striker in 2 vs. 2 simulation, WASMS



Figure 5.43 – User as goalkeeper in 2 vs. 2 simulation, WASMS

5.2.4 Arcade

To add a twist to the custom playing of the user, an arcade feature is provided, as seen in Figure 5.44. In here the user will play 5 consecutive levels: each is a different scenario from custom play and scores are awarded at the end of each level. If a level is completed, the user is allowed to proceed to the next level. If a level is failed, it will be game over and the level will reset again to the first level. (See Figures 5.45-5.46)



Figure 5.44 – Arcade Mode, WASMS



Figure 5.45 – Arcade (level cleared), WASMS

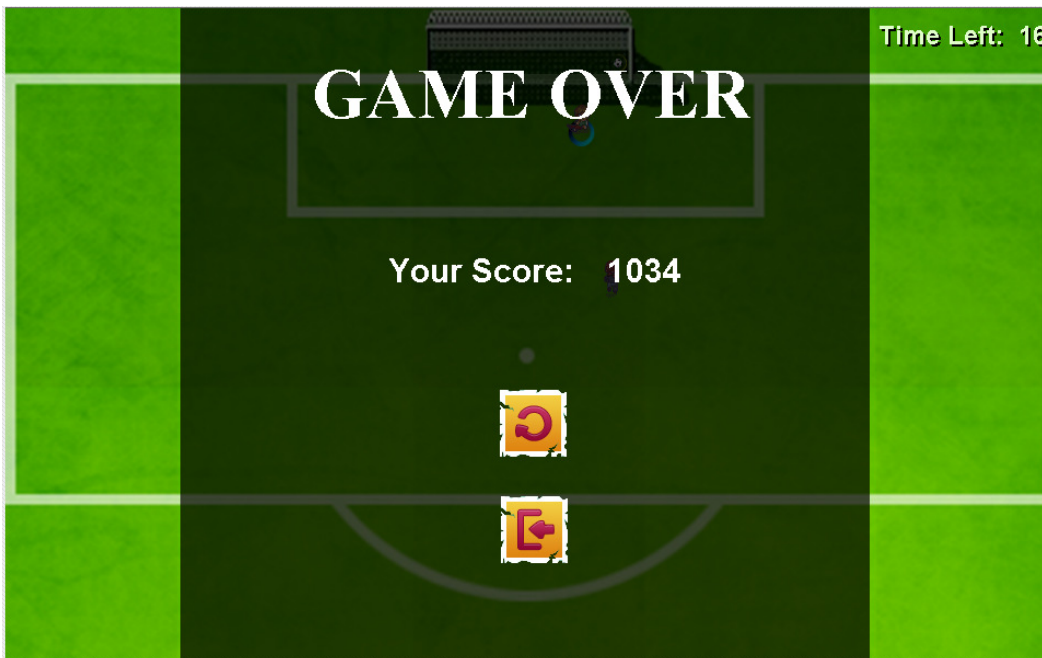


Figure 5.46 – Arcade (game over), WASMS

5.2.5 Scores

This is an additional functionality to the arcade feature where in the top 5 scores from arcade will be recorded. The user can reset the scores back to all 0's. (See Figure 5.47) To be able to save the high scores even when the game is closed, the user must allow access to its browser's cookies. The high scores will be saved as cookies and can be loaded again every time the applet is started.

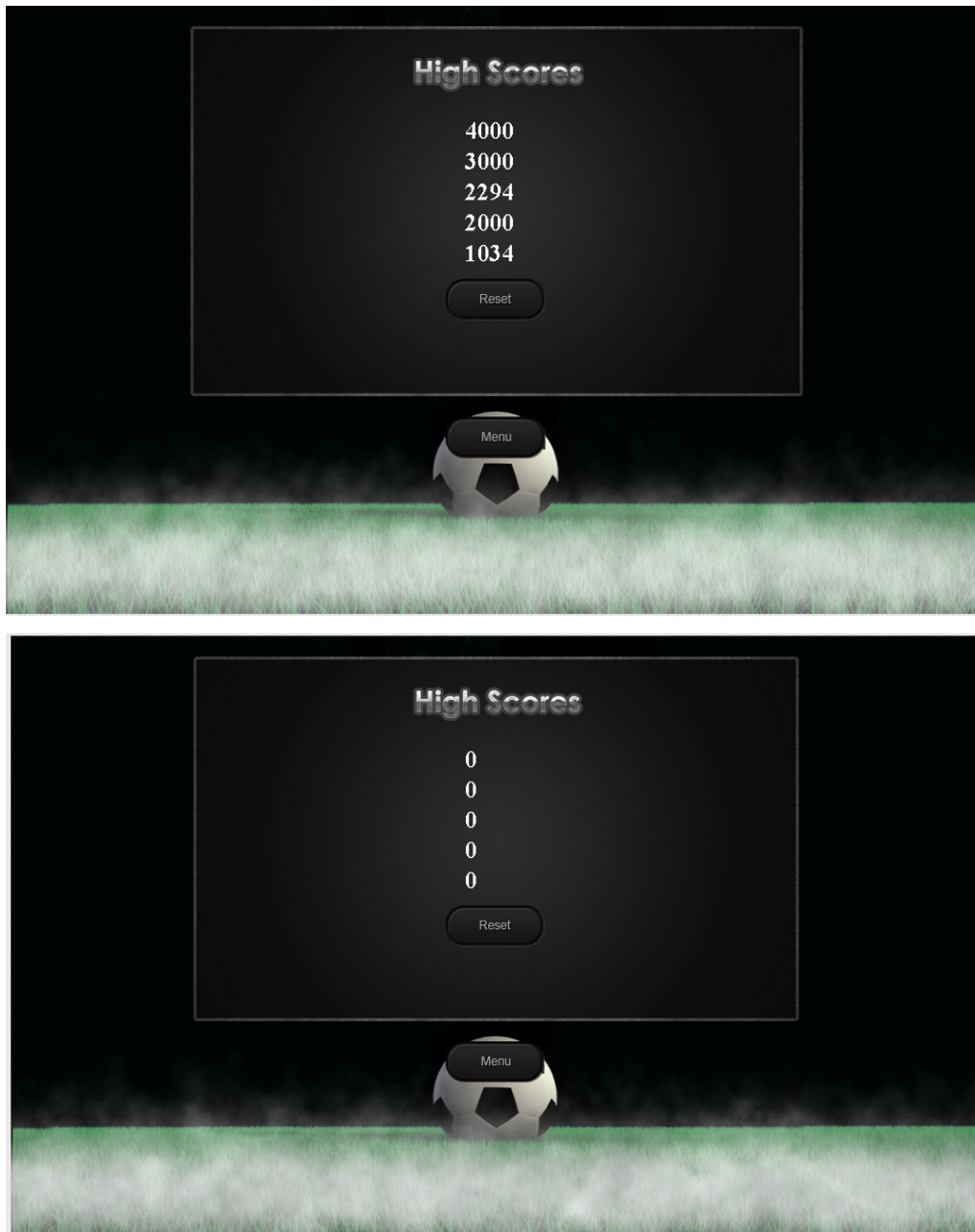


Figure 5.47 – High Scores, WASMS

5.3 The Website

This motivational tool for soccer, being web-based, starts from a home page. (See Figure 5.48)

WASMS

SOCCER MOTIVATION TOOL

HOME SOCCER OVERVIEW LAWS OF THE GAME FUNDAMENTALS LOCAL SETTING PLAY QUIZ

Eat, Sleep, Play Soccer

A place where football can only be fun...

Watch Video

A Quick Overview

"What is soccer? Is that a food? This is the first time that I encounter that!" Whether soccer is still foreign to you or you're already a die hard FIFA fan, you don't want to miss this section where interesting soccer facts are presented. Did you know where the word 'soccer' came from? How about why most Americans don't like soccer?

Read More

National Sport?

Our country just love basketball, unconditionally. But we have a conundrum: we are not born for it, literally. And you already know what I mean. On the other hand, soccer is the sport that is more suited for us. Why? It is answered in this section where compilations of articles about the relatively dormant state of football are presented.

Take the quiz

Not Just Physical

So you think playing soccer is just about physical activities? You're wrong. There's also fun in taking a soccer quiz. Yes, you have read it right: an interactive test on what you have learned about football from this site. Answers are provided and explained afterwards. Take the quiz and see if you're smart enough to be a soccer player.

Learn the Basics

From the essential skills one must develop before playing a match, to the required conditionings of a seasoned player - everything fundamental to the sport is discussed here.

Know the Rules

In every game there are rules, as well as in football. They might not be necessary on the street plays, but before you start to play in actual matches, be sure to find out the laws of the game.

Play the Game

If you are a fan of both soccer and computer games, good news for you. This site features a soccer game that allows you to play as a striker or a goalkeeper. Or just watch simulations!

Figure 5.48 – Home Page, WASMS

The website has a menu bar that allows navigation to the main pages/sections of the site, namely Soccer Overview, Laws of the Game, Fundamentals, Local Setting, Play and Quiz. It features three sliding images about soccer; each has a short slogan and a link to a soccer video clip.

5.3.1 Soccer Overview

The main purpose of this page is to provide a brief introduction to soccer for those unfamiliar to the sport. This is shown in Figure 5.49.

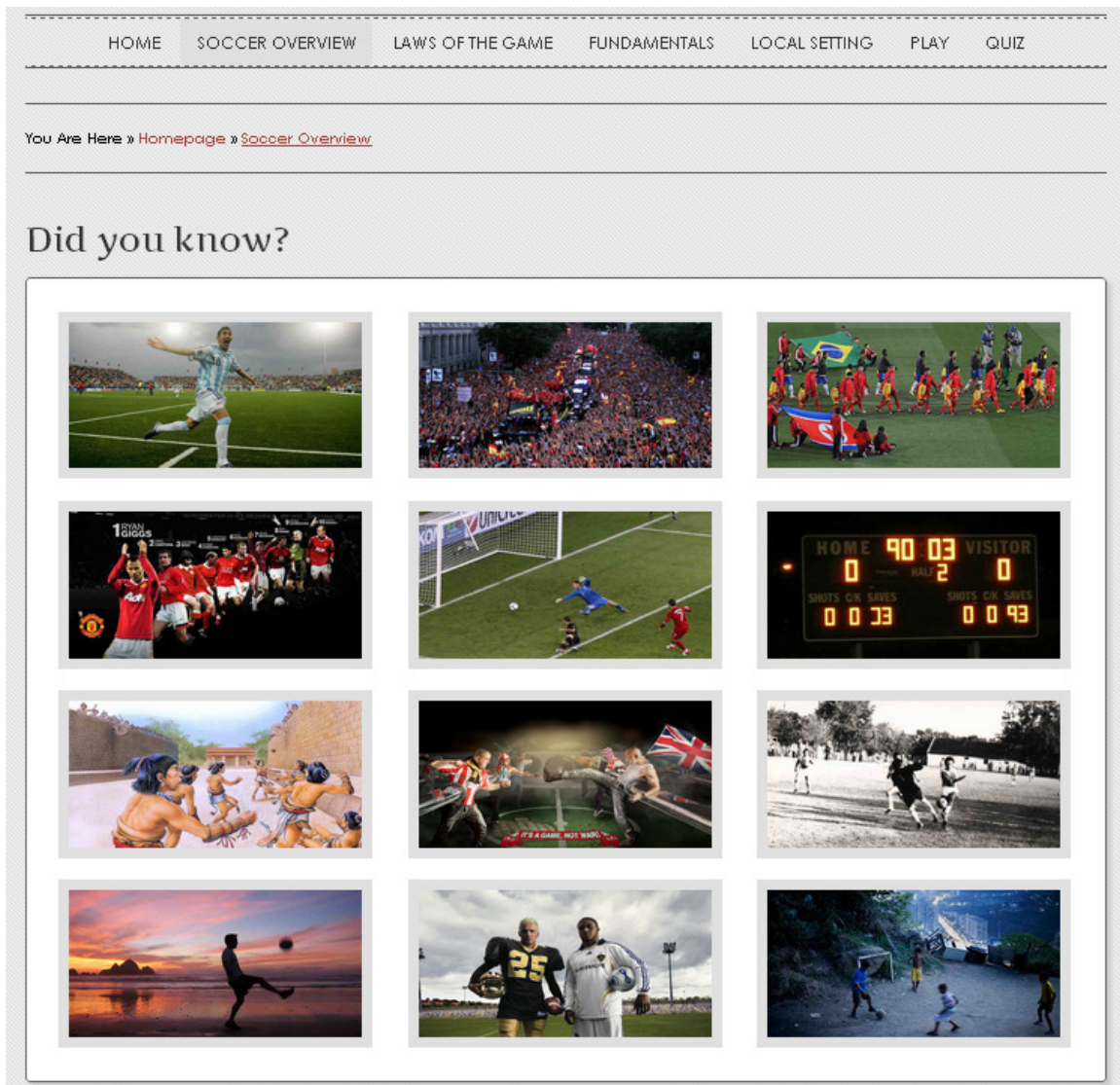


Figure 5.49 - Soccer Overview Page, WASMS

It is basically a gallery of images that zoom when clicked and display interesting facts about football. It displays screenshots from soccer matches, tells the objectives of the sport, talks about the soccer history and etymology, etc. A sample screenshot is seen in Figure 5.50.



Figure 5.50 – Example of a zoomed image, WASMS

5.3.2 Laws of the Game

Since reading documentations of rules are often irksome tasks, WASMS uses an embedded flash to visually and interactively present the official rules from FIFA, which are often called as Laws of the Game. The flash application used is an open-source software obtained from soccertrainingguide.com.

(See Figures 5.51 - 5.52)



Figure 5.51 – Laws of the Game Page, WASMS



Figure 5.52 – Example of a rule: Free Kick, WASMS


5.3.3 Fundamentals

This is the most informative section of WASMS, tutorial-wise. It provides a relatively detailed discussion and videos for the essential things to learn before playing soccer. A navigation sidebar is provided in the right for quicker access to the subsections. It has three subsections: skills, strategy and conditioning, as seen in Figure 5.53.

HOME SOCCER OVERVIEW LAWS OF THE GAME **FUNDAMENTALS** LOCAL SETTING PLAY QUIZ

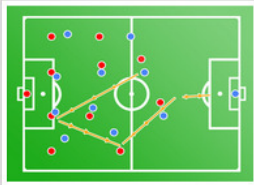
You Are Here » [Homepage](#) » [Fundamentals](#)

Fundamentals




Skills

The sport of Soccer is unique in demanding excellent physical fitness and excellent technique. Without strong technical skills players will not be able to score goals or defend effectively. Receiving, dribbling, passing, shooting and heading are fundamental techniques all players must develop and continually refine. The best players always have strong technique.



Strategies

Unlike most sports in which plays are predetermined, Soccer gives individual players room to improvise - albeit within a guiding theme. The theme follows from the strategy and tactics their coach devise. To be able to execute the playing structure of your team, one must become familiar with the basic principles, styles and systems of play as well as individual and group tactics.



Conditioning

Though success in sports is determined primarily by athletic ability and proper training, nutrition affects the athlete in many ways. Nutrition is important for normal growth and development and for maintaining good health. A healthy athlete feels better, trains harder, recovers more quickly and is less susceptible to illness.

Navigation


- Skills
 - Passing
 - Heading
 - Receiving
 - Dribbling
 - Shooting
- Strategy
 - Positions
 - Formations
 - Tactics
- Conditioning
 - Fitness
 - Nutrition
 - Injuries

Figure 5.53 – Fundamentals Page, WASMS

In the skills category, user is allowed to learn the five basic moves in soccer: dribbling, heading, passing, receiving and shooting, as illustrated in Figure 5.54. Each skill is displayed in a separate page which contains a tutorial video, a discussion on how to perform the skill, and a related random trivia. Also, the video has full-screen capability. (See Figures 5.55 - 5.56) This goes similarly to the rest of the subsections (Strategy, Conditioning and their further subsections).

You Are Here » [Homepage](#) » [Fundamentals](#) » [Skills](#)

Skills



Over its century long existence in its current (professional) form, soccer continually evolved into an all-skills sport. In order to be a good soccer player, you can't simply focus on a single skill. You could be an extraordinary free kick taker and score every one of two close range kicks, but if you have no passing or receiving skills for example, no coach will risk throwing you in the team and literally playing 10 versus 11.

The basic skills are not "seen" during a match, but they allow you to build upon them and perform moves that would otherwise be impossible.


This section is an examination of the basic soccer skills. If players can't pass and catch the ball in basketball, they can't play the game. If they can't pass and receive the ball in soccer, they are useless. It should be emphasized that these skills are critical to be successful. Repetition of these skills is the key to learning and mastering them.

But still remember, only reading these will never be enough. You need to practice, practice and practice for thousands of hours.

Having said those, let's now take a look at the main soccer fundamental skills that are required in a modern day player.

Navigation

- Skills
- Passing
- Heading
- Receiving
- Dribbling
- Shooting
- Strategy
- Positions
- Formations
- Tactics
- Conditioning
- Fitness
- Nutrition
- Injuries



[Begin »](#)

Figure 5.54 – Skills Subsection, WASMS

Heading



Heading a soccer ball is a forced mechanics that you will probably have hard time learning at first. This is because as humans, we are naturally afraid of hitting an object that's moving towards us with our heads. In order to learn how to head a soccer ball correctly, you'll first have to overcome this fear.

Remember how the ball hurt your head the first time you tried heading it? That's most likely because you let the ball hit your head and not vice versa.

If you charge at the ball and **hit it first**, it's the ball that will take most of the shock and not your head. Just try it a couple of times on your next practice and you'll notice it's not all that painful.

Another important aspect of heading correctly is learning where to hit the ball and hitting it with the correct part of your head. The area you should try hitting the ball with is the upper part of your forehead, the part where the skull is slightly bumped outwards. This area is tough and is composed simply of skin and bone, so there's no pain involved when hitting the ball with it.

You should focus on hitting the ball around its equator. Otherwise, if you hit it too low or too high, it won't go straight. But in order to hit it in the right place, you will have to see the ball coming all the way.

Now, we have a natural instinct to close our eyes when hitting something with our heads and that's the second instinct you'll have to suppress. If you can't see the ball, you can't hit it right and there's a chance it might even smack you in the face! Trust me, you don't want that.

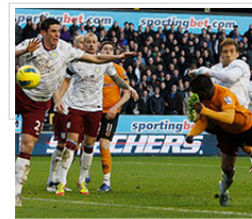
Lastly, we should learn how to apply force to a header. It might seem that the strength in a soccer header comes from the neck, but in truth, the neck plays a very small role in the final force formula. It's actually your **back and your abdominal muscles** that do most of the work, with the neck playing a secondary role. So if you want to obtain strong headers, make sure you work your lower back and abdomen extensively.



Navigation

- Skills
- Passing
- Heading
- Receiving
- Dribbling
- Shooting
- Strategy
- Positions
- Formations
- Tactics
- Conditioning
- Fitness
- Nutrition
- Injuries

Boot in the Face



Wolves midfielder Emmanuel Frimpong was taken to hospital with an eye injury he suffered during the 3-2 defeat by Aston Villa. The 20-year-old was struck by the boot of Villa's Stiliyan Petrov's as he attempted a diving header. "I can't remember too much about it to be honest," Frimpong said afterwards. "I remember heading the ball and, from what I heard, I then got a kick in the face. We'll just have to give it a couple of days and wait for it to settle down."

Figure 5.55 – Example of a skill: Heading, WASMS



Figure 5.56 – Example of a full-screened video, WASMS

5.3.4 Local Setting

Figure 5.57 is a collection of soccer articles from various sport writers and analysts. It discusses the soccer culture of certain nations and how the youth affects it, and then relates it here in our country. The main purpose of this section is to explain why Filipinos should prioritize soccer more than any other sport, especially basketball. Any article can be clicked to expand and allow the user to view its entirety, as shown in Figure 5.58.

You Are Here » [Homepage](#) » [Local Setting](#)

Why soccer is best suited for Filipinos

14
JUN

2010

Despite the global frenzy over the ongoing Soccer World Cup in South Africa, some diehard sports followers are puzzled why football, or soccer, lacks popular appeal in the Philippines unlike basketball which commands tremendous following

As former POC president and retired Col. Julian Malonso said: "Football is a sport best suited for the Filipinos mainly because the ball is on the ground unlike basketball where the ball is on the air, hence giving the tall players undue advantage."



Why we're not into soccer

23
JUN

2010

With the World Cup 2010 madness at its height, when European capitals stand still as their national teams compete, you are likely to ask yourself: "Are we so different that we don't play the game everyone's playing around the world?"

It's not a trivial question. Nearly one billion human beings are said to be watching the World Cup 2010 games, and we're not. We're very strangely not participants in what an American columnist termed as the 'human family at play.' If football, as a historian pointed out, is 'the new religion,' then we Filipinos are weirdly the fringe group atheists.



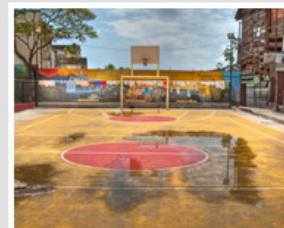
Basketball vs. Soccer

05
AUG

2010

Jaemark Tordecilla is a short geeky graduate of Philippine Science High School, while Rafe Bartholomew is a white 6'3" jock from New York. They met at the intersection of exuberant writing and a passion for Philippine basketball.

For months they conducted a spirited exchange about all things basketball, often disagreeing about contentious issues, but always driven by a mutual love for the sport that found its most hospitable home in a land of height-challenged ballers.



The time has come for soccer

30
JAN

2011

The long-time dream of soccer fans in the Philippines that their favorite sport could at least be a poor second to basketball in national consciousness may have come. As I have written time and again in this newspaper, **it doesn't make sense for Filipinos to be so obsessed with basketball.** No matter how the genes of Filipinos are evolving as there are more intermarriages with Caucasians, it may take centuries before we can produce a generation of Michael Jordans and Pau Gasols. We will always be handicapped in basketball global competition by our having more "unanos" (enanos in the original Spanish word) than giants.



U.S. soccer culture must be overhauled

07
JUL

2011

Here is an article discussing how U.S. soccer culture should be developed further and that is by focusing on youth soccer. Their situation is **very similar here in the Philippines since we probably had gotten our love for basketball, and not for soccer, from the Americans.** Like them, the right way to overwhelm our culture with soccer is through the youth. Moving on to the article:

The U.S. national team was routed in the CONCACAF Gold Cup final by a Mexican side featuring young attacking talent so good, it likely left even the most biased American fan wistful.



Figure 5.57 – Local Setting Page, WASMS

"Soccer is a sport we can be good in!"

02 SEP — It's good to know that brands like Cortal SQR and the Philippine Azkals, our very own National Team, are up for the challenge to promote soccer/football in the country.

SEP They both believe that Soccer can become a sport in which we Filipinos can excel, if given proper attention and support to. Yours truly believes so as well.

I used to play Soccer for my small community back then in Germany, when I was about 6-10 years of age. I really love the sport and it's not that difficult to learn.

My favorite position back then (which it still is right now) was the left wing. It's mastering the sport, that can be a steep learning curve. Especially if you're trying to work it out with people aged 18 and above.

Philippine Azkals Winger Yannick Tuazon nailed it when he said that Soccer should be taught to children of young age. He doesn't mean to discourage people of all age to engage with the sport, no, but it makes more sense teaching the young to ensure that our National Team will have very competitive, experienced and skilled players when these mature.

Though neither Cortal SQR and Philippine Azkals seem to have drafted a solid plan to follow on how to promote the sport, it's very good see them trying to make some noise, make people aware that Soccer is here to stay.

Soccer can be played by people of all ages, almost anywhere you'd like. Yannick was spot on when he said that you could just take a couple of stones and think that these are your goal posts. There's no excuse for someone not to be able to do the sport really!

For those who are not aware yet, Cortal SQR is a pain reliever, a combination of both Ibuprofen and Paracetamol. This medicine can be attained OTC (over the counter) and does not require a doctors' prescription. It is recommended though that you do not exceed recommended dosage.

Many people are yet unaware of this "in-15-minutes-effective" pain reliever, and yes, many people are yet unaware of the sport. It's a good blend of two start ups getting together and rally for the common cause. Promotion of football

Which will hopefully lead the Philippines to the... 2018 World Cup!



By Kevin Paquet

Second Chance



Figure 5.58 – Example of an expanded article, WASMS

5.3.5 Play

The Play page allows the user to play the java applet soccer game discussed in Section 5.2. It allows the user to view the tutorial on soccer moves, watch simulations on shooting scenarios of soccer, and play as the striker or as the goalkeeper. (See Figure 5.59)

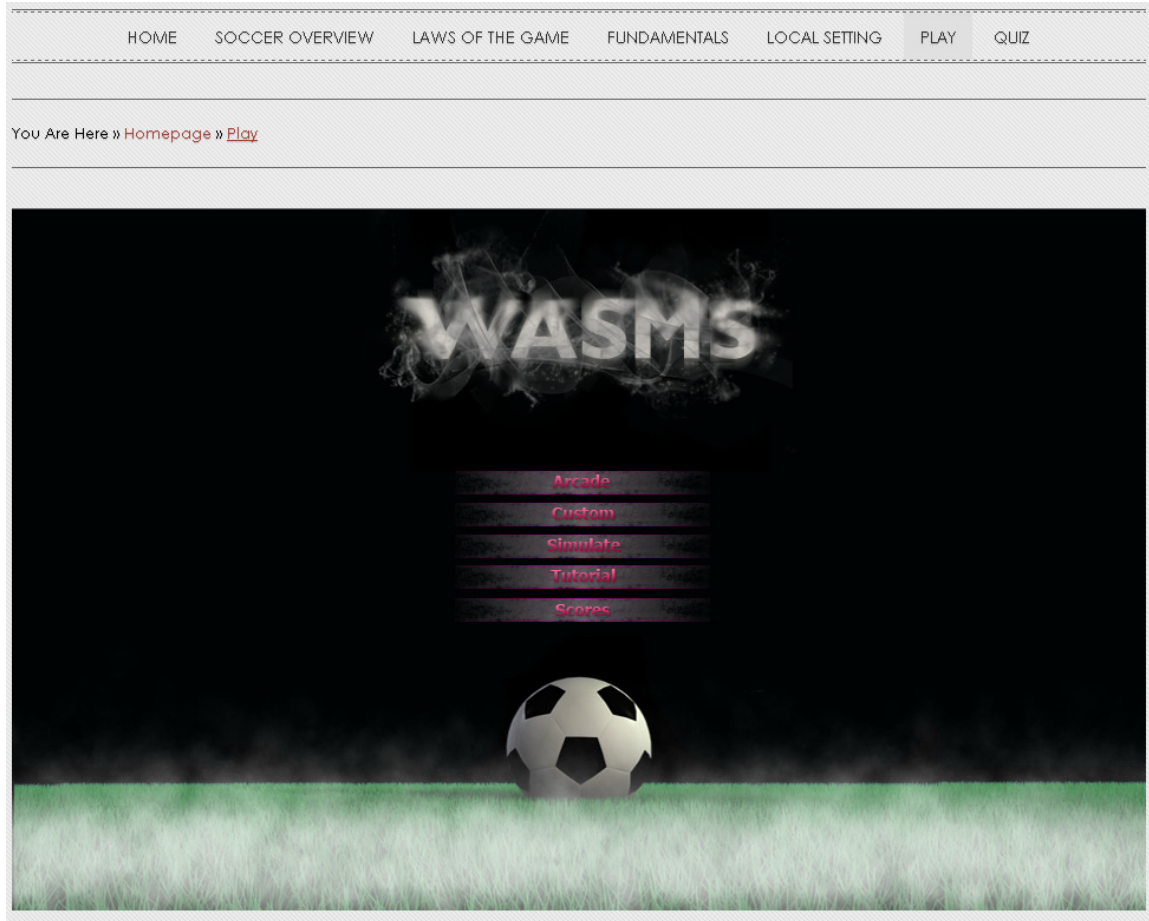


Figure 5.59 – Play Page, WASMS

5.3.6 Quiz

An interactive quiz is given here to test the understanding of the user about anything that has been discussed in the website. The quiz has 30 questions composed of True or False, Multiple Choice and Identification types. After answering a question, the correct answer is supplied. The quiz is randomized from 5 different sets of questions. A total time of 15 minutes is given to the user to answer all the questions. The quiz result is provided afterwards. (See Figures 5.60 - 5.64)

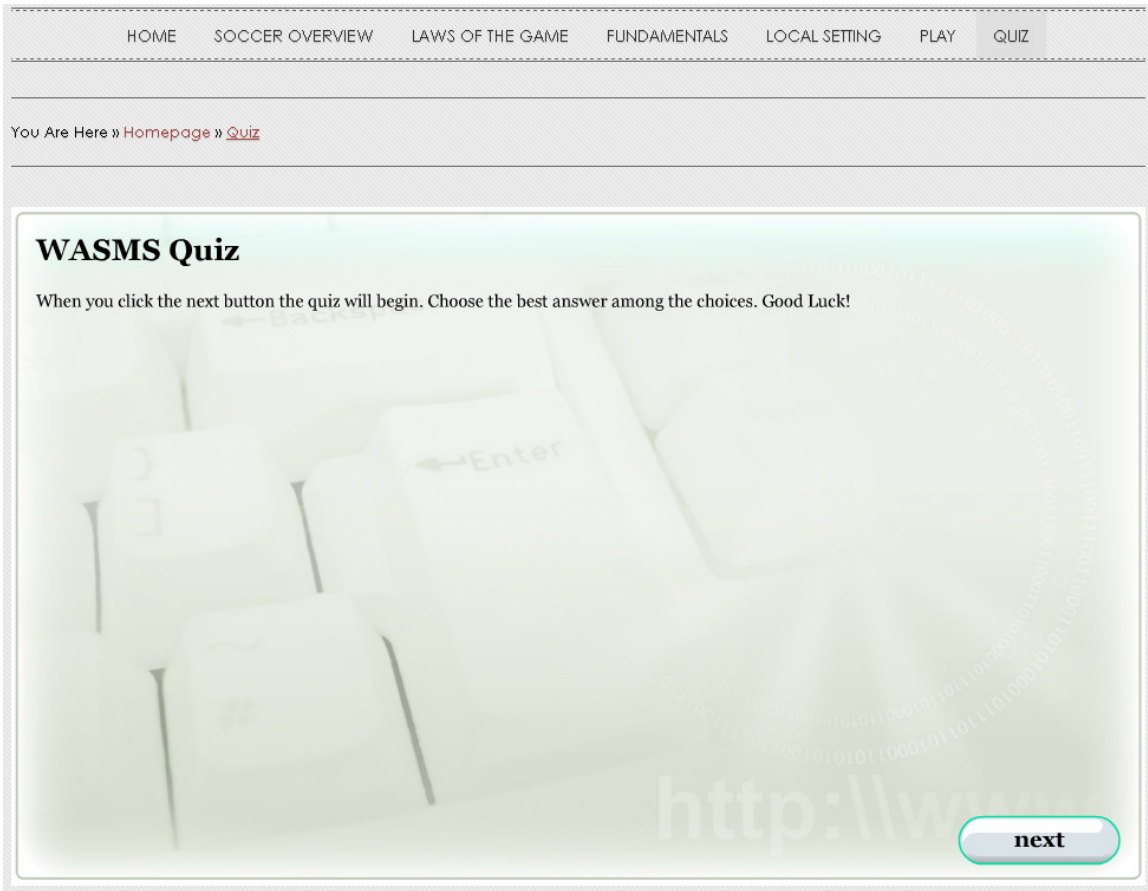


Figure 5.60 – Quiz Page, WASMS

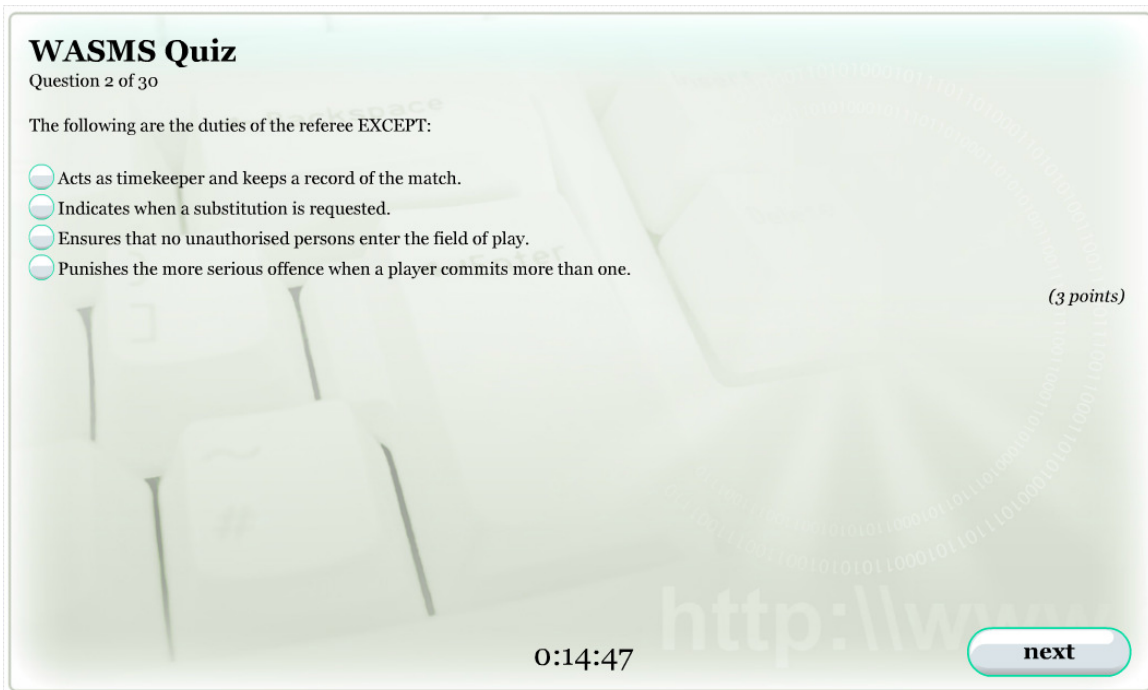


Figure 5.61 – Example of a question (multiple choice), WASMS

WASMS Quiz
Question 12 of 30

The referee indicates **DIRECT FREE KICK** by raising his arm above his head.

True
 False ✓

Correct. A referee indicates an indirect free kick by raising his arm above his head.

(1 points)

0:14:23 [next](#)

Figure 5.62 – Example of a question (true or false), WASMS

WASMS Quiz
Question 18 of 30

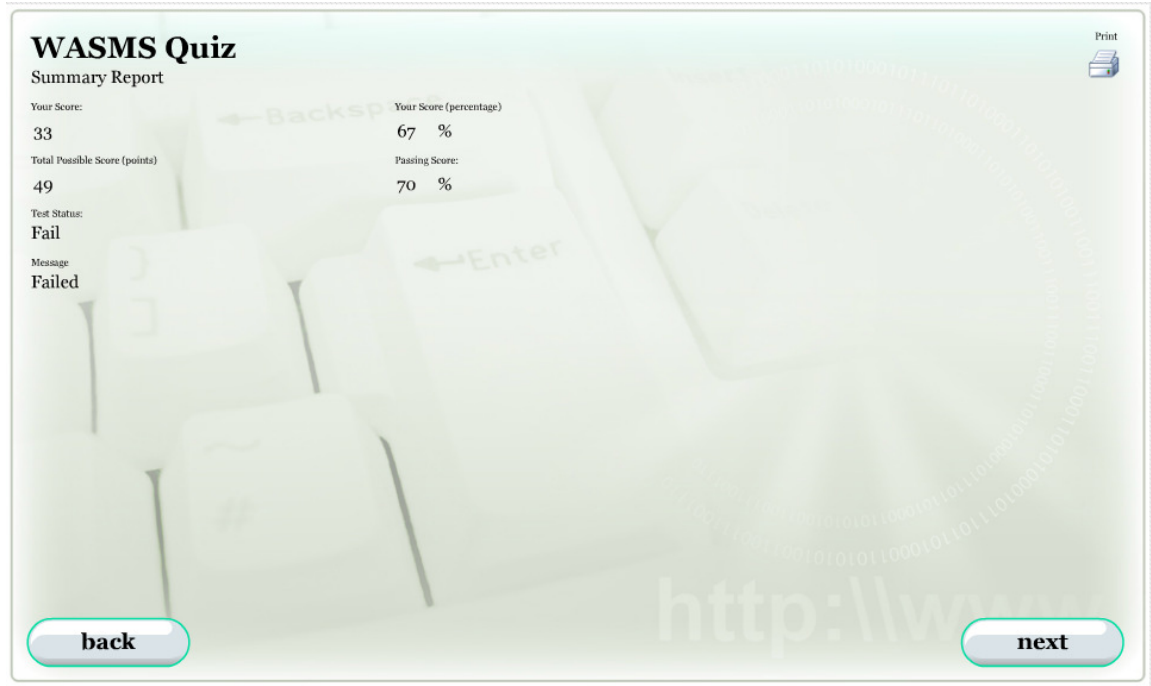
The only player who is allowed to use his hands.

Type your answer:

(1 points)

0:14:00 [next](#)

Figure 5.63 – Example of a question (identification), WASMS

The image shows a screenshot of a quiz result page for 'WASMS Quiz'. The page has a light green background with a faint image of a computer keyboard and binary code. The text is as follows:

WASMS Quiz
Summary Report

Your Score: 33
Total Possible Score (points): 49
Test Status: Fail
Message: Failed

Your Score (percentage): 67 %
Passing Score: 70 %

Print

back next

Figure 5.64 – Quiz Result, WASMS

6 DISCUSSION

WASMS is a complete static web-based application for introducing to people, especially children, the beautiful sport of soccer. It provides all the basic knowledge to make someone familiar to football. It has interesting facts and trivia, tutorial discussions and videos, critical articles, etc. It renders the knowledge and ideas to the user in a creative way, thus, motivating them at the same time. Also, this tool is focused here in our local setting, for the purpose of encouraging the Filipino youth to start playing and enjoying soccer.

The website is the front end of the tool, and it functions like any other soccer sites. The main difference of WASMS is that is introductory and motivational. Introductory in a way that it avoids being too technical for someone new to soccer. The usability of the site does not require or assume any background knowledge about the sport. It is motivational because it presents useful data in a creative and interesting way. This is by means of using different web applications like videos, Facebook-like viewing of photos, embedded flash, and java applet – everything is interactive. Another key difference of WASMS to other football sites is that it focuses here in the local setting. Currently, there are very few available and decent soccer websites from the Philippines, so this tool will be more useful and applicable to the Filipino users who want to learn soccer.

The Java applet game is the main feature of WASMS. Since the target users are children or the youth, a web based game is a very effective way for further motivation. The game is highly graphical and animated. Animations are present in almost every screen the user will see while playing the game. Descriptive and interactive tutorials about the skills are provided. The applet is focused on the shooting scenarios of soccer since a goal is the most highly anticipated and craziest event of a match.

From Chapter 2, the simulations created in the game are inspired by the RoboCup 2D Simulation League. RoboCup has been a benchmark for artificial intelligence research since the last decade. Although the simulation environment in WASMS is much simplified version of that in RoboCup, the approach to developing part of the AI's is similar. In particular, the applet game applies an artificial neural network as a solution to the Optimal Scoring Problem.

The neural network developed is capable of answering two classification problems: a) when to shoot ("don't shoot" and "shootable" categories), and afterwards, b) where to shoot (30 goal sections as categories). It is applied to the AI *strickers* (those who attempt to shoot the ball into the goal) in the soccer simulations of WASMS. This network is trained similarly to the network developed by Kaviani *et. al*(2005) which was applied successfully in RoboSina, a participating team in the RoboCup Simulation league [13].

The 5600 samples used in training the neural network is generated by cluster random sampling. This methodology ensures that the sampling population for the simulations is well-represented by the data set, as shown from the results. The reason for ascertaining this is because neural networks are good interpolators but poor extrapolators [33]. Also, implementing this methodology enables the input data to be free from the presence of outliers, thus, allowing the usage of Minmax normalization.

The trained network shows high classification confusion (>90%) in the 6th output node. This means that it is highly accurate in classifying a certain situation into "shootable" or "don't shoot" case. However, its capability to predict the best section in the goal to shoot the ball is not very reliable. The confusions of the first two target-output pairs are above 90% and 80%, respectively. But the confusions of the 3rd, 4th, and 5th output nodes are all below 60%. As a consequence, the predicted best section can often deviate by 1 to 7 (since there are 3 bits) sections from the ideal.

One possible reason for the low confusions is the reduction of the dimensionality of the output, from 30 to 5, by using 5-bit binary coding. Using binary values as targets in classification problems is effective as long as 1-of-C or 1-of-(C-1) coding is used [34]. This implies that if there would be 30 output neurons, instead of just 5, the predicting accuracy of the network for the second classification problem might improve. However, the training would become a lot more difficult.

The second possible cause is perhaps the mapping of the problem itself. The first five output nodes determine the *best section* in the goal, which is in turn the median of the largest group of successful sections [13]. This means that there are really many successful sections in the goal, and the best section is just a representative of those sections. Technically, one can assign any of the successful sections as the best section. Since the chosen best sections were not necessarily the only successful sections, ambiguity in the training might have arisen. If that was the case, it would lead to the relatively low classification confusions.

An evident effect of the network's relatively unreliable prediction of the best section was the high percentage of false positive predictions during the evaluations of the network. The computed precision was only 0.7638, far lower than the computed recall which was 0.9246. Unfortunately, precision often weighs heavier than recall when it comes to Machine Learning [23]. Nevertheless, the success rate of the network's prediction is close from the results of Kaviani *et.al* (2005).

Over-all, several benefits are provided by this study. The methodology used in developing the neural network of WASMS could serve as a reference or guide to further applications of neural nets regarding artificial intelligence research. The Java applet game could be used as a guide in animations and game programming in Java. The website provides lots of useful information about soccer. It could be effective as an education tool for kids in a soccer program or soccer schools.

7 CONCLUSION

This study developed a web-based tool, WASMS, which aims to introduce the users to the sport of soccer and motivates them in playing the sport. It provides an overview, discusses the fundamentals, explained the official rules, tackles the current culture of soccer here in our country and why we should develop it further, and allows the users to take an interactive quiz about the rendered information in the website. It features a Java applet game that shows interactive tutorials on soccer skills and simulations of shooting situations in soccer. The simulations are inspired by RoboCup 2D Simulation League, however, the simulation environment in WASMS are simplified but with better graphics and animations. An artificial neural network is implemented in the decision-making process of the AIs in shooting the ball. Proper statistical methods are applied in training and testing the neural net.

8 RECOMMENDATION

From Chapter 6, the relatively low classification confusions from the 3rd, 4th and 5th output neurons were possibly caused by either 1) the reduction of the dimensionality of the output, from 30 possible sections to 5 output nodes, by using 5-bit binary coding, or 2) the mapping of the problem, that is, the middle of the largest group of successful goal sections being the target best section. To test which of the two really causes those unsatisfactory confusions, two separate methods are recommended. For the first possible reason, we could increase the dimensionality of the output back to 30 nodes. This would remove the effect of the 5-bit binary coding. However, an output layer with 30 neurons is just so large and maybe inappropriate for the training. Instead, we could use only one output neuron: representing the decimal value of the target best section (1-30), as shown in Figure 8.1. Although, be wary of the necessary changes in training the network. In particular, the log-sigmoid activation function can no longer be used if the target values are now in the range of 1-30. If this representation of output data shows significant improvement in the network's classification capability, then the problem is indeed caused by the usage of 5-bit binary coding.

110111	→	27
000111	→	3
100001	→	16

Figure 8.1 – Recoding of 5-bit binary output into decimal {1,...,30}

On the other hand, the second possible reason can be tested by remapping the problem. Instead of using the best section of the goal as the target data, we could use the total number of successful goal sections given by the episode's results, as illustrated in Figure 8.2. By doing this, the ambiguity from choosing the median of the largest group of successful sections as the target best section will be removed. The use of 5-bit binary coding is still retained but those first five output

neurons will now hold the binary equivalent of the total number of successful goal sections. If this results to considerable improvement in the network's performance, then the problem mapping is really the cause.

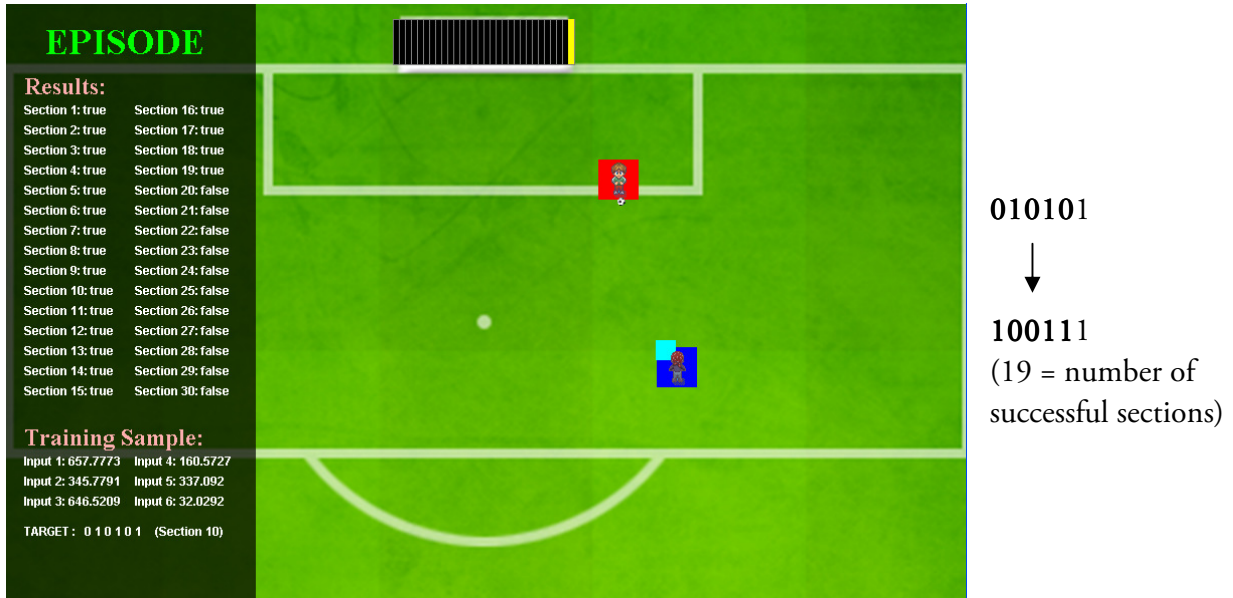


Figure 8.2 – Remapping of the problem, from best sections into number of successful sections as targets

The neural network's performance was evaluated using only a single algorithm for the AI goalkeeper. The network was designed so that the prediction will be independent to the algorithm of the opponent keeper. However, the results may still vary for different AI goalkeeper algorithms. Thus, this study recommends the testing of the trained network using other AI goalkeepers.

The Java applet game focuses only simulations on shooting situations of soccer. A recommendable improvement would be to extend the simulations to other parts of a football match. Though developing a whole match simulation seems farfetched, a mini-soccer match composed of reduced number of players for each team, i.e. 4 vs. 4 or 6 vs. 6 soccer, which is pretty common in soccer-related computer games. But developing intelligent AI players for these will be much more complicated.

Saving the best for last, conversion of the Java applet game to an Android application is extremely recommended. The game is made web-based for accessibility purposes and converting it to an Android app would probably make it a lot easier to be obtained and used by children. However, one possible conundrum in doing this is changing the game's resolution.

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10 APPENDIX

10.1 Java (SE 6) Source Codes

MobileObject.java

```
package soccerApplet;
import java.awt.Rectangle;

public abstract class MobileObject {

    protected Coordinate position;
    protected double speed;
    protected double direction;
    protected Rectangle rect;

    public MobileObject(double posX, double posY, double speed, double
direction,
        int width, int length) {
        position = new Coordinate(posX, posY);
        this.speed = speed;
        this.direction = direction;
        setRect(width, length);
    }

    public MobileObject(Coordinate c, double speed, double direction, int
width,
        int length) {
        position = new Coordinate(c);
        this.speed = speed;
        this.direction = direction;
        setRect(width, length);
    }

    /*
    *
    * =====
    *
    * Getters and Setters
    *
    * =====
    */

    public Coordinate getPosition() {
        return position;
    }

    public void setPosition(Coordinate position) {
        this.position = position;
    }

    public double getSpeed() {
        return speed;
    }

    public void setSpeed(double speed) {
        this.speed = speed;
    }

    public double getDirection() {
        return direction;
    }

    public void setDirection(double direction) {
        this.direction = direction;
    }

    public void setDirection(Coordinate nextPosition) {
        if (position.distanceTo(nextPosition) > 5)
            direction = Math.atan2(nextPosition.getY() - position.getY(),
                nextPosition.getX() - position.getX());
    }

    public Rectangle getRect() {
        return rect;
    }

    public void setRect(int width, int length) {
        rect = new Rectangle((int) position.getX() - width / 2, (int) position.getY()
            - length / 2, width, length);
    }

    public void setRect(Rectangle rect) {
        this.rect = new Rectangle(rect);
    }

    /*
    *
    * =====
    *
    * Movements methods
    *
    * =====
    */

    public double distanceTo(Coordinate c) {
        return position.distanceTo(c);
    }

    public double distanceTo(MobileObject o) {
        return distanceTo(o.getPosition());
    }

    public boolean checkCollision(MobileObject o) {
        return rect.intersects(o.rect);
    }

    public void move() {
        position.setX(position.getX() + speed * Math.cos(direction));
        position.setY(position.getY() + speed * Math.sin(direction));
    }

    public boolean checkIfOutOfBounds() {
        if (position.getX() > Constants.FIELD_LOWER_RIGHT.getX()) // right
side
            return true;
        else if (position.getX() < Constants.FIELD_LOWER_LEFT.getX()) // left
// side
            return true;
        else if (position.getY() > Constants.FIELD_LOWER_LEFT.getY()) //
bottom
            return true;
    }
}
```

```

return true;
else if ((position.getY() < Constants.GOAL_LEFT.getY() - 3) && // top
(position.getX() < Constants.GOAL_LEFT.getX() - 3) // left
(position.getX() > Constants.GOAL_RIGHT.getX() + 3)) // right
return true;
else if (position.getY() < Constants.GOAL_CENTER.getY() - 40)
return true;
return false;
}

/*
*
=====
*
* Other methods
*
*
=====
*/
@Override
public String toString() {
return "Pos: " + position + " - Speed: " + speed + " - Direction: "
+ direction;
}
}

```

Coordinate.java

```
package soccerApplet;
```

```
public class Coordinate {
```

```
private double x;
private double y;
```

```
public Coordinate(double x, double y) {
this.x = x;
this.y = y;
}

```

```
public Coordinate(Coordinate c) {
x = c.getX();
y = c.getY();
}

```

```
/*
*
=====

```

```

*
* Getters and Setters
*
*
=====

```

```

/*
/**
* @return the x
*/
public double getX() {
return x;
}

```

```

/**
* @param x
* the x to set

```

```

*/
public void setX(double x) {
this.x = x;
}

```

```

/**
* @return the y
*/
public double getY() {
return y;
}

```

```

/**
* @param y
* the y to set
*/
public void setY(double y) {
this.y = y;
}

```

```

/**
* Subtract Coordinate v
*/
public Coordinate subtract(Coordinate c) throws NullCoordinateException {
if (c == null) {
throw new NullCoordinateException();
}
return new Coordinate(x - c.getX(), y - c.getY());
}

```

```

/**
* Add Coordinate c
*/
public Coordinate add(Coordinate c) throws NullCoordinateException {
if (c == null) {
throw new NullCoordinateException();
}
return new Coordinate(x + c.getX(), y + c.getY());
}

```

```

/**
* Multiply Coordinate c
*/
public double multiply(Coordinate c) throws NullCoordinateException {
if (c == null) {
throw new NullCoordinateException();
}
return x * c.getX() + y * c.getY();
}

```

```

public double polarRadius() {
return Math.sqrt(Math.pow(x, 2) + Math.pow(y, 2));
}

```

```

public double polarAngle() {
double angle;
if ((y == 0) && (x == 0)) {
angle = 0.0D;
} else {
angle = Math.toDegrees(Math.atan2(y, x));
}
return angle;
}

```

```

public double distanceTo(int x, int y) {
return (new Coordinate(x, y)).subtract(this).polarRadius();
}

```



```

public double distanceTo(Coordinate c) throws NullCoordinateException
{
    if (c == null) {
        throw new NullCoordinateException();
    }
    return c.subtract(this).polarRadius();
}

public double directionOf(double x, double y) {
    return (new Coordinate(x, y)).subtract(this).polarAngle();
}

public double directionOf(Coordinate c) throws NullCoordinateException
{
    if (c == null) {
        throw new NullCoordinateException();
    }
    return this.subtract(c).polarAngle();
}

```

NullCoordinateException.java

```

package soccerApplet;

public class NullCoordinateException extends NullPointerException
{
    public NullCoordinateException()
    {
    }

    public NullCoordinateException(String message)
    {
        super(message);
    }
}

```

Ball.java

```

package soccerApplet;
import java.awt.Rectangle;

public class Ball extends MobileObject {

    private boolean isMoving;
    private boolean isPossessed;
    BallAnimator ballFrame;

    public Ball(double posX, double posY, double speed, double direction) {
        super(posX, posY, speed, direction, Constants.BALL_DIAMETER,
            Constants.BALL_DIAMETER);
        isMoving = false;
        isPossessed = true;
        ballFrame = new BallAnimator();
        // setRect(new Coordinate(posX, posY));
    }

    public Ball(Coordinate c, double speed, double direction) {
        super(c, speed, direction, Constants.BALL_DIAMETER,
            Constants.BALL_DIAMETER);
        isMoving = false;
        isPossessed = true;
        ballFrame = new BallAnimator();
        // setRect(c);
    }

    public boolean isPossessed() {

```

```

        return isPossessed;
    }

    public void setPossessed(boolean isPossessed) {
        this.isPossessed = isPossessed;
    }

    public boolean isMoving() {
        return isMoving;
    }

    public void setIsMoving(boolean isMoving) {
        this.isMoving = isMoving;
    }

    public void setRect(Coordinate ballPos) {
        double upperLeftCornerX = ballPos.getX() - Constants.BALL_DIAMETER
        / 2;
        double upperLeftCornerY = ballPos.getY() - Constants.BALL_DIAMETER
        / 2;
        rect = new Rectangle((int) upperLeftCornerX, (int) upperLeftCornerY,
            Constants.BALL_DIAMETER, Constants.BALL_DIAMETER);
    }

    public void update() {
        if (isMoving) {
            move();
            ballFrame.increaseFrameDelay();
            setRect(getPosition());
            if (!isPossessed) {
                if (speed < Constants.TERMINAL_SPEED)
                    isMoving = false;
                speed = speed * Constants.BALL_DECAY;
            } else {
                isMoving = false;
            }
        }
    }

    public int getFrame() {
        return ballFrame.frame;
    }

    private class BallAnimator {

        int frame = 0;
        int delay = 0;

        BallAnimator() {
        };

        public void increaseFrameDelay() {
            delay++;
            if (delay > 5) {
                if (frame < 3)
                    frame++;
                else
                    frame = 0;
                delay = 0;
            }
        }
    }
}

```

Player.java

```

package soccerApplet;

public abstract class Player extends MobileObject {

```

```

protected boolean hasBall;
protected boolean controlled;

public Player(double posX, double posY, double speed, double direction,
boolean hasBall, boolean controlled) {
super(posX, posY, speed, direction, Constants.PLAYER_WIDTH,
Constants.PLAYER_HEIGHT);
this.hasBall = hasBall;
this.controlled = controlled;
}

public Player(Coordinate c, double speed, double direction, boolean
hasBall,
boolean controlled) {
super(c, speed, direction, Constants.PLAYER_WIDTH,
Constants.PLAYER_HEIGHT);
this.hasBall = hasBall;
this.controlled = controlled;
}

public boolean isHasBall() {
return hasBall;
}

public void setHasBall(boolean hasBall) {
this.hasBall = hasBall;
}

public boolean isControlled() {
return controlled;
}

public void setControlled(boolean controlled) {
this.controlled = controlled;
}

@Override
public void move() {
position.setX(position.getX() + speed * Math.cos(direction));
position.setY(position.getY() + speed * Math.sin(direction));
if (checkIfOutOfBounds()) {
position.setX(position.getX() - 2 * speed * Math.cos(direction));
position.setY(position.getY() - 2 * speed * Math.sin(direction));
}
}

public boolean checkIfOutOfBounds() {
if (position.getX() > Constants.FIELD_LOWER_RIGHT.getX()) // right
side
return true;
else if (position.getX() < Constants.FIELD_LOWER_LEFT.getX()) // left
side
return true;
else if (position.getY() > Constants.FIELD_LOWER_LEFT.getY()) //
bottom
return true;
else if (position.getY() < 5) // top
return true;
return false;
}
}

```

GoalKeeper.java

```

package soccerApplet;
import java.awt.Rectangle;

```

```

public class GoalKeeper extends Player {

protected Rectangle catchRect;
protected Animator moveFrame;
protected CatchAnimator catchFrame;
protected int catchDelay;
protected GoalKeeperActionType action;

public GoalKeeper(double posX, double posY, double speed, double
direction,
boolean controlled) {
super(posX, posY, speed, direction, false, controlled);
setCatchRect(new Coordinate(posX, posY));
moveFrame = new Animator(false);
catchFrame = new CatchAnimator();
catchDelay = 0;
action = GoalKeeperActionType.STOP;
}

public GoalKeeper(Coordinate c, double speed, double direction,
boolean controlled) {
super(c, speed, direction, false, controlled);
setCatchRect(c);
moveFrame = new Animator(false);
catchFrame = new CatchAnimator();
catchDelay = 0;
action = GoalKeeperActionType.STOP;
}

public void setHasBall(boolean b) {
catchDelay = 0;
hasBall = b;
}

protected boolean checkCatchDelay() {
if (catchDelay > 0) {
catchDelay--;
return false;
} else
return true;
}

public void setCatchRect(Coordinate keeperPos) {
double upperLeftCornerX = keeperPos.getX() +
Constants.KEEPER_CATCH_REACH
* Math.cos(direction);
double upperLeftCornerY = keeperPos.getY() +
Constants.KEEPER_CATCH_REACH
* Math.sin(direction);
upperLeftCornerX = upperLeftCornerX -
Constants.KEEPER_CATCH_REACH / 2;
upperLeftCornerY = upperLeftCornerY -
Constants.KEEPER_CATCH_REACH / 2;
catchRect = new Rectangle((int) upperLeftCornerX, (int)
upperLeftCornerY,
Constants.PLAYER_HEIGHT, Constants.PLAYER_HEIGHT);
}

public Rectangle getCatchRect() {
return catchRect;
}

public int getCatchDelay() {
return catchDelay;
}

public int getFrame() {
if (catchDelay > 0) {
return catchFrame.getFrame();
} else if (isHasBall())
}

```

```

    return 45; // ball caught sprite
else
    return moveFrame.getFrame();
}

public void setAction(GoalKeeperActionType action) {
    this.action = action;
}

public GoalKeeperActionType getAction() {
    return action;
}

public void catchBall() {
    // rect = catchRect;
    /*
    * if(rect.contains(b.rect) && (Math.toDegrees(direction)>=75 &&
    * Math.toDegrees(direction)<105)) { //ballCaught = true;
    * b.setPossessed(true); b.setIsMoving(false); }
    */
    /*
    * if(Math.toDegrees(direction)>=75 && Math.toDegrees(direction)<105)
    {
    * setBallCaught(true); b.setPossessed(true); b.setIsMoving(false); }
    */
    catchDelay = 50;
}

public void execute(Ball b) {
    if (checkCatchDelay()) {
        switch (action) {
            case MOVE: {
                moveFrame.increaseDelay();
                moveFrame.setDirection(direction);
                move();
                break;
            }
            case CATCH: {
                catchFrame.setDirection(direction);
                catchBall();
                break;
            }
            default:
                break;
        }
        setCatchRect(getPosition());
        setRect(Constants.PLAYER_WIDTH, Constants.PLAYER_HEIGHT);
    } else {
        int x = (int) (catchDelay / 10 * Math.cos(direction));
        int y = (int) (catchDelay / 15 * Math.sin(direction));
        x += rect.x;
        y += rect.y;
        setRect(new Rectangle(x, y, 40, 40));
        setPosition(new Coordinate(rect.getCenterX(), rect.getCenterY()));
    }
    setAction(GoalKeeperActionType.STOP);
}

public void execute(Ball b, final Attacker a1, final Attacker a2) {
    if (checkCatchDelay()) {
        switch (action) {
            case MOVE: {
                moveFrame.increaseDelay();
                moveFrame.setDirection(direction);
                move();
                break;
            }
            case CATCH: {
                catchFrame.setDirection(direction);
                catchBall();
            }
        }
    }
}

```

```

    break;
}
default:
    break;
}
setCatchRect(getPosition());
setRect(Constants.PLAYER_WIDTH, Constants.PLAYER_HEIGHT);
} else {
    int x = (int) (catchDelay / 10 * Math.cos(direction));
    int y = (int) (catchDelay / 15 * Math.sin(direction));
    x += rect.x;
    y += rect.y;
    setRect(new Rectangle(x, y, 40, 40));
    setPosition(new Coordinate(rect.getCenterX(), rect.getCenterY()));
}
setAction(GoalKeeperActionType.STOP);
}

protected class CatchAnimator extends Animator {

    // int catchDelayCount = 0;
    CatchAnimator() {
        super(false);
    }

    public int getFrame() {
        if (catchDelay > 0)
            changeFrame();
        return frame;
    }

    public void changeFrame() {
        delayCount++;
        if (delayCount == 27 & (frame == 40 || frame == 42 || frame == 44)) {
            frame++;
        }
        if (delayCount >= 42 && frame < 44) {
            frame = 46;
        }
        if (delayCount > 49)
            delayCount = 0;
    }

    public void setDirection(Double d) {
        double deg = Math.toDegrees(d);
        if (deg >= 75 && deg <= 105) // south
            direction = 44;
        else if (deg < 75 && deg > -90) // east
            direction = 42;
        else
            // west
            direction = 40;
        frame = direction;
    }
}

```

GoalKeeperActionType.java

```

package soccerApplet;

public enum GoalKeeperActionType {
    MOVE, CATCH, HORIZONTALMOVE, STOP
}

```

GoalKeeperAI.java

```

package soccerApplet;
import java.awt.Rectangle;
import javax.sound.sampled.TargetDataLine;

```

```

public class GoalKeeperAI extends GoalKeeper {

    protected double defDist;
    protected Coordinate defLeft;
    protected Coordinate defRight;
    protected Ball ball;
    protected Coordinate targetPosition;
    protected boolean targetFound = false;

    public GoalKeeperAI(double posX, double posY, double speed, double
direction) {
        super(posX, posY, speed, direction, false);
        adjustDefenseLine();
    }

    public GoalKeeperAI(Coordinate c, double speed, double direction) {
        super(c, speed, direction, false);
        adjustDefenseLine();
    }

    protected void adjustDefenseLine() {
        defDist = Constants.GOAL_HEIGHT / 2;
        defLeft = new Coordinate(Constants.GOAL_LEFT.getX(),
            Constants.GOAL_LEFT.getY() + defDist);
        defRight = new Coordinate(Constants.GOAL_RIGHT.getX(),
            Constants.GOAL_RIGHT.getY() + defDist);
    }

    protected void adjustDefenseLine(double defenseLineDist) {
        defDist = defenseLineDist;
        defLeft = new Coordinate(Constants.GOAL_LEFT.getX(),
            Constants.GOAL_LEFT.getY() + defDist);
        defRight = new Coordinate(Constants.GOAL_RIGHT.getX(),
            Constants.GOAL_RIGHT.getY() + defDist);
    }

    protected double computeDefDist() {
        double dist = Constants.GOAL_HEIGHT / 2;
        double ratio = (Constants.START_POS_ATTACKER1.getY() -
            Constants.GOAL_AREA_RIGHT
                .getY());
        ratio = (Constants.START_POS_ATTACKER1.getY() -
            ball.getPosition().getY())
            / ratio;
        if (ratio > .2 && ratio < 1)
            dist = ratio
                * (Constants.GOAL_AREA_RIGHT.getY() -
                    (Constants.GOAL_CENTER.getY() + Constants.GOAL_HEIGHT / 2));
        else if (ratio >= 1)
            dist = ball.getPosition().getY()
                - (Constants.GOAL_CENTER.getY() + Constants.GOAL_HEIGHT / 2);
        return dist;
    }

    protected void lookForBall(Ball b) {
        ball = b;
    }

    protected Coordinate predictBallNextPosition(Ball b, int cycles) {
        Ball temp = new Ball(b.getPosition(), b.getSpeed(), b.direction);
        for (int i = 1; i <= cycles; i++) {
            if (temp.speed >= Constants.TERMINAL_SPEED) {
                temp.move();
                temp.speed = temp.speed * Constants.BALL_DECAY;
            } else {
                return temp.getPosition();
            }
        }
        return temp.getPosition();
    }

```

```

    }

    public static boolean checkIfInsideGoalArea(Coordinate c) {
        if (c.getX() < Constants.GOAL_AREA_LEFT.getX()
            || c.getX() > Constants.GOAL_AREA_RIGHT.getX()
            || c.getY() > Constants.GOAL_AREA_LEFT.getY()
            || c.getY() < Constants.GOAL_CENTER.getY())
            return false;
        return true;
    }

    protected boolean checkIfInDefendingLine(Coordinate c) {
        if (c.getX() < defLeft.getX() || c.getX() > defRight.getX()
            || c.getY() > defLeft.getY() + 5 || c.getY() <
            Constants.GOAL_CENTER.getY())
            return false;
        return true;
    }

    protected int predictCyclesToNextPosition(Coordinate nextPos) {
        int cycles = 1;
        return cycles + (int) (this.distanceTo(nextPos) / speed);
    }

    protected boolean interceptBallPassive(Ball b) {
        Ball temp = new Ball(b.getPosition(), b.getSpeed(), b.getDirection());
        if (!targetFound) {
            int maxCycles = 100;
            int cycles = 1;
            int needed = 100;
            Coordinate c;
            do {
                c = predictBallNextPosition(temp, cycles);
                if (c.getY() < Constants.GOAL_CENTER.getY() -
                    Constants.BALL_DIAMETER)
                    cycles = maxCycles;
                if (checkIfInDefendingLine(c))
                    needed = predictCyclesToNextPosition(c);
                cycles++;
            } while ((cycles <= needed && cycles < maxCycles));
            if (cycles < maxCycles) {
                targetPosition = c;
                targetFound = true;
                return true;
            }
        }
        return false;
    }

    protected boolean interceptBallAggressive(Ball b) {
        Ball temp = new Ball(b.getPosition(), b.getSpeed(), b.getDirection());
        if (!targetFound) {
            int maxCycles = 100;
            int cycles = 1;
            int needed = 100;
            Coordinate c;
            do {
                c = predictBallNextPosition(temp, cycles);
                if (c.getY() < Constants.GOAL_CENTER.getY() -
                    Constants.BALL_DIAMETER)
                    cycles = maxCycles;
                if (checkIfInsideGoalArea(c))
                    needed = predictCyclesToNextPosition(c);
                cycles++;
            } while ((cycles <= needed && cycles < maxCycles));
            if (cycles < maxCycles) {
                targetPosition = c;
                targetFound = true;
                return true;
            }
        }
    }

```

```

}
return false;
}

protected void adjustDefendingPosition() {
adjustDefenseLine(computeDefDist());
double distanceLeftGoalToBall = Constants.GOAL_LEFT.distanceTo(ball
.getPosition());
double distanceRightGoalToBall =
Constants.GOAL_RIGHT.distanceTo(ball
.getPosition());
double leftSlope = getSlope(Constants.GOAL_LEFT);
double rightSlope = getSlope(Constants.GOAL_RIGHT);
double ratio = distanceLeftGoalToBall / distanceRightGoalToBall;
double leftIntersection = defLeft.getX();
double rightIntersection = defRight.getX();
if (leftSlope != 0) {
leftIntersection = (defLeft.getY() - ball.getPosition().getY()) / leftSlope
+ ball.getPosition().getX();
if (leftIntersection < Constants.GOAL_AREA_LEFT.getX())
leftIntersection = Constants.GOAL_AREA_LEFT.getX() +
Constants.PLAYER_WIDTH;
}
if (rightSlope != 0) {
rightIntersection = (defRight.getY() - ball.getPosition().getY())
/ rightSlope + ball.getPosition().getX();
if (rightIntersection > Constants.GOAL_AREA_RIGHT.getX())
rightIntersection = Constants.GOAL_AREA_RIGHT.getX()
- Constants.PLAYER_WIDTH;
}
double partition = (rightIntersection - leftIntersection) / (ratio + 1);
targetPosition = new Coordinate(leftIntersection + partition * ratio,
defLeft.getY());
}

protected double getSlope(Coordinate c) {
double rise = ball.getPosition().getY() - c.getY();
double run = ball.getPosition().getX() - c.getX();
if (run == 0)
return 0;
return rise / run;
}

protected boolean moveToTargetPosition() {
if (distanceTo(targetPosition) > 5) {
setDirection(targetPosition);
return true;
}
setDirection(ball.getPosition());
// resetFrame();
return false;
}

protected boolean horizontalMoveToTargetPosition() {
if (distanceTo(targetPosition) > 5) {
setDirection(targetPosition);
return true;
}
setDirection(ball.getPosition());
resetFrame();
return false;
}

protected void horizontalMove() {
setPosition(new Coordinate(getPosition().getX()
+ Math.signum(Math.cos(direction)) * speed, getPosition().getY()));
}

protected void resetFrame() {
setDirection(ball.getPosition());

```

```

double d = direction;
if (d < 0) {
d = Math.abs(d);
if (Math.toDegrees(d) >= 0 && Math.toDegrees(d) < 23)
d = 0; // EAST
else if (Math.toDegrees(d) >= 23 && Math.toDegrees(d) < 68)
d = 7; // NORTHEAST
else if (Math.toDegrees(d) >= 68 && Math.toDegrees(d) < 113)
d = 6; // NORTH
else if (Math.toDegrees(d) >= 113 && Math.toDegrees(d) < 158)
d = 5; // NORTHWEST
else
d = 4; // WEST
} else {
if (Math.toDegrees(d) >= 0 && Math.toDegrees(d) < 23)
d = 0; // EAST
else if (Math.toDegrees(d) >= 23 && Math.toDegrees(d) < 68)
d = 1; // SOUTHEAST
else if (Math.toDegrees(d) >= 68 && Math.toDegrees(d) < 113)
d = 2; // SOUTH
else if (Math.toDegrees(d) >= 113 && Math.toDegrees(d) < 158)
d = 3; // SOUTHWEST
else
d = 4; // WEST
}
moveFrame.setFrame((int) d + 24);
}

protected GoalKeeperActionType aiCycle(Ball b) {
if (!checkCatchDelay() || isHasBall()) {
int x = (int) (catchDelay / 10 * Math.cos(direction));
int y = (int) (catchDelay / 15 * Math.sin(direction));
x += rect.x;
y += rect.y;
setRect(new Rectangle(x, y, 40, 40));
setPosition(new Coordinate(rect.getCenterX(), rect.getCenterY()));
return GoalKeeperActionType.STOP;
}
lookForBall(b);
if ((ball.distanceTo(getPosition()) < Constants.KEEPER_CATCH_REACH
|| (ball
.getPosition().getY() - Constants.GOAL_CENTER.getY()) < defDist)
&& checkIfInsideGoalArea(ball.getPosition())) { // ball is very close
return GoalKeeperActionType.CATCH;
} else { // ball is not very close
if (ball.isPossessed()) { // if possessed by an attacker
if (checkIfInsideGoalArea(ball.getPosition())) {
targetPosition = ball.getPosition(); // go to ball
if (moveToTargetPosition()) {
return GoalKeeperActionType.MOVE;
}
} else {
adjustDefendingPosition(); // stay passive at defending line
if (Math.abs(position.getY() - defLeft.getY()) < 5) {
if (horizontalMoveToTargetPosition()) {
return GoalKeeperActionType.HORIZONTALMOVE;
}
} else {
if (moveToTargetPosition()) {
return GoalKeeperActionType.MOVE;
}
}
}
} else { // if ball is free
if (b.getDirection() > 0 || !b.isMoving()) { // if ball was just rejected
targetFound = false;
targetPosition = Constants.START_POS_KEEPER; // go back to start
position
if (moveToTargetPosition()) {
return GoalKeeperActionType.MOVE;
}
}
}
}

```

```

} else {
    resetFrame();
    return GoalKeeperActionType.STOP;
}
}
if (!targetFound) { // if ball has been kicked.
// find intercept point AT THE DEFENDING LINE, if any
if (interceptBallPassive(ball)) {
    if (moveToTargetPosition()) { // go to that point
        return GoalKeeperActionType.MOVE;
    }
} else { // find intercept point INSIDE GOAL AREA if any
if (interceptBallAggressive(ball)) {
    if (moveToTargetPosition()) {
        return GoalKeeperActionType.MOVE;
    }
} else {
// if ball can't be intercepted
if (checkIfInsideGoalArea(ball.getPosition())) {
    adjustDefendingPosition();
    if (moveToTargetPosition()) {
        return GoalKeeperActionType.MOVE;
    }
} else { // if ball wont pass inside goal area
    adjustDefendingPosition(); // stay passive at defending line
    if (moveToTargetPosition()) {
        return GoalKeeperActionType.MOVE;
    }
}
}
} else { // intercept point already found
if (moveToTargetPosition()) { // go to that point
    return GoalKeeperActionType.MOVE;
}
}
}
return GoalKeeperActionType.STOP;
}

public void execute(Ball b) {
    lookForBall(b);
    setAction(aiCycle(ball));
    switch (action) {
    case MOVE: { // move
        moveFrame.increaseDelay();
        moveFrame.setDirection(direction);
        move();
        break;
    }
    case HORIZONTALMOVE: { // horizontal move
        horizontalMove();
        break;
    }
    case CATCH: { // catch
        catchFrame.setDirection(direction);
        catchBall();
        break;
    }
    default: { // if 0
        break; // wait, do nothing
    }
}
setCatchRect(getPosition());
setRect(Constants.PLAYER_WIDTH, Constants.PLAYER_HEIGHT);
setAction(GoalKeeperActionType.STOP);
}
}

```

Attacker.java

```

package soccerApplet;
import java.awt.Rectangle;

public class Attacker extends Player {

    protected Rectangle    attackRect;
    protected AttackerAnimator  moveFrame;
    protected AttackerActionType action;
    protected int          tackleDelay, pickDelay, askPassDelay;

    public Attacker(double posX, double posY, double speed, double
direction,
        boolean hasBall, boolean controlled) {
        super(posX, posY, speed, direction, hasBall, controlled);
        setAttackRect(new Coordinate(posX, posY));
        moveFrame = new AttackerAnimator();
        tackleDelay = 0;
        pickDelay = 0;
        askPassDelay = 0;
        action = AttackerActionType.STOP;
    }

    public Attacker(Coordinate c, double speed, double direction, boolean
hasBall,
        boolean controlled) {
        super(c, speed, direction, hasBall, controlled);
        setAttackRect(c);
        moveFrame = new AttackerAnimator();
        tackleDelay = 0;
        pickDelay = 0;
        action = AttackerActionType.STOP;
    }

    public boolean isHasBall(Ball b) {
        if (attackRect.contains(b.getRect()))
            return true;
        return false;
    }

    public void setHasBall(Ball b) {
        if (attackRect.contains(b.getRect()))
            hasBall = true;
        else
            hasBall = false;
    }

    public void setTackleDelay(int delay) {
        tackleDelay = delay;
    }

    public int getTackleDelay() {
        return tackleDelay;
    }

    public void setPickDelay(int delay) {
        pickDelay = delay;
    }

    public int getFrame() {
        return moveFrame.getFrame();
    }

    public Rectangle getAttackRect() {
        return attackRect;
    }

    public void setAttackRect(Coordinate attackerPos) {

```

```

    double upperLeftCornerX = attackerPos.getX()
    + (Constants.PLAYER_KICK_REACH * Math.cos(direction));
    double upperLeftCornerY = attackerPos.getY()
    + (Constants.PLAYER_KICK_REACH * Math.sin(direction));
    upperLeftCornerX = upperLeftCornerX -
    Constants.PLAYER_KICK_REACH / 2;
    upperLeftCornerY = upperLeftCornerY -
    Constants.PLAYER_KICK_REACH / 2;
    attackRect = new Rectangle((int) upperLeftCornerX, (int)
    upperLeftCornerY,
    Constants.PLAYER_KICK_REACH, Constants.PLAYER_KICK_REACH);
}

public void setAttackRect(Rectangle attackRect) {
    this.attackRect = new Rectangle(attackRect);
}

public void setAction(AttackerActionType action) {
    this.action = action;
}

public AttackerActionType getAction() {
    return action;
}

protected boolean checkDelays() {
    if (tackleDelay > 0) {
        tackleDelay--;
        return false;
    } else if (pickDelay > 0) {
        pickDelay--;
        return false;
    } else if (askPassDelay > 0) {
        askPassDelay--;
        return false;
    } else
        return true;
}

public void dribble(Ball b) {
    if (hasBall) {
        b.setDirection(direction);
        b.setPosition(new Coordinate(attackRect.getX() + attackRect.width / 2,
        attackRect.getY() + attackRect.height / 2));
        b.setIsMoving(true);
        speed--;
        move();
        speed++;
    }
}

public void kick(Ball b, double speed, double direction) {
    setDirection(direction);
    setAttackRect(position);
    b.setPosition(new Coordinate(attackRect.getX() + attackRect.width / 2,
    attackRect.getY() + attackRect.height / 2));
    // b.setPosition(new Coordinate(position.getX(), position.getY()));
    b.setDirection(direction);
    b.setSpeed(speed);
    b.setPossessed(false);
    b.setIsMoving(true);
    hasBall = false;
}

public void tackle(Ball b) {
    tackleDelay = 40;
}

public void getBall(Ball b) {
    hasBall = true;
}

b.setPossessed(true);
pickDelay = 2;
}

protected void askPass(final Attacker teamMate) {
    askPassDelay = 20;
    setDirection(teamMate.getPosition());
    moveFrame.setDirection(direction);
}

public void execute(Ball b) {
    if (checkDelays()) {
        switch (action) {
            case MOVE: {
                moveFrame.increaseDelay();
                moveFrame.setDirection(direction);
                move();
                break;
            }
            case DRIBBLE: {
                moveFrame.increaseDelay();
                moveFrame.setDirection(direction);
                dribble(b);
                break;
            }
            case KICK: {
                kick(b, Constants.PLAYER_KICK, direction);
                break;
            }
            case PASS: {
                kick(b, Constants.PLAYER_PASS, direction);
                break;
            }
            case TACKLE: {
                moveFrame.setDirection(direction);
                tackle(b);
                break;
            }
            default: {
                }
            }
        setAttackRect(getPosition());
        setRect(Constants.PLAYER_WIDTH, Constants.PLAYER_HEIGHT);
    } else {
        int x = (int) (tackleDelay / 11 * Math.cos(direction));
        int y = (int) (tackleDelay / 11 * Math.sin(direction));
        x += rect.x;
        y += rect.y;
        setRect(new Rectangle(x, y, 40, 40));
        setPosition(new Coordinate(rect.getCenterX(), rect.getCenterY()));
        setAttackRect(getPosition());
    }
    setAction(AttackerActionType.STOP);
}

public void execute(Ball b, final Coordinate k) {
    if (checkDelays()) {
        switch (action) {
            case MOVE: {
                moveFrame.increaseDelay();
                moveFrame.setDirection(direction);
                move();
                break;
            }
            case DRIBBLE: {
                moveFrame.increaseDelay();
                moveFrame.setDirection(direction);
                dribble(b);
                break;
            }
        }
    }
}

```



```

case KICK: {
kick(b, Constants.PLAYER_KICK, direction);
break;
}
case PASS: {
kick(b, Constants.PLAYER_PASS, direction);
break;
}
case TACKLE: {
moveFrame.setDirection(direction);
tackle(b);
break;
}
default: {
}
}
setAttackRect(getPosition());
setRect(Constants.PLAYER_WIDTH, Constants.PLAYER_HEIGHT);
} else {
int x = (int) (tackleDelay / 11 * Math.cos(direction));
int y = (int) (tackleDelay / 11 * Math.sin(direction));
x += rect.x;
y += rect.y;
setRect(new Rectangle(x, y, 40, 40));
setPosition(new Coordinate(rect.getCenterX(), rect.getCenterY()));
setAttackRect(getPosition());
}
setAction(AttackerActionType.STOP);
}

public void execute(Ball b, final Coordinate k, final Attacker a) {
if (checkDelays()) {
switch (action) {
case MOVE: {
moveFrame.increaseDelay();
moveFrame.setDirection(direction);
move();
break;
}
case DRIBBLE: {
moveFrame.increaseDelay();
moveFrame.setDirection(direction);
dribble(b);
break;
}
case KICK: {
kick(b, Constants.PLAYER_KICK, direction);
break;
}
case PASS: {
kick(b, Constants.PLAYER_PASS, direction);
break;
}
case TACKLE: {
moveFrame.setDirection(direction);
tackle(b);
break;
}
case ASKPASS: {
askPass(a);
break;
}
default: {
}
}
}
setAttackRect(getPosition());
setRect(Constants.PLAYER_WIDTH, Constants.PLAYER_HEIGHT);
} else {
int x = (int) (tackleDelay / 11 * Math.cos(direction));
int y = (int) (tackleDelay / 11 * Math.sin(direction));

```

```

x += rect.x;
y += rect.y;
setRect(new Rectangle(x, y, 40, 40));
setPosition(new Coordinate(rect.getCenterX(), rect.getCenterY()));
setAttackRect(getPosition());
}
setAction(AttackerActionType.STOP);
}

public void execute(Ball b, final Coordinate kPos, final Attacker mate,
final DefenderAI def) {
if (checkDelays()) {
switch (action) {
case MOVE: {
moveFrame.increaseDelay();
moveFrame.setDirection(direction);
move();
break;
}
case DRIBBLE: {
moveFrame.increaseDelay();
moveFrame.setDirection(direction);
dribble(b);
break;
}
case KICK: {
kick(b, Constants.PLAYER_KICK, direction);
break;
}
case PASS: {
kick(b, Constants.PLAYER_PASS, direction);
break;
}
case TACKLE: {
setDirection(b.getPosition());
moveFrame.setDirection(direction);
tackle(b);
break;
}
case ASKPASS: {
askPass(mate);
break;
}
default: {
}
}
}
setAttackRect(getPosition());
setRect(Constants.PLAYER_WIDTH, Constants.PLAYER_HEIGHT);
} else {
int x = (int) (tackleDelay / 11 * Math.cos(direction));
int y = (int) (tackleDelay / 11 * Math.sin(direction));
x += rect.x;
y += rect.y;
setRect(new Rectangle(x, y, 40, 40));
setPosition(new Coordinate(rect.getCenterX(), rect.getCenterY()));
setAttackRect(getPosition());
}
setAction(AttackerActionType.STOP);
}

protected class AttackerAnimator extends Animator {

public AttackerAnimator() {
super(true);
}

public int getFrame() {
if (tackleDelay > 0) {
return 32 + (frame % 8);
} else if (pickDelay > 2) {
return 47;
}
}

```

```

} else if (askPassDelay > 0) {
    if (askPassDelay > 10)
        return this.direction + 24;
    else
        return this.direction + 8;
} else {
    return frame;
}
}
}
}

```

AttackerActionType.java

```

package soccerApplet;
public enum AttackerActionType {
    MOVE, DRIBBLE, KICK, PASS, TACKLE, STOP, ASKPASS
}

```

AttackerAI.java

```

package soccerApplet;
import java.awt.Rectangle;
import java.util.Random;

public class AttackerAI extends Attacker {

    protected Ball    ball;
    protected Coordinate    keeperPos;
    protected Coordinate    targetPosition;
    protected boolean    targetFound    = false;
    protected int    targetSection    = 0;
    protected int    maxRandSteps    = 0;
    protected int    cycleCount    = 10;
    protected int    dontShootCount    = 0;
    protected final Coordinate[] shootingLocations = {
        new Coordinate(479 - 220, 317), new Coordinate(479 - 200, 317 - 50),
        new Coordinate(479 - 300, 317 - 75), new Coordinate(479 - 250, 317 -
175),
        Constants.PENALTY_KICK, new Coordinate(479 + 220, 317),
        new Coordinate(479 + 200, 317 - 50), new Coordinate(479 + 300, 317 -
75),
        new Coordinate(479 + 250, 317 - 175)    };
    protected int    shootLocIndex    = 4;
    protected double    prevDirection;

    public AttackerAI(double posX, double posY, double speed, double
direction,
        boolean hasBall) {
        super(posX, posY, speed, direction, hasBall, false);
        changeShootLocIndex();
    }

    public AttackerAI(Coordinate c, double speed, double direction, boolean
hasBall) {
        super(c, speed, direction, hasBall, false);
        changeShootLocIndex();
    }

    protected void lookAround(Ball b, Coordinate k) {
        ball = b;
        keeperPos = k;
    }

    protected int getMaxRandSteps() {
        double d = position.distanceTo(shootingLocations[shootLocIndex]);
        int max = (int) (Math.abs(800 - d) / 200);
        return max;
    }
}

```

```

protected double randomizeDirection() {
    double newDirection;
    do {
        Random r = new Random();
        newDirection = -Math.PI + r.nextDouble() * 2 * Math.PI;
    } while (Math.abs(direction - newDirection) > Math.PI / 2);
    return newDirection;
}

```

```

protected void changeShootLocIndex() {
    Random r = new Random();
    shootLocIndex = r.nextInt(9);
}

```

```

protected void moveRandomly() {
    if (cycleCount >= 15) {
        if (maxRandSteps > 0) // step to a random direction
            setDirection(randomizeDirection());
        maxRandSteps--;
    } else // limit of random steps reached, direction to penalty kick, a bias
        setDirection(shootingLocations[shootLocIndex]);
    maxRandSteps = getMaxRandSteps();
}
    targetPosition = new Coordinate(position);
    targetFound = true;
    cycleCount = 0;
}
    cycleCount++;
}

```

```

public boolean checkIfInsidePenaltyArea(Coordinate c) {
    if (c.getX() < Constants.PENALTY_AREA_LEFT.getX()
        || c.getX() > Constants.PENALTY_AREA_RIGHT.getX()
        || c.getY() > Constants.PENALTY_AREA_LEFT.getY()
        || c.getY() < Constants.GOAL_CENTER.getY())
        return false;
    return true;
}

```

```

protected Coordinate predictBallNextPosition(Ball b, int cycles) {
    Ball temp = new Ball(b.getPosition(), b.getSpeed(), b.direction);
    for (int i = 1; i <= cycles; i++) {
        if (temp.speed >= Constants.TERMINAL_SPEED) {
            temp.move();
            temp.speed = temp.speed * Constants.BALL_DECAY;
        } else {
            return temp.getPosition();
        }
    }
    return temp.getPosition();
}

```

```

protected int predictCyclesToNextPosition(Coordinate nextPos) {
    int cycles = 1;
    return cycles + (int) (this.distanceTo(nextPos) / speed);
}

```

```

protected boolean interceptBall(Ball b) {
    Ball temp = new Ball(b.getPosition(), b.getSpeed(), b.getDirection());
    if (!targetFound) {
        int maxCycles = 100;
        int cycles = 1;
        int needed = 1;
        Coordinate c;
        do {
            c = predictBallNextPosition(temp, cycles);
            needed = predictCyclesToNextPosition(c);
            cycles++;
        } while ((cycles <= needed && cycles < maxCycles));
    }
}

```

```

    if (cycles < maxCycles) {
        targetPosition = new Coordinate(c);
        targetFound = true;
        return true;
    }
}
return false;
}

protected boolean moveToTargetPosition() {
    if (distanceTo(targetPosition) > Constants.PLAYER_WIDTH / 20) {
        setDirection(targetPosition);
        return true;
    } else
        setDirection(ball.getPosition());
    return false;
}

protected boolean isShootable(Ball b, Coordinate k) {
    double[] params = { b.getPosition().getX(), b.getPosition().getY(),
k.getX(),
    k.getY(), b.distanceTo(Constants.GOAL_CENTER),
    b.getPosition().directionOf(Constants.GOAL_CENTER) };
    int[] output = NeuralNetwork.getOutput(params);
    if (output[5] == 1) { // shoot
        int value = 0;
        for (int i = 0; i < 5; i++) {
            value += output[i] * Math.pow(2, 5 - i - 1);
        }
        if (value > 30)
            value = 30;
        else if (value < 1)
            value = 1;
        targetSection = value - 1;
        double x = Constants.GOAL_LEFT.getX() + targetSection
            * (Constants.BALL_DIAMETER) + 3;
        double y = Constants.GOAL_LEFT.getY() - Constants.BALL_DIAMETER
/ 2;
        setDirection(new Coordinate(x, y));
        return true;
    }
    targetFound = false;
    return false;
}

protected boolean ifCantShoot() {
    dontShootCount++;
    if (dontShootCount > 19) {
        System.out.println("CHEAT");
        dontShootCount = 0;
        boolean left = true;
        if (keeperPos.getX() > Constants.GOAL_CENTER.getX())
            left = false;
        if (left) {
            Random r = new Random();
            targetSection = 29 - r.nextInt(5);
            double x = Constants.GOAL_LEFT.getX() + targetSection
                * (Constants.BALL_DIAMETER) + 3;
            double y = Constants.GOAL_LEFT.getY() -
Constants.BALL_DIAMETER / 2;
            setDirection(new Coordinate(x, y));
        } else {
            Random r = new Random();
            targetSection = r.nextInt(5);
            double x = Constants.GOAL_LEFT.getX() + targetSection
                * (Constants.BALL_DIAMETER) + 3;
            double y = Constants.GOAL_LEFT.getY() -
Constants.BALL_DIAMETER / 2;
            setDirection(new Coordinate(x, y));
        }
    }
}

return true;
}
return false;
}

private AttackerActionType aiCycle() {
    if (hasBall) {
        if (!targetFound) {
            // findTargetPosition();
            moveRandomly();
            // if(moveToTargetPosition())
            return AttackerActionType.DRIBBLE;
        } else {
            if (isShootable(ball, keeperPos)) {
                targetFound = false;
                return AttackerActionType.KICK;
            } else {
                if (ifCantShoot()) {
                    targetFound = false;
                    return AttackerActionType.KICK;
                } else {
                    if (dontShootCount % 5 == 0)
                        changeShootLocIndex();
                    moveRandomly();
                    return AttackerActionType.DRIBBLE;
                }
            }
        }
    } else {
        dontShootCount = 0;
        if (!ball.isPossessed()) {
            setDirection(ball.getPosition());
            return AttackerActionType.MOVE;
        }
    }
    return AttackerActionType.STOP;
}

public void execute(Ball b, final Coordinate k) {
    if (checkDelays()) {
        lookAround(b, k);
        setAction(aiCycle());
        switch (action) {
            case MOVE: {
                moveFrame.increaseDelay();
                moveFrame.setDirection(direction);
                move();
                break;
            }
            case DRIBBLE: {
                moveFrame.increaseDelay();
                moveFrame.setDirection(direction);
                dribble(ball);
                break;
            }
            case KICK: {
                kick(ball, Constants.PLAYER_KICK, direction);
                changeShootLocIndex();
                break;
            }
            case PASS: {
                kick(ball, Constants.PLAYER_PASS, direction);
                break;
            }
            case TACKLE: {
                tackle(b);
                break;
            }
            default: {
            }
        }
    }
}

```

```

    }
    setAttackRect(getPosition());
    setRect(Constants.PLAYER_WIDTH, Constants.PLAYER_HEIGHT);
} else {
    int x = (int) (tackleDelay / 11 * Math.cos(direction));
    int y = (int) (tackleDelay / 11 * Math.sin(direction));
    x += rect.x;
    y += rect.y;
    setRect(new Rectangle(x, y, 40, 40));
    setPosition(new Coordinate(rect.getCenterX(), rect.getCenterY()));
    setAttackRect(getPosition());
}
setAction(AttackerActionType.STOP);
}
}

```

AttackerAI2.java

```

package soccerApplet;
import java.awt.Rectangle;
import java.util.Random;

```

```

public class AttackerAI2 extends AttackerAI {

```

```

    protected Attacker teamMate;
    protected boolean toLeft;
    protected boolean passBall;

```

```

    public AttackerAI2(double posX, double posY, double speed, double
direction,

```

```

        boolean hasBall) {
        super(posX, posY, speed, direction, hasBall);
        if (posX >= Constants.GOAL_CENTER.getX()) {
            toLeft = false;
            changeShootLocIndex();
        } else {
            toLeft = true;
            changeShootLocIndex();
        }
        passBall = false;
    }

```

```

    public AttackerAI2(Coordinate c, double speed, double direction,
        boolean hasBall) {
        super(c, speed, direction, hasBall);
        if (c.getX() >= Constants.GOAL_CENTER.getX()) {
            toLeft = false;
            changeShootLocIndex();
        } else {
            toLeft = true;
            changeShootLocIndex();
        }
        passBall = false;
    }

```

```

    private void lookAround(Ball b, Coordinate k, final Attacker a) {
        ball = b;
        keeperPos = k;
        teamMate = a;
        setToLeft();
        if (a.isHasBall(b))
            passBall = false;
    }

```

```

    private void setToLeft() {
        if (teamMate.getPosition().getX() < position.getX()) {
            toLeft = false;
        } else
            toLeft = true;
    }
}

```

```

protected int getMaxRandSteps() {
    double d = position.distanceTo(shootingLocations[shootLocIndex]);
    int max = (int) (Math.abs(600 - d) / 250);
    return max;
}

```

```

protected void changeShootLocIndex() {
    if (toLeft) {
        Random r = new Random();
        shootLocIndex = r.nextInt(4);
    } else {
        Random r = new Random();
        shootLocIndex = 5 + r.nextInt(4);
    }
}

```

```

public boolean isPassBall() {
    return passBall;
}

```

```

protected boolean isInShootingZone() {
    if (position.distanceTo(Constants.GOAL_CENTER) < 400
        && position.getY() > Constants.GOAL_CENTER.getY() +
Constants.GOAL_HEIGHT
        / 2)
        return true;
    return false;
}

```

```

protected boolean isShootable2(Ball b, Coordinate k) {
    Ball b2 = new Ball(b.getPosition(), b.getSpeed(), b.getDirection());
    b2.setPosition(new Coordinate(attackRect.getX() + attackRect.width / 2,
        attackRect.getY() + attackRect.height / 2));
    double[] params = { b2.getPosition().getX(), b2.getPosition().getY(),
        k.getX(), k.getY(), b2.distanceTo(Constants.GOAL_CENTER),
        b2.getPosition().directionOf(Constants.GOAL_CENTER) };
    int[] output = NeuralNetwork.getOutput(params);
    if (output[5] == 1) { // shoot
        int value = 0;
        for (int i = 0; i < 5; i++) {
            value += output[i] * Math.pow(2, 5 - i - 1);
        }
        if (value > 30)
            value = 30;
        else if (value < 1)
            value = 1;
        targetSection = value - 1;
        double x = Constants.GOAL_LEFT.getX() + targetSection
            * (Constants.BALL_DIAMETER) + 3;
        double y = Constants.GOAL_LEFT.getY() - Constants.BALL_DIAMETER
            / 2;
        setDirection(new Coordinate(x, y));
        return true;
    }
    targetSection++;
    targetFound = false;
    return false;
}

```

```

private AttackerActionType aiCycle() {
    if (hasBall) {
        if (teamMate.askPassDelay > 8) {
            Random r = new Random();
            if (r.nextBoolean() && teamMate.distanceTo(this) > 150) {
                passBall = true;
                setDirection(teamMate.getPosition());
                return AttackerActionType.PASS;
            }
        }
        passBall = false;
    }
}

```

```

if (!targetFound) {
    // findTargetPosition();
    moveRandomly();
    // if(moveToTargetPosition())
    return AttackerActionType.DRIBBLE;
} else {
    if (isShootable(ball, keeperPos)) {
        targetFound = false;
        return AttackerActionType.KICK;
    } else {
        Random r = new Random();
        if (ifCantShoot()) {
            targetFound = false;
            return AttackerActionType.KICK;
        } else {
            if (r.nextInt(3) == 2 && teamMate.distanceTo(this) > 200) {
                passBall = true;
                setDirection(teamMate.getPosition());
                return AttackerActionType.PASS;
            }
            if (dontShootCount % 5 == 0)
                changeShootLocIndex();
            moveRandomly();
            return AttackerActionType.DRIBBLE;
        }
    }
} else {
    dontShootCount = 0;
    if (!ball.isPossessed()) { // ball is free
        if (passBall) { // if he just recently passed the ball, don't go to the ball
            moveRandomly();
            return AttackerActionType.MOVE;
        } else {
            if (teamMate.distanceTo(ball) > ball.distanceTo(position)) {
                if (interceptBall(ball)) {
                    moveToTargetPosition();
                } else {
                    setDirection(ball.getPosition());
                }
                return AttackerActionType.MOVE;
            } else {
                moveRandomly();
                return AttackerActionType.MOVE;
            }
        }
    } else { // ball is in team mate
        if (isInShootingZone() && isShootable2(ball, keeperPos)) {
            targetFound = false;
            return AttackerActionType.ASKPASS;
        } else {
            moveRandomly();
            return AttackerActionType.MOVE;
        }
    }
}
// return AttackerActionType.STOP;
}

public void execute(Ball b, final Coordinate k, final Attacker a) {
    if (checkDelays()) {
        lookAround(b, k, a);
        setAction(aiCycle());
        switch (action) {
            case MOVE: {
                moveFrame.increaseDelay();
                moveFrame.setDirection(direction);
                move();
                break;
            }
        }
    }
}

```

```

case DRIBBLE: {
    moveFrame.increaseDelay();
    moveFrame.setDirection(direction);
    dribble(ball);
    break;
}
case KICK: {
    kick(ball, Constants.PLAYER_KICK + 1, direction);
    changeShootLocIndex();
    break;
}
case PASS: {
    kick(ball, Constants.PLAYER_PASS - .5, direction);
    changeShootLocIndex();
    break;
}
case TACKLE: {
    tackle(b);
    break;
}
case ASKPASS: {
    askPass(teamMate);
    break;
}
default: {
}
}
setAttackRect(getPosition());
setRect(Constants.PLAYER_WIDTH, Constants.PLAYER_HEIGHT);
} else {
    int x = (int) (tackleDelay / 11 * Math.cos(direction));
    int y = (int) (tackleDelay / 11 * Math.sin(direction));
    x += rect.x;
    y += rect.y;
    setRect(new Rectangle(x, y, 40, 40));
    setPosition(new Coordinate(rect.getCenterX(), rect.getCenterY()));
    setAttackRect(getPosition());
}
setAction(AttackerActionType.STOP);
}
}

```

AttackerAI3.java

```

package soccerApplet;
import java.awt.Rectangle;
import java.util.Random;

public class AttackerAI3 extends AttackerAI2 {

    private DefenderAI defender;

    public AttackerAI3(Coordinate c, double speed, double direction,
        boolean hasBall) {
        super(c, speed, direction, hasBall);
    }

    public void lookAround(Ball b, Coordinate kPos, Attacker a, DefenderAI
        d) {
        teamMate = a;
        ball = b;
        keeperPos = kPos;
        defender = d;
    }

    private AttackerActionType aiCycle() {
        if (hasBall) {
            if (teamMate.askPassDelay > 8 || this.distanceTo(defender) < 50) {
                Random r = new Random();
            }
        }
    }
}

```

```

if (r.nextBoolean() && teamMate.distanceTo(this) > 150) {
    passBall = true;
    setDirection(teamMate.getPosition());
    return AttackerActionType.PASS;
}
}
if (!targetFound) {
    moveRandomly();
    return AttackerActionType.DRIBBLE;
} else {
    if (isShootable(ball, keeperPos)) {
        targetFound = false;
        return AttackerActionType.KICK;
    } else {
        Random r = new Random();
        if (r.nextInt(4) == 3 && teamMate.distanceTo(this) > 200) {
            passBall = true;
            setDirection(teamMate.getPosition());
            return AttackerActionType.PASS;
        }
        if (dontShootCount % 5 == 0)
            changeShootLocIndex();
        moveRandomly();
        return AttackerActionType.DRIBBLE;
    }
} else {
    if (teamMate.isHasBall()) {
        passBall = false;
        if (isInShootingZone() && isShootable(ball, keeperPos)) {
            targetFound = false;
            return AttackerActionType.ASKPASS;
        } else {
            moveRandomly();
            return AttackerActionType.MOVE;
        }
    } else if (defender.isHasBall()) {
        passBall = false;
        if (teamMate.distanceTo(ball) > ball.distanceTo(position)) {
            if (ball.distanceTo(getPosition()) < Constants.KEEPER_CATCH_REACH
- 10) {
                return AttackerActionType.TACKLE;
            } else {
                setDirection(ball.getPosition());
                return AttackerActionType.MOVE;
            }
        } else {
            moveRandomly();
            return AttackerActionType.MOVE;
        }
    } else {
        if (passBall) { // if he just recently passed the ball, don't go to the ball
            moveRandomly();
            return AttackerActionType.MOVE;
        } else {
            if (teamMate.distanceTo(ball) > ball.distanceTo(position)) {
                if (interceptBall(ball)) {
                    moveToTargetPosition();
                } else {
                    setDirection(ball.getPosition());
                }
            }
            return AttackerActionType.MOVE;
        } else {
            moveRandomly();
            return AttackerActionType.MOVE;
        }
    }
}
// return AttackerActionType.STOP;

```

```

}

public void execute(Ball b, final Coordinate kPos, final Attacker mate,
    final DefenderAI def) {
    if (checkDelays()) {
        lookAround(b, kPos, mate, def);
        setAction(aiCycle());
        switch (action) {
            case MOVE: {
                moveFrame.increaseDelay();
                moveFrame.setDirection(direction);
                move();
                break;
            }
            case DRIBBLE: {
                moveFrame.increaseDelay();
                moveFrame.setDirection(direction);
                dribble(ball);
                break;
            }
            case KICK: {
                kick(ball, Constants.PLAYER_KICK, direction);
                changeShootLocIndex();
                break;
            }
            case PASS: {
                kick(ball, Constants.PLAYER_PASS - .5, direction);
                changeShootLocIndex();
                break;
            }
            case TACKLE: {
                changeShootLocIndex();
                tackle(b);
                break;
            }
            case ASKPASS: {
                askPass(teamMate);
                break;
            }
            default: {
            }
        }
        setAttackRect(getPosition());
        setRect(Constants.PLAYER_WIDTH, Constants.PLAYER_HEIGHT);
    } else {
        int x = (int) (tackleDelay / 11 * Math.cos(direction));
        int y = (int) (tackleDelay / 11 * Math.sin(direction));
        x += rect.x;
        y += rect.y;
        setRect(new Rectangle(x, y, 40, 40));
        setPosition(new Coordinate(rect.getCenterX(), rect.getCenterY()));
        setAttackRect(getPosition());
    }
    setAction(AttackerActionType.STOP);
}

```

DefenderAI.java

```

package soccerApplet;
import java.awt.Rectangle;

public class DefenderAI extends AttackerAI2 {

    private Attacker attacker;
    private Coordinate keeperPos;

    public DefenderAI(double posX, double posY, double speed, double
direction) {

```

```

super(posX, posY, speed, direction, false);
moveFrame.setDirection(direction);
}

public DefenderAI(Coordinate c, double speed, double direction) {
super(c, speed, direction, false);
moveFrame.setDirection(direction);
}

public void lookAround(Ball b, Coordinate kPos, Attacker a1, Attacker a2)
{
attacker = a1;
teamMate = a2;
ball = b;
keeperPos = kPos;
}

protected int getMaxRandSteps() {
double d = position.distanceTo(keeperPos);
int max = (int) (Math.abs(600 - d) / 200);
return max;
}

protected void moveRandomly() {
if (cycleCount >= 10) {
if (maxRandSteps > 0) { // step to a random direction
setDirection(randomizeDirection());
maxRandSteps--;
} else { // limit of random steps reached, direction to penalty kick, a bias
setDirection(keeperPos);
maxRandSteps = getMaxRandSteps();
}
cycleCount = 0;
}
cycleCount++;
}

protected AttackerActionType aiCycle(Ball b, final Coordinate kPos,
final Attacker attacker1, final Attacker attacker2) {
if (isHasBall()) {
moveRandomly();
return AttackerActionType.DRIBBLE;
} else if (attacker.hasBall) { // attacker a1 is controlling the ball
if (ball.distanceTo(getPosition()) < Constants.KEEPER_CATCH_REACH
- 10)
return AttackerActionType.TACKLE;
else {
setDirection(ball.getPosition());
return AttackerActionType.MOVE;
}
} else if (teamMate.hasBall) { // attacker a2 is controlling the ball
if (ball.distanceTo(getPosition()) < Constants.KEEPER_CATCH_REACH
- 10)
return AttackerActionType.TACKLE;
else {
setDirection(ball.getPosition());
return AttackerActionType.MOVE;
}
} else { // if ball is not possessed
if (ball.isMoving()) { // ball moving
if (interceptBall(ball)) {
moveToTargetPosition();
} else {
setDirection(ball.getPosition());
}
}
return AttackerActionType.MOVE;
} else {
setDirection(ball.getPosition());
return AttackerActionType.MOVE;
}
}

```

```

}
// return AttackerActionType.STOP;
}

public void execute(Ball b, final Coordinate kPos, final Attacker attacker1,
final Attacker attacker2) {
if (checkDelays()) {
lookAround(b, kPos, attacker1, attacker2);
setAction(aiCycle(ball, keeperPos, attacker, teamMate));
switch (action) {
case MOVE: {
moveFrame.increaseDelay();
moveFrame.setDirection(direction);
move();
break;
}
case DRIBBLE: {
moveFrame.increaseDelay();
moveFrame.setDirection(direction);
dribble(ball);
break;
}
case TACKLE: {
moveFrame.setDirection(direction);
tackle(ball);
break;
}
default: {
}
}
setAttackRect(getPosition());
setRect(Constants.PLAYER_WIDTH, Constants.PLAYER_HEIGHT);
} else {
int x = (int) (tackleDelay / 11 * Math.cos(direction));
int y = (int) (tackleDelay / 11 * Math.sin(direction));
x += rect.x;
y += rect.y;
setRect(new Rectangle(x, y, 40, 40));
setPosition(new Coordinate(rect.getCenterX(), rect.getCenterY()));
setAttackRect(getPosition());
}
setAction(AttackerActionType.STOP);
}
}

```

NeuralNetwork.java

```

package soccerApplet;
import training.DataSample;
import externalUtil.BoundNumbers;

public class NeuralNetwork {

private static double inputs[] = new double[6];
private static double hidden[] = new double[5];
private static int outputs[] = new int[6];
private static final double inputWeights[][] = {
{ 0.3641, -0.3781, 6.3017, 0.8094, -2.9085, 1.2992 },
{ 0.9888, -0.1806, -2.7186, 0.1918, -1.2615, -0.4529 },
{ -1.9326, 0.2571, 3.3073, 0.5248, -3.2260, -0.3013 },
{ -0.0672, -0.4002, -2.1010, 0.4795, -1.2139, -0.0959 },
{ 5.4170, -0.6346, -6.3681, 0.2424, 1.3969, 0.1548 } };
private static final double inputBias[] = { 0.4485, -1.0944, -2.0935,
-2.0753, 0.6996 };
private static final double hiddenWeights[][] = {
{ -0.7838, 1.2097, 1.0555, -4.0989, 2.1252 },
{ -1.1241, -3.6945, 3.0474, 1.5120, 3.2686 },
{ -0.0519, -0.7653, 0.4705, 1.0193, 0.5075 },
{ -0.0188, -0.1419, 0.2121, 1.0068, -0.0198 },
{ 0.0841, -0.0834, 0.1245, 0.5864, 0.1417 },

```



```

    { 1.7098, 6.9551, 0.4514, -4.0605, -1.5160 } };
private static final double hiddenBias[] = { -2.3541, 1.8662, 0.8238,
0.9253, 0.5933, 1.4804
    };
private static final double inputMinMax[][] = { { 35.629, 925.8097 },
{ 67.389, 557.6564 }, { 274.0533, 683.9 }, { 60.0153, 179.987 },
{ 11.3718, 666.6033 }, { 0.0506, 87.358 } };

public static int[] getOutput(double[] params) {
    inputs = params;
    mapMinMax(inputs);
    computeHiddenLayer();
    computeOutputLayer();
    return outputs;
}

private static void mapMinMax(double[] inputs) {
    double ymax = 1, ymin = -1;
    for (int i = 0; i < inputs.length; i++) {
        double xmin = inputMinMax[i][0];
        double xmax = inputMinMax[i][1];
        inputs[i] = (ymax - ymin) * (inputs[i] - xmin) / (xmax - xmin) + ymin;
    }
}

private static void computeHiddenLayer() {
    double sum;
    int rows = hidden.length;
    int cols = inputs.length;
    for (int i = 0; i < rows; i++) {
        sum = 0;
        for (int j = 0; j < cols; j++) {
            sum = sum + inputs[j] * inputWeights[i][j];
        }
        hidden[i] = tanSig(sum + inputBias[i]);
    }
}

private static void computeOutputLayer() {
    double sum;
    int rows = outputs.length;
    int cols = hidden.length;
    for (int i = 0; i < rows; i++) {
        sum = 0;
        for (int j = 0; j < cols; j++) {
            sum = sum + hidden[j] * hiddenWeights[i][j];
        }
        outputs[i] = (int) DataSample.round(logSig(sum + hiddenBias[i]), 0);
    }
}

private static double logSig(final double d) {
    return 1.0 / (1 + BoundNumbers.exp(-1.0 * d));
}

public static double tanSig(double d) {
    final double result = (BoundNumbers.exp(d * 2.0) - 1.0)
        / (BoundNumbers.exp(d * 2.0) + 1.0);
    return result;
}
}

```

Animator.java

```

package soccerApplet;

public class Animator {

    int direction;
    int prevDirection;

```

```

    int frame;
    int delayCount = 0;
    boolean frameFlag = true;

    Animator(boolean isStriker) {
        if (isStriker) {
            direction = 6;
        } else {
            direction = 18;
        }
        prevDirection = direction;
        frame = direction + 8;
    }

    public int getFrame() {
        return frame;
    }

    public void setFrame(int frame) {
        this.frame = frame;
    }

    public void changeFrame() {
        if (frameFlag)
            frame = frame + 8;
        else
            frame = frame - 8;
        if (frame > 23) {
            frameFlag = false;
            frame = frame - 16;
        } else if (frame < 0) {
            frameFlag = true;
            frame = frame + 16;
        }
    }

    public void increaseDelay() {
        delayCount++;
        if (delayCount > 5) {
            changeFrame();
            delayCount = 0;
        }
    }

    public void setDirection(Double d) {
        if (d < 0) {
            d = Math.abs(d);
            if (Math.toDegrees(d) >= 0 && Math.toDegrees(d) < 23)
                direction = 0; // EAST
            else if (Math.toDegrees(d) >= 23 && Math.toDegrees(d) < 68)
                direction = 7; // NORTHEAST
            else if (Math.toDegrees(d) >= 68 && Math.toDegrees(d) < 113)
                direction = 6; // NORTH
            else if (Math.toDegrees(d) >= 113 && Math.toDegrees(d) < 158)
                direction = 5; // NORTHWEST
            else
                direction = 4; // WEST
        } else {
            if (Math.toDegrees(d) >= 0 && Math.toDegrees(d) < 23)
                direction = 0; // EAST
            else if (Math.toDegrees(d) >= 23 && Math.toDegrees(d) < 68)
                direction = 1; // SOUTHEAST
            else if (Math.toDegrees(d) >= 68 && Math.toDegrees(d) < 113)
                direction = 2; // SOUTH
            else if (Math.toDegrees(d) >= 113 && Math.toDegrees(d) < 158)
                direction = 3; // SOUTHWEST
            else
                direction = 4; // WEST
        }
        if (direction != prevDirection) {

```

```

prevDirection = direction;
delayCount = 0;
frame = direction;
}
}
}

```

Constants.java

```

package soccerApplet;

public class Constants {

    public static final double PLAYER_SPEED = 3.0D;
    public static final double PLAYER_KICK = 12.0D;
    public static final double PLAYER_PASS = 7.30D;
    public static final double BALL_DECAY = 0.988D;
    public static final double TERMINAL_SPEED = 2.0D;
    public static final int PLAYER_HEIGHT = 40;
    public static final int PLAYER_WIDTH = 40;
    public static final int PLAYER_KICK_REACH = 20;
    public static final int KEEPER_CATCH_REACH = 40;
    public static final int BALL_DIAMETER = 6;
    public static final int GOAL_WIDTH = BALL_DIAMETER *
30;
    public static final int GOAL_HEIGHT = GOAL_WIDTH / 4;
    public static final int GAME_TIME = 20;
    public static final Coordinate GOAL_CENTER = new
Coordinate(479, 60);
    public static final Coordinate GOAL_LEFT = new Coordinate(
GOAL_CENTER.getX()
- GOAL_WIDTH / 2,
GOAL_CENTER.getY());
    public static final Coordinate GOAL_RIGHT = new Coordinate(
GOAL_CENTER.getX()
+ GOAL_WIDTH / 2,
GOAL_CENTER.getY());
    public static final Coordinate GOAL_AREA_LEFT = new Coordinate(
GOAL_LEFT.getX() - 115,
GOAL_LEFT.getY() + 120);
    public static final Coordinate GOAL_AREA_RIGHT = new Coordinate(
GOAL_RIGHT.getX() + 115,
GOAL_RIGHT.getY() + 120);
    public static final Coordinate PENALTY_KICK = new Coordinate(
Constants.GOAL_CENTER
.getX(),
317);
    public static final Coordinate PENALTY_AREA_LEFT = new
Coordinate(20, 455);
    public static final Coordinate PENALTY_AREA_RIGHT = new
Coordinate(940, 455);
    public static final Coordinate FIELD_LOWER_LEFT = new
Coordinate(0, 595);
    public static final Coordinate FIELD_LOWER_RIGHT = new
Coordinate(960, 595);
    public static final Coordinate START_POS_ATTACKER1 = new
Coordinate(
GOAL_CENTER.getX(), 550);
    public static final Coordinate START_POS_ATTACKER2A = new
Coordinate(
GOAL_CENTER.getX() - 100,
550);
    public static final Coordinate START_POS_ATTACKER2B = new
Coordinate(
GOAL_CENTER.getX() + 100,
550);
    public static final Coordinate START_POS_KEEPER = new Coordinate(
GOAL_CENTER.getX(),
GOAL_CENTER.getY())

```

```

+ Constants.GOAL_HEIGHT
/ 2);
public static final Coordinate START_POS_BALL = new Coordinate(
GOAL_CENTER.getX(), 530);
}

```

Goal.java

```

package soccerApplet;

public final class Goal {

    public final int left;
    public final int right;
    public final int y;
    private boolean goal;
    private int section;
    private boolean collideable;

    public Goal(int x1, int x2, int y) {
        left = x1 - 3;
        right = x2 + 1;
        this.y = y;
        goal = false;
        collideable = true;
    }

    public boolean isGoal() {
        return goal;
    }

    public int getSection() {
        return section;
    }

    public boolean checkIfGoal(Ball b) {
        bounceBall(b);
        if (b.getRect().y + Constants.BALL_DIAMETER <= y)
            if (b.getRect().x >= left
                && b.getRect().x + Constants.BALL_DIAMETER <= right)
                goal = true;
        return goal;
    }

    public void bounceBall(Ball b) {
        // bounce inside the goal (left and right)
        if (b.getPosition().getX() >= left && b.getPosition().getX() <= right
            && b.getPosition().getY() <= y
            && b.getPosition().getY() >= y - Constants.GOAL_HEIGHT) {
            if ((b.getPosition().getX() - 3 < left || b.getPosition().getX() + 3 > right)
                && collideable) {
                b.setSpeed(b.getSpeed() * .5);
                double direction = b.getDirection()
- (2 * (b.getDirection() + Math.PI / 2));
                b.setDirection(direction);
                collideable = false;
            }
        }
    }

    public void resetGoal() {
        goal = false;
        collideable = true;
    }

    public int whichSection(final Ball b) {
        if (goal) {
            section = b.getRect().x + Constants.BALL_DIAMETER / 2;
            section = (section - left) / Constants.BALL_DIAMETER;
        }
    }
}

```

```

    return section;
}
return -1;
}
}

```

GameTime.java

```

package soccerApplet;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import javax.swing.Timer;

public class GameTime implements ActionListener {

    Timer timer;
    int remaining;

    GameTime() {
        remaining = 23; // default is 23 seconds
        timer = new Timer(1000, this);
        timer.setInitialDelay(0); // First timer is immediate.
    }

    GameTime(int seconds) {
        remaining = seconds;
        timer = new Timer(1000, this);
        timer.setInitialDelay(0);
    }

    @Override
    public void actionPerformed(ActionEvent e) {
        remaining--;
        if (remaining < 0)
            remaining = 0;
        if (remaining == 0)
            timer.stop();
    }

    // Start or resume the countdown
    void resume() {
        timer.start(); // Start the timer
    }

    void pause() {
        timer.stop(); // Stop the timer
    }

    public boolean isRunning() {
        return timer.isRunning();
    }

    public int getTime() {
        return remaining;
    }
}

```

Soccer.java

```

package soccerApplet;
import java.awt.event.MouseEvent;
import java.awt.event.MouseListener;
import java.awt.event.MouseMotionListener;
import java.util.Random;

public class Soccer implements Runnable, MouseListener,
    MouseMotionListener {

```

```

    GoalKeeper keeper;
    Attacker striker;
    Ball ball;
    Goal goal;
    int goalSection = -1;
    boolean collideable = true;
    boolean isRunning = false;
    boolean started = false;
    final int gameType;
    boolean toShoot = true;
    Ball pseudoBall;
    Coordinate pseudoTarget;
    public GameTime gameTime;

    /**
     * @param gameType
     * THE TYPE OF GAME: 0 = no human-controlled, keeper and striker
     are
     * both AI 1 = human-controlled striker, keeper AI 2 = human-
     controlled
     * keeper, striker AI
     */
    public Soccer(int gameType) {
        this.gameType = gameType;
        switch (gameType) {
            case 1: {
                keeper = new GoalKeeperAI(Constants.START_POS_KEEPER,
                    Constants.PLAYER_SPEED, Math.PI / 2);
                striker = new Attacker(Constants.START_POS_ATTACKER1,
                    Constants.PLAYER_SPEED, -Math.PI / 2, true, true);
                break;
            }
            case 2: {
                keeper = new GoalKeeper(Constants.START_POS_KEEPER,
                    Constants.PLAYER_SPEED,
                    Math.PI / 2, true);
                striker = new AttackerAI(Constants.START_POS_ATTACKER1,
                    Constants.PLAYER_SPEED, -Math.PI / 2, true);
                break;
            }
            default: {
                keeper = new GoalKeeperAI(Constants.START_POS_KEEPER,
                    Constants.PLAYER_SPEED, Math.PI / 2);
                striker = new AttackerAI(Constants.START_POS_ATTACKER1,
                    Constants.PLAYER_SPEED, -Math.PI / 2, true);
                break;
            }
        }
        ball = new Ball(Constants.START_POS_BALL,
            Constants.PLAYER_SPEED, 0.0D);
        pseudoBall = ball;
        goal = new Goal((int) Constants.GOAL_LEFT.getX(),
            (int) Constants.GOAL_RIGHT.getX(), (int)
            Constants.GOAL_CENTER.getY());
        gameTime = new GameTime(Constants.GAME_TIME + 3);
    }

    public Soccer(int gameType, int gameTime) {
        this.gameType = gameType;
        switch (gameType) {
            case 1: {
                keeper = new GoalKeeperAI(Constants.START_POS_KEEPER,
                    Constants.PLAYER_SPEED, Math.PI / 2);
                striker = new Attacker(Constants.START_POS_ATTACKER1,
                    Constants.PLAYER_SPEED, -Math.PI / 2, true, true);
                break;
            }
            case 2: {
                keeper = new GoalKeeper(Constants.START_POS_KEEPER,
                    Constants.PLAYER_SPEED,

```

```

    Math.PI / 2, true);
    striker = new AttackerAI(Constants.START_POS_ATTACKER1,
        Constants.PLAYER_SPEED, -Math.PI / 2, true);
    break;
}
default: {
    keeper = new GoalKeeperAI(Constants.START_POS_KEEPER,
        Constants.PLAYER_SPEED, Math.PI / 2);
    striker = new AttackerAI(Constants.START_POS_ATTACKER1,
        Constants.PLAYER_SPEED, -Math.PI / 2, true);
    break;
}
}
ball = new Ball(Constants.START_POS_BALL,
    Constants.PLAYER_SPEED, 0.0D);
goal = new Goal((int) Constants.GOAL_LEFT.getX(),
    (int) Constants.GOAL_RIGHT.getX(), (int)
    Constants.GOAL_CENTER.getY());
this.gameTime = new GameTime(gameTime + 3);
}

@Override
public void run() {
    if (gameTime.getTime() == Constants.GAME_TIME && !started) { // 20
        seconds
            // mark is the
            // start of game

        isRunning = true;
        started = true;
    }
    if (isRunning) {
        striker.execute(ball, keeper.getPosition());
        if (gameType == 0) {
            if (toShoot && ball.getSpeed() > 11 && ball.distanceTo(keeper) < 350) {
                Random r = new Random();
                int i = r.nextInt(3);
                System.out.println(i);
                if (i == 0) {
                    pseudoBall = ball;
                    pseudoTarget = Constants.GOAL_CENTER;
                    toShoot = false;
                    System.out.println(i);
                } else if (i == 1) {
                    pseudoBall = new Ball(new Coordinate(ball.getPosition()),
                        Constants.PLAYER_SPEED, 0.0D);
                    pseudoTarget = new Coordinate(Constants.GOAL_LEFT.getX() + 25,
                        Constants.GOAL_LEFT.getY());
                    if (toShoot) {
                        toShoot = false;
                        striker.setDirection(pseudoTarget);
                        striker.kick(pseudoBall, Constants.PLAYER_KICK,
                            striker.getDirection());
                    }
                } else if (i == 2) {
                    pseudoBall = new Ball(new Coordinate(ball.getPosition()),
                        Constants.PLAYER_SPEED, 0.0D);
                    pseudoTarget = new Coordinate(Constants.GOAL_LEFT.getX() + 155,
                        Constants.GOAL_LEFT.getY());
                    if (toShoot) {
                        toShoot = false;
                        striker.setDirection(pseudoTarget);
                        striker.kick(pseudoBall, Constants.PLAYER_KICK,
                            striker.getDirection());
                    }
                }
            }
            keeper.execute(pseudoBall);
            checkballCollisions();
            double bspeed = ball.getSpeed();
            Coordinate bposition = new Coordinate(ball.getPosition());

```

```

        pseudoBall.update();
        ball.setSpeed(bspeed);
        ball.setPosition(bposition);
    } else {
        keeper.execute(ball);
        checkballCollisions();
    }
    ball.update();
    if (goal.checkIfGoal(ball)) {
        goalSection = goal.whichSection(ball);
        gameTime.pause();
        isRunning = false;
    } else if (keeper.isHasBall() || ball.checkIfOutOfBounds()
        || !gameTime.isRunning()) {
        gameTime.pause();
        isRunning = false;
    }
}

public void checkballCollisions() {
    if (ball.checkCollision(keeper)) {
        if (((Math.toDegrees(keeper.getDirection()) >= 75 &&
            Math.toDegrees(keeper
                .getDirection()) < 105) || ball.getSpeed() < Constants.PLAYER_PASS - 2)
            && GoalKeeperAI.checkIfInsideGoalArea(ball.getPosition())) {
            keeper.setHasBall(true);
            ball.setPosition(keeper.getPosition());
            ball.setPossessed(true);
            ball.setIsMoving(false);
        } else if (collideable) { // a block
            ball.setSpeed(ball.getSpeed() * .75);
            ball.setDirection(ball.getDirection() * -1);
        }
        collideable = false;
        toShoot = true;
        pseudoBall = ball;
    }
    if (ball.checkCollision(striker)
        && ball.getSpeed() < Constants.PLAYER_PASS - 2) {
        if (!ball.isPossessed()) {
            striker.getBall(ball);
            collideable = true;
        }
    }
}

public boolean isFinished() {
    return (!isRunning && started);
}

public void start() {
    gameTime.resume();
}

@Override
public void mouseDragged(MouseEvent me) {
    switch (gameType) {
    case 1: {
        if (striker.getTackleDelay() == 0 && striker.askPassDelay == 0) {
            striker.setDirection(new Coordinate(me.getX(), me.getY()));
            if (striker.isHasBall())
                striker.setAction(AttackerActionType.DRIBBLE);
            else
                striker.setAction(AttackerActionType.MOVE);
        }
        break;
    }
    case 2: {
        if (keeper.getCatchDelay() == 0)

```

```

    keeper.setDirection(new Coordinate(me.getX(), me.getY()));
    keeper.setAction(GoalKeeperActionType.MOVE);
    break;
}
default: {
    break;
}
}

@Override
public void mouseMoved(MouseEvent arg0) {
    // TODO Auto-generated method stub
}

@Override
public void mouseClicked(MouseEvent me) {
    switch (gameType) {
    case 1: {
        if (striker.isHasBall() && striker.getTackleDelay() == 0
            && striker.askPassDelay == 0) {
            striker.setDirection(new Coordinate(me.getX(), me.getY()));
            striker.setAction(AttackerActionType.PASS);
        } else {
            striker.setDirection(new Coordinate(me.getX(), me.getY()));
            striker.setAction(AttackerActionType.ASKPASS);
        }
        break;
    }
    case 2: {
        break;
    }
    default: {
        break;
    }
    }
}

@Override
public void mouseEntered(MouseEvent arg0) {
    // TODO Auto-generated method stub
}

@Override
public void mouseExited(MouseEvent arg0) {
    // TODO Auto-generated method stub
}

@Override
public void mousePressed(MouseEvent me) {
    if (me.isMetaDown()) {
        switch (gameType) {
        case 1: {
            if (striker.getTackleDelay() == 0 && striker.askPassDelay == 0) {
                if (striker.isHasBall()) {
                    striker.setDirection(new Coordinate(me.getX(), me.getY()));
                    striker.setAction(AttackerActionType.KICK);
                } else {
                    striker.setDirection(new Coordinate(me.getX(), me.getY()));
                    striker.setAction(AttackerActionType.TACKLE);
                }
            }
            break;
        }
        case 2: {
            if (keeper.getCatchDelay() == 0) {
                keeper.setDirection(new Coordinate(me.getX(), me.getY()));
                keeper.setAction(GoalKeeperActionType.CATCH);
            }
            break;
        }
    }
}

```

```

    default:
    break;
}
}

@Override
public void mouseReleased(MouseEvent arg0) {
    // TODO Auto-generated method stub
}
}

```

Soccer2.java

```

package soccerApplet;
import java.awt.event.MouseListener;
import java.awt.event.MouseMotionListener;
import java.util.Random;

public class Soccer2 extends Soccer implements Runnable, MouseListener,
    MouseMotionListener {

    protected AttackerAI2 teamMate;

    public Soccer2(int gameType) {
        super(gameType);
        Random rand = new Random();
        if (rand.nextBoolean()) {
            teamMate = new AttackerAI2(Constants.START_POS_ATTACKER2A,
                Constants.PLAYER_SPEED, -Math.PI / 2, false);
        }
        if (gameType != 1)
            striker = new AttackerAI2(Constants.START_POS_ATTACKER2B,
                Constants.PLAYER_SPEED, -Math.PI / 2, true);
        else
            striker = new Attacker(Constants.START_POS_ATTACKER2B,
                Constants.PLAYER_SPEED, -Math.PI / 2, true, true);
        ball = new Ball(Constants.START_POS_ATTACKER2B.getX(), 530,
            Constants.PLAYER_SPEED, 0.0D);
    }
    else {
        teamMate = new AttackerAI2(Constants.START_POS_ATTACKER2B,
            Constants.PLAYER_SPEED, -Math.PI / 2, false);
        if (gameType != 1)
            striker = new AttackerAI2(Constants.START_POS_ATTACKER2A,
                Constants.PLAYER_SPEED, -Math.PI / 2, true);
        else
            striker = new Attacker(Constants.START_POS_ATTACKER2A,
                Constants.PLAYER_SPEED, -Math.PI / 2, true, true);
        ball = new Ball(Constants.START_POS_ATTACKER2A.getX(), 530,
            Constants.PLAYER_SPEED, 0.0D);
    }
    pseudoBall = ball;
}

public Soccer2(int gameType, int gameTime) {
    super(gameType, gameTime);
    if (gameType != 1)
        striker = new AttackerAI2(Constants.START_POS_ATTACKER1,
            Constants.PLAYER_SPEED, -Math.PI / 2, true);
    Random rand = new Random();
    if (rand.nextBoolean())
        teamMate = new AttackerAI2(Constants.START_POS_ATTACKER2A,
            Constants.PLAYER_SPEED, -Math.PI / 2, false);
    else
        teamMate = new AttackerAI2(Constants.START_POS_ATTACKER2B,
            Constants.PLAYER_SPEED, -Math.PI / 2, false);
}

@Override
public void run() {

```

```

if (gameTime.getTime() == Constants.GAME_TIME && !started) { // 20
seconds
                // mark is the
                // start of game

isRunning = true;
started = true;
}
if (isRunning) {
striker.execute(ball, keeper.getPosition(), teamMate);
teamMate.execute(ball, keeper.getPosition(), striker);
if (gameType == 0) {
if (toShoot && ball.getSpeed() > 11 && ball.distanceTo(keeper) < 350) {
Random r = new Random();
int i = r.nextInt(3);
if (i == 0) {
pseudoBall = ball;
pseudoTarget = Constants.GOAL_CENTER;
toShoot = false;
} else if (i == 1) {
pseudoBall = new Ball(new Coordinate(ball.getPosition()),
Constants.PLAYER_SPEED, 0.0D);
pseudoTarget = new Coordinate(Constants.GOAL_LEFT.getX() + 25,
Constants.GOAL_LEFT.getY());
if (toShoot) {
toShoot = false;
if (ball.distanceTo(striker) < ball.distanceTo(teamMate)) {
striker.setDirection(pseudoTarget);
striker.kick(pseudoBall, Constants.PLAYER_KICK,
striker.getDirection());
} else {
teamMate.setDirection(pseudoTarget);
teamMate.kick(pseudoBall, Constants.PLAYER_KICK,
teamMate.getDirection());
}
}
} else if (i == 2) {
pseudoBall = new Ball(new Coordinate(ball.getPosition()),
Constants.PLAYER_SPEED, 0.0D);
pseudoTarget = new Coordinate(Constants.GOAL_LEFT.getX() + 155,
Constants.GOAL_LEFT.getY());
if (toShoot) {
toShoot = false;
if (ball.distanceTo(striker) < ball.distanceTo(teamMate)) {
striker.setDirection(pseudoTarget);
striker.kick(pseudoBall, Constants.PLAYER_KICK,
striker.getDirection());
} else {
teamMate.setDirection(pseudoTarget);
teamMate.kick(pseudoBall, Constants.PLAYER_KICK,
teamMate.getDirection());
}
}
}
}
keeper.execute(pseudoBall);
checkballCollisions();
double bspeed = ball.getSpeed();
Coordinate bposition = new Coordinate(ball.getPosition());
pseudoBall.update();
ball.setSpeed(bspeed);
ball.setPosition(bposition);
} else {
keeper.execute(ball);
checkballCollisions();
}
ball.update();
if (goal.checkIfGoal(ball)) {
goalSection = goal.whichSection(ball);
isRunning = false;
gameTime.pause();
}

```

```

} else if (keeper.isHasBall() || ball.checkIfOutOfBounds()
|| !gameTime.isRunning()) {
isRunning = false;
gameTime.pause();
}
}
}

public void checkballCollisions() {
if (ball.checkCollision(keeper)) {
if (((Math.toDegrees(keeper.getDirection()) >= 75 &&
Math.toDegrees(keeper
.getDirection()) < 105) || ball.getSpeed() < Constants.PLAYER_PASS - 2)
&& GoalKeeperAI.checkIfInsideGoalArea(ball.getPosition())) {
keeper.setHasBall(true);
ball.setPosition(keeper.getPosition());
ball.setPossessed(true);
ball.setIsMoving(false);
} else if (collideable) { // a block
ball.setSpeed(ball.getSpeed() * .65);
ball.setDirection(ball.getDirection() * -1);
}
collideable = false;
toShoot = true;
pseudoBall = ball;
} else if (!ball.isPossessed()
&& ball.getSpeed() < Constants.PLAYER_PASS - 1.4) {
if (ball.checkCollision(striker)) {
striker.getBall(ball);
collideable = true;
} else if (ball.checkCollision(teamMate)) {
teamMate.getBall(ball);
collideable = true;
}
}
}
}
}
}

```

Soccer3.java

```

package soccerApplet;
import java.awt.event.MouseListener;
import java.awt.event.MouseMotionListener;
import java.util.Random;

public class Soccer3 extends Soccer2 implements Runnable,
MouseListener,
MouseMotionListener {

public DefenderAI defender;
protected int tackleDelay = 0;

public Soccer3(int gameType) {
super(gameType);
defender = new DefenderAI(Constants.PENALTY_KICK,
Constants.PLAYER_SPEED - 0.5, Math.PI / 2);
Random rand = new Random();
if (rand.nextBoolean()) {
teamMate = new AttackerAI3(Constants.START_POS_ATTACKER2A,
Constants.PLAYER_SPEED, -Math.PI / 2, false);
if (gameType != 1)
striker = new AttackerAI3(Constants.START_POS_ATTACKER2B,
Constants.PLAYER_SPEED, -Math.PI / 2, true);
else
striker = new Attacker(Constants.START_POS_ATTACKER2B,
Constants.PLAYER_SPEED, -Math.PI / 2, true, true);
ball = new Ball(Constants.START_POS_ATTACKER2B.getX(), 530,
Constants.PLAYER_SPEED, 0.0D);
} else {

```

```

teamMate = new AttackerAI3(Constants.START_POS_ATTACKER2B,
  Constants.PLAYER_SPEED, -Math.PI / 2, false);
if (gameType != 1)
  striker = new AttackerAI3(Constants.START_POS_ATTACKER2A,
    Constants.PLAYER_SPEED, -Math.PI / 2, true);
else
  striker = new Attacker(Constants.START_POS_ATTACKER2A,
    Constants.PLAYER_SPEED, -Math.PI / 2, true, true);
ball = new Ball(Constants.START_POS_ATTACKER2A.getX(), 530,
  Constants.PLAYER_SPEED, 0.0D);
}
}

public Soccer3(int gameType, int gameTime) {
  super(gameType, gameTime);
  defender = new DefenderAI(Constants.PENALTY_KICK,
    Constants.PLAYER_SPEED - 0.5, Math.PI / 2);
  if (gameType != 1) {
    striker = new AttackerAI3(Constants.START_POS_ATTACKER1,
      Constants.PLAYER_SPEED, -Math.PI / 2, true);
  }
  Random rand = new Random();
  if (rand.nextBoolean())
    teamMate = new AttackerAI3(Constants.START_POS_ATTACKER2A,
      Constants.PLAYER_SPEED, -Math.PI / 2, false);
  else
    teamMate = new AttackerAI3(Constants.START_POS_ATTACKER2B,
      Constants.PLAYER_SPEED, -Math.PI / 2, false);
}

@Override
public void run() {
  if (gameTime.getTime() == Constants.GAME_TIME && !started) { // 20
seconds
    // mark is the
    // start of game

    isRunning = true;
    started = true;
  }
  if (isRunning) {
    striker.execute(ball, keeper.getPosition(), teamMate, defender);
    teamMate.execute(ball, keeper.getPosition(), striker, defender);
    defender.execute(ball, keeper.getPosition(), striker, teamMate);
    keeper.execute(ball);
    checkballCollisions();
    ball.update();
    if (goal.checkIfGoal(ball)) {
      goalSection = goal.whichSection(ball);
      isRunning = false;
      gameTime.pause();
      keeper.catchDelay = 0; // for catchframe bug purposes
    } else if (keeper.isHasBall() || ball.checkIfOutOfBounds()
      || !gameTime.isRunning()) {
      isRunning = false;
      gameTime.pause();
      keeper.catchDelay = 0; // for catchframe bug purposes
    }
  }
}

public void checkballCollisions() {
  if (ball.checkCollision(keeper)) {
    if ((Math.toDegrees(keeper.getDirection()) >= 75 &&
Math.toDegrees(keeper
      .getDirection()) < 105) || ball.getSpeed() < Constants.PLAYER_PASS - 2)
      && GoalKeeperAI.checkIfInsideGoalArea(ball.getPosition())) {
    keeper.setHasBall(true);
    ball.setPosition(keeper.getPosition());
    ball.setPossessed(true);
    ball.setIsMoving(false);

```

```

} else if (collideable) { // a block
  ball.setSpeed(ball.getSpeed() * .7);
  ball.setDirection(ball.getDirection() * -1);
}
collideable = false;
toShoot = true;
pseudoBall = ball;
}
// if ball is free and not moving too fast
else if (!ball.isPossessed() && ball.getSpeed() < Constants.PLAYER_PASS
- 1.4) {
  if (ball.checkCollision(striker)) { // attacker collision
    striker.getBall(ball);
    collideable = true;
  } else if (ball.checkCollision(teamMate)) { // attacker2 collision
    teamMate.getBall(ball);
    collideable = true;
  } else if (ball.checkCollision(defender)) { // defender collision
    defender.getBall(ball);
    collideable = true;
  }
}
if (tackleDelay > 0) {
  tackleDelay--;
} else if (tackleDelay == 0) {
  Random r = new Random();
  // striker attempting to tackle defender
  if (striker.getTackleDelay() > 0 && ball.checkCollision(striker)) {
    if (defender.isHasBall() && r.nextBoolean()) { // defender
      striker.getBall(ball);
      defender.setHasBall(false);
      defender.setPickDelay(50);
      tackleDelay = 60;
    }
  }
  // teamMate attempting to tackle defender
  else if (teamMate.getTackleDelay() > 0 &&
ball.checkCollision(teamMate)) {
    if (defender.isHasBall() && r.nextBoolean()) { // defender
      teamMate.getBall(ball);
      defender.setHasBall(false);
      defender.setPickDelay(50);
      tackleDelay = 60;
    }
  }
  // defender attempting to tackle strikers
  else if (defender.getTackleDelay() > 0 && ball.checkCollision(defender))
{
  if (teamMate.isHasBall() && r.nextBoolean()) { // teamMate
    defender.getBall(ball);
    teamMate.setHasBall(false);
    teamMate.setPickDelay(50);
    tackleDelay = 60;
  } else if (striker.isHasBall() && r.nextBoolean()) { // striker
    defender.getBall(ball);
    striker.setHasBall(false);
    striker.setPickDelay(50);
    tackleDelay = 60;
  }
}
}
}
}

```


Tutorial.java

```
package soccerApplet;
import java.awt.Rectangle;
import java.awt.event.MouseEvent;
import java.awt.event.MouseListener;
import java.awt.event.MouseMotionListener;
import java.util.Random;

public class Tutorial implements Runnable, MouseListener,
MouseMotionListener {

    // 0 = dribbling, 1 = passing, 2 = shooting
    int type;
    Attacker tutor;
    Attacker teamMate;
    Attacker defender;
    GoalKeeper tutor2;
    GoalKeeperAI keeper;
    Ball ball;
    Ball pseudoBall;
    Coordinate pseudoTarget;
    Goal goal;
    Coordinate[] targetPositions;
    int targetIndex; // index of current target
    boolean controlled; // if user has controls over tutor
    boolean endTutorial; // if going back to main menu
    boolean success; // if challenge is completed
    GameTime gameTime;
    boolean collideable;
    Rectangle next, menu;
    boolean hovers[];
    int currentScreen;
    int tackleDelay;
    int goalSection;
    boolean aiRunning;
    boolean toShoot;
    int aiPauseDelay = 0;
    int arrowIndex = 0;
    int arrowDelay = 0;
    int arrowNumber = 0;

    public Tutorial(int type) {
        this.type = type;
        currentScreen = 0;
        targetIndex = 0;
        goalSection = 0;
        controlled = false;
        collideable = true;
        endTutorial = false;
        success = false;
        tackleDelay = 0;
        aiRunning = true;
        targetPositions = new Coordinate[7];
        switch (type) {
            case 0: {
                tutor = new Attacker(Constants.START_POS_ATTACKER1,
Constants.PLAYER_SPEED,
                -Math.PI / 2, true, false);
                ball = new Ball(Constants.START_POS_BALL,
Constants.PLAYER_SPEED, 0.0D);
                targetPositions[0] = new Coordinate(479, 387);
                targetPositions[1] = new Coordinate(650, 220);
                targetPositions[2] = Constants.PENALTY_KICK;
                targetPositions[3] = new Coordinate(800, 150);
                targetPositions[4] = new Coordinate(350, 550);
                targetPositions[5] = new Coordinate(900, 100);
                targetPositions[6] = new Coordinate(740, 500);
                break;
            }
        }
    }
}
```

```
        case 1: {
            targetPositions[0] = new Coordinate(350, 386);
            targetPositions[1] = new Coordinate(400, 400);
            targetPositions[2] = new Coordinate(460, 430);
            targetPositions[3] = new Coordinate(700, 150);
            tutor = new Attacker(Constants.START_POS_ATTACKER1,
Constants.PLAYER_SPEED,
                -Math.PI / 2, true, false);
            teamMate = new Attacker(targetPositions[3], Constants.PLAYER_SPEED,
                Math.PI / 2, false, false);
            teamMate.setDirection(tutor.getPosition());
            teamMate.moveFrame.setDirection(teamMate.getDirection());
            defender = new Attacker(300, 100, Constants.PLAYER_SPEED - .5,
Math.PI / 2,
                false, false);
            ball = new Ball(Constants.START_POS_BALL,
Constants.PLAYER_SPEED, 0.0D);
            break;
        }
        case 2: {
            toShoot = false;
            targetPositions[0] = new Coordinate(350, 270);
            targetPositions[2] = new Coordinate(500, 320);
            targetPositions[1] = new Coordinate(665, 260);
            targetPositions[3] = new Coordinate(Constants.GOAL_LEFT.getX() +
155,
                Constants.GOAL_CENTER.getY());
            targetPositions[5] = new Coordinate(Constants.GOAL_LEFT.getX() + 5,
                Constants.GOAL_CENTER.getY());
            targetPositions[4] = new Coordinate(Constants.GOAL_LEFT.getX() + 14,
                Constants.GOAL_CENTER.getY());
            goal = new Goal((int) Constants.GOAL_LEFT.getX(),
                (int) Constants.GOAL_RIGHT.getX(), (int)
                Constants.GOAL_CENTER.getY());
            tutor = new Attacker(Constants.START_POS_ATTACKER1,
Constants.PLAYER_SPEED,
                -Math.PI / 2, true, false);
            ball = new Ball(Constants.START_POS_BALL,
Constants.PLAYER_SPEED, 0.0D);
            keeper = new GoalKeeperAI(Constants.START_POS_KEEPER,
                Constants.PLAYER_SPEED - 1, Math.PI / 2);
            break;
        }
        case 3: {
            toShoot = false;
            targetPositions[0] = new Coordinate(Constants.GOAL_LEFT.getX() + 5,
560);
            targetPositions[1] = new Coordinate(640, 220);
            targetPositions[2] = new Coordinate(455, 300);
            targetPositions[3] = new Coordinate(Constants.GOAL_LEFT.getX() + 5,
                Constants.GOAL_CENTER.getY());
            targetPositions[4] = new Coordinate(Constants.GOAL_LEFT.getX() +
105,
                Constants.GOAL_CENTER.getY());
            targetPositions[5] = new Coordinate(Constants.GOAL_LEFT.getX() +
174,
                Constants.GOAL_CENTER.getY());
            goal = new Goal((int) Constants.GOAL_LEFT.getX(),
                (int) Constants.GOAL_RIGHT.getX(), (int)
                Constants.GOAL_CENTER.getY());
            tutor = new Attacker(targetPositions[targetIndex],
Constants.PLAYER_SPEED,
                -Math.PI / 2, true, false);
            ball = new Ball(new Coordinate(tutor.attackRect.getX()
                + tutor.attackRect.width / 2, tutor.attackRect.getY()
                + tutor.attackRect.height / 2), Constants.PLAYER_SPEED, 0.0D);
            tutor2 = new GoalKeeperAI(Constants.START_POS_KEEPER,
                Constants.PLAYER_SPEED, Math.PI / 2);
        }
        default:
    }
}
```

```

    break;
}
next = new Rectangle(90, 410, 65, 65);
menu = new Rectangle(90, 500, 65, 65);
hovers = new boolean[2];
}

@Override
public void run() {
    switch (type) { // TODO Auto-generated method stub
    case 0: {
        if (currentScreen == 0) {
            if (aiRunning)
                dribblerAI();
            else {
                aiPauseDelay++;
                if (aiPauseDelay % 4 == 0) {
                    if (arrowIndex < 3)
                        arrowIndex++;
                    else
                        arrowIndex = 0;
                }
                if (aiPauseDelay == 100) {
                    aiRunning = true;
                    // aiPauseDelay = 0;
                }
                if (aiPauseDelay == 220) {
                    tutor = new Attacker(Constants.START_POS_ATTACKER1,
                        Constants.PLAYER_SPEED, -Math.PI / 2, true, false);
                    ball = new Ball(Constants.START_POS_BALL,
                        Constants.PLAYER_SPEED, 0.0D);
                    targetPositions[0] = new Coordinate(479, 387);
                    targetPositions[1] = new Coordinate(650, 220);
                    targetIndex = 0;
                    aiRunning = true;
                    aiPauseDelay = 0;
                }
            }
            tutor.execute(ball);
            ball.update();
        } else if (currentScreen == 1) {
            tutor.execute(ball);
            ball.update();
            checkballCollisions();
            if (isChallengeDone()) {
                controlled = false;
                gameTime.pause();
                currentScreen = 2;
            }
            if (tutor.isHasBall()
                && tutor.getPosition().distanceTo(targetPositions[targetIndex]) < 20) {
                targetIndex++;
            }
        }
        break;
    }
    case 1: {
        if (currentScreen == 0) {
            if (aiRunning) {
                passerAI();
                receiverAI();
                defenderAI();
            } else {
                aiPauseDelay++;
                if (aiPauseDelay % 4 == 0) {
                    if (arrowIndex < 3)
                        arrowIndex++;
                    else
                        arrowIndex = 0;
                }
            }
        }
    }
}

```

```

    }
    tutor.execute(ball);
    teamMate.execute(ball, null, tutor);
    defender.execute(ball);
    checkballCollisions();
    ball.update();
    if (teamMate.isHasBall()) { // restart cycle
        aiRunning = false;
        if (aiPauseDelay == 65) {
            tutor = new Attacker(Constants.START_POS_ATTACKER1,
                Constants.PLAYER_SPEED, -Math.PI / 2, true, false);
            targetIndex = 0;
            teamMate = new Attacker(targetPositions[3],
                Constants.PLAYER_SPEED,
                Math.PI / 2, false, false);
            teamMate.setDirection(tutor.getPosition());
            teamMate.moveFrame.setDirection(teamMate.getDirection());
            defender = new Attacker(300, 100, Constants.PLAYER_SPEED - .5,
                -Math.PI / 2, false, false);
            ball = new Ball(Constants.START_POS_BALL,
                Constants.PLAYER_SPEED, 0.0D);
            aiRunning = true;
            aiPauseDelay = 0;
        }
    }
    } else if (currentScreen == 1) {
        tutor.execute(ball);
        receiverAI();
        defenderAI();
        teamMate.execute(ball, null, tutor);
        defender.execute(ball);
        ball.update();
        checkballCollisions();
        if (isChallengeDone()) {
            controlled = false;
            gameTime.pause();
            currentScreen = 2;
        }
    }
    }
    break;
}
case 2: {
    if (currentScreen == 0) {
        if (aiRunning)
            shooterAI();
        else {
            aiPauseDelay++;
            if (aiPauseDelay % 4 == 0) {
                if (arrowIndex < 3)
                    arrowIndex++;
                else
                    arrowIndex = 0;
            }
            if (aiPauseDelay == 50 || aiPauseDelay == 100 || aiPauseDelay == 170) {
                aiRunning = true;
                toShoot = true;
            }
        }
        if (aiPauseDelay >= 170)
            aiPauseDelay = 0;
    }
    keeper.execute(ball);
    tutor.execute(ball);
    checkballCollisions();
    ball.update();
    if (goal.checkIfGoal(ball) || (!ball.isMoving() && !tutor.isHasBall())) {
        tutor = new Attacker(Constants.START_POS_ATTACKER1,
            Constants.PLAYER_SPEED, -Math.PI / 2, true, false);
        ball = new Ball(Constants.START_POS_BALL,
            Constants.PLAYER_SPEED, 0.0D);
        goal = new Goal((int) Constants.GOAL_LEFT.getX(),
    }
}

```

```

        (int) Constants.GOAL_RIGHT.getX(), (int)
Constants.GOAL_CENTER.getY());
collideable = true;
keeper = new GoalKeeperAI(Constants.START_POS_KEEPER,
    Constants.PLAYER_SPEED - 1, Math.PI / 2);
toShoot = false;
}
} else if (currentScreen == 1) {
tutor.execute(ball);
if (toShoot && !tutor.isHasBall()) {
toShoot = false;
tutor.setDirection(pseudoTarget);
tutor.kick(pseudoBall, Constants.PLAYER_KICK, tutor.getDirection());
}
keeper.execute(pseudoBall);
double speed = ball.getSpeed();
Coordinate position = new Coordinate(ball.getPosition());
pseudoBall.update();
ball.setPosition(position);
ball.setSpeed(speed);
System.out.println(ball.speed);
ball.update();
checkballCollisions();
if (isChallengeDone()) {
controlled = false;
gameTime.pause();
currentScreen = 2;
}
}
break;
}
case 3: {
if (currentScreen == 0) {
if (aiRunning) {
shooterAI2();
tutor2.execute(ball);
tutor.execute(ball);
checkballCollisions();
ball.update();
} else {
aiPauseDelay++;
if (aiPauseDelay % 4 == 0) {
if (arrowIndex < 3)
arrowIndex++;
else
arrowIndex = 0;
}
if (aiPauseDelay == 80 || aiPauseDelay == 130 || aiPauseDelay == 180) {
aiRunning = true;
}
if (aiPauseDelay >= 180)
aiPauseDelay = 0;
}
if (goal.checkIfGoal(ball) || (!ball.isMoving() && !tutor.isHasBall())) {
tutor = new Attacker(targetPositions[targetIndex],
Constants.PLAYER_SPEED,
-Math.PI / 2, true, false);
tutor.setDirection(targetPositions[targetIndex + 3]);
tutor.moveFrame.setDirection(tutor.direction);
tutor.setAttackRect(tutor.getPosition());
ball = new Ball(new Coordinate(tutor.attackRect.getX()
+ tutor.attackRect.width / 2, tutor.attackRect.getY()
+ tutor.attackRect.height / 2), Constants.PLAYER_SPEED, 0.0D);
goal = new Goal((int) Constants.GOAL_LEFT.getX(),
(int) Constants.GOAL_RIGHT.getX(), (int)
Constants.GOAL_CENTER.getY());
collideable = true;
tutor2 = new GoalKeeperAI(Constants.START_POS_KEEPER,
    Constants.PLAYER_SPEED, Math.PI / 2);
}
}

```

```

} else if (currentScreen == 1) {
strikerAI();
tutor.execute(ball);
tutor2.execute(ball);
ball.update();
checkballCollisions();
if (isChallengeDone()) {
controlled = false;
gameTime.pause();
currentScreen = 2;
}
}
break;
}
default:
break;
}
}

public int getCurrentScreen() {
return currentScreen;
}

public int getType() {
return type;
}

public void setAIRunning(boolean isRunning) {
aiRunning = isRunning;
}

public boolean getAIRunning() {
return aiRunning;
}

public Coordinate getTargetPositions(int i) {
return targetPositions[i];
}

public boolean isSuccess() {
return success;
}

public void dribblerAI() {
tutor.setDirection(targetPositions[targetIndex]);
tutor.setAction(AttackerActionType.DRIBBLE);
if (targetPositions[targetIndex].distanceTo(tutor.getPosition()) < 5) {
if (targetIndex < 6)
targetIndex++;
else
targetIndex = 0;
aiRunning = false;
}
}

public void passerAI() {
if (targetPositions[targetIndex].distanceTo(tutor.getPosition()) < 5) {
if (targetIndex < 3)
targetIndex++;
}
tutor.setDirection(targetPositions[targetIndex]);
if (targetIndex == 3 && tutor.isHasBall()) {
tutor.setAction(AttackerActionType.PASS);
} else {
if (tutor.isHasBall()) {
tutor.setAction(AttackerActionType.DRIBBLE);
} else {
tutor.setAction(AttackerActionType.STOP);
}
}
}
}

```

```

}

public void receiverAI() {
if (!ball.isPossessed()
    && teamMate.getPosition().distanceTo(ball.getPosition()) < 100) {
teamMate.setDirection(ball.getPosition());
teamMate.setAction(AttackerActionType.MOVE);
} else {
teamMate.setDirection(tutor.getPosition());
teamMate.moveFrame.setDirection(teamMate.getDirection());
teamMate.setAction(AttackerActionType.ASKPASS);
}
}

public void defenderAI() {
defender.setDirection(ball.getPosition());
if (defender.getPosition().distanceTo(ball.getPosition()) <
Constants.KEEPER_CATCH_REACH - 10
    && ball.isPossessed()) {
defender.moveFrame.setDirection(defender.getDirection());
defender.setAction(AttackerActionType.TACKLE);
} else
defender.setAction(AttackerActionType.MOVE);
}

public void shooterAI() {
if (targetPositions[targetIndex].distanceTo(tutor.getPosition()) < 5) {
if (!toShoot) {
aiRunning = false;
tutor.setDirection(targetPositions[targetIndex + 3]);
tutor.moveFrame.setDirection(tutor.getDirection());
tutor.setAttackRect(tutor.getPosition());
tutor.dribble(ball);
return;
}
if (tutor.isHasBall()) {
tutor.setDirection(targetPositions[targetIndex + 3]);
tutor.setAttackRect(tutor.getPosition());
tutor.setAction(AttackerActionType.KICK);
}
}
if (targetIndex < 2)
targetIndex++;
else
targetIndex = 0;
} else {
if (tutor.isHasBall()) {
tutor.setDirection(targetPositions[targetIndex]);
tutor.setAction(AttackerActionType.DRIBBLE);
} else {
tutor.setAction(AttackerActionType.STOP);
}
}
}

public void shooterAI2() {
if (targetPositions[targetIndex].distanceTo(tutor.getPosition()) < 5) {
if (tutor.isHasBall()) {
tutor.setDirection(targetPositions[targetIndex + 3]);
tutor.setAttackRect(tutor.getPosition());
tutor.setAction(AttackerActionType.KICK);
aiRunning = false;
}
}
if (targetIndex < 2)
targetIndex++;
else
targetIndex = 0;
} else {
if (tutor.isHasBall()) {
tutor.setDirection(targetPositions[targetIndex]);
tutor.setAction(AttackerActionType.DRIBBLE);
}
}
} else {
tutor.setAction(AttackerActionType.STOP);
}
}

public void strikerAI() {
if (targetPositions[targetIndex].distanceTo(tutor.getPosition()) < 5) {
if (tutor.isHasBall()) {
Random r = new Random();
int targetSection = r.nextInt(30);
if (r.nextBoolean()) {
if (r.nextBoolean()) {
targetSection = r.nextInt(4);
} else {
targetSection = 29 - r.nextInt(4);
}
}
}
double x = Constants.GOAL_LEFT.getX() + targetSection
    * (Constants.BALL_DIAMETER) + 3;
double y = Constants.GOAL_LEFT.getY() -
Constants.BALL_DIAMETER / 2;
tutor.setDirection(new Coordinate(x, y));
tutor.moveFrame.setDirection(tutor.getDirection());
tutor.setAttackRect(tutor.getPosition());
tutor.dribble(ball);
tutor.setAction(AttackerActionType.KICK);
}
} else {
if (tutor.isHasBall()) {
tutor.setDirection(targetPositions[targetIndex]);
tutor.setAction(AttackerActionType.DRIBBLE);
} else {
tutor.setAction(AttackerActionType.STOP);
}
}
}

public void checkballCollisions() {
switch (type) {
case 0: {
if (ball.checkCollision(tutor)
    && ball.getSpeed() < Constants.PLAYER_PASS - 1) {
if (!ball.isPossessed()) {
tutor.getBall(ball);
collideable = true;
}
}
break;
}
case 1: {
if (!ball.isPossessed() && (ball.getSpeed() < Constants.PLAYER_PASS)) {
if (ball.checkCollision(defender)) { // defender collision
defender.getBall(ball);
collideable = true;
}
}
if (!ball.isPossessed() && (ball.getSpeed() < Constants.PLAYER_PASS -
1)) {
if (ball.checkCollision(tutor)) { // attacker collision
tutor.getBall(ball);
collideable = true;
} else if (ball.checkCollision(teamMate)) {
teamMate.getBall(ball);
collideable = true;
}
}
}
if (tackleDelay > 0) {
tackleDelay--;
} else if (tackleDelay == 0) {
}
}
}
}

```

```

// tutor attempting to tackle from teamMAtE or from defender
if (tutor.getTackleDelay() > 0 && ball.checkCollision(tutor)) {
    if (teamMate.isHasBall()) { // teamMAtE
        tutor.getBall(ball);
        teamMate.setHasBall(false);
    } else if (defender.isHasBall()) { // defender
        tutor.getBall(ball);
        defender.setHasBall(false);
    }
    tackleDelay = 60;
}
// teamMate attempting to tackle from teamMAtE or from defender
else if (teamMate.getTackleDelay() > 0 &&
ball.checkCollision(teamMate)) {
    if (tutor.isHasBall()) { // tutor
        teamMate.getBall(ball);
        tutor.setHasBall(false);
    } else if (defender.isHasBall()) { // defender
        teamMate.getBall(ball);
        defender.setHasBall(false);
    }
    tackleDelay = 60;
}
// defender attempting to tackle from teamMAtE or from defender
else if (defender.getTackleDelay() > 0 && ball.checkCollision(defender))
{
    if (teamMate.isHasBall()) { // teamMAtE
        defender.getBall(ball);
        teamMate.setHasBall(false);
    } else if (tutor.isHasBall()) { // tutor
        defender.getBall(ball);
        tutor.setHasBall(false);
    }
    tackleDelay = 60;
}
}
break;
}
case 2: {
    if (ball.checkCollision(keeper)) {
        if ((Math.toDegrees(keeper.getDirection()) >= 75 &&
Math.toDegrees(keeper
.getDirection()) < 105))
        // || ball.getSpeed() < Constants.PLAYER_PASS-2)
        && GoalKeeperAI.checkIfInsideGoalArea(ball.getPosition())) {
            keeper.setHasBall(true);
            ball.setPosition(keeper.getPosition());
            ball.setPossessed(true);
            ball.setIsMoving(false);
        } else if (collideable) { // a block
            ball.setSpeed(ball.getSpeed() * .5);
            ball.setDirection(ball.getDirection() * -1);
        }
        pseudoBall = ball;
        collideable = false;
    }
}
if (ball.checkCollision(tutor)
&& ball.getSpeed() < Constants.PLAYER_PASS - 1) {
    if (!ball.isPossessed()) {
        tutor.getBall(ball);
        collideable = true;
    }
}
break;
}
case 3: {
    if (ball.checkCollision(tutor2)) {
        if ((Math.toDegrees(tutor2.getDirection()) >= 75 &&
Math.toDegrees(tutor2
.getDirection()) < 105)
        && GoalKeeperAI.checkIfInsideGoalArea(ball.getPosition())) {
            tutor2.setHasBall(true);
            ball.setPosition(tutor2.getPosition());
            ball.setPossessed(true);
            ball.setIsMoving(false);
        } else if (collideable) { // a block
            ball.setSpeed(ball.getSpeed() * .5);
            ball.setDirection(ball.getDirection() * -1);
        }
        collideable = false;
    }
}
break;
}
default:
break;
}

public void startChallenge() {
    currentScreen = 1;
    collideable = true;
    endTutorial = false;
    success = false;
    controlled = true;
    gameTime = new GameTime(Constants.GAME_TIME + 10);
    gameTime.resume();
    tutor = new Attacker(Constants.START_POS_ATTACKER1,
Constants.PLAYER_SPEED,
-Math.PI / 2, true, false);
    ball = new Ball(Constants.START_POS_BALL,
Constants.PLAYER_SPEED, 0.0D);
    if (type == 1) {
        teamMate = new Attacker(650, 150, Constants.PLAYER_SPEED, -
Math.PI / 2,
        false, false);
        defender = new Attacker(600, 220, Constants.PLAYER_SPEED - .9, -
Math.PI / 2,
        false, false);
    } else if (type == 0) {
        targetIndex = 2;
    } else if (type == 2) {
        toShoot = true;
        keeper = new GoalKeeperAI(479, 125, Constants.PLAYER_SPEED + .75,
Math.PI / 2);
        tutor = new Attacker(Constants.PENALTY_KICK.getX(),
Constants.PENALTY_KICK.getY() + 15, Constants.PLAYER_SPEED, -
Math.PI / 2,
        true, false);
        ball = new Ball(Constants.PENALTY_KICK, Constants.PLAYER_SPEED,
0.0D);
        goal = new Goal((int) Constants.GOAL_LEFT.getX(),
(int) Constants.GOAL_RIGHT.getX(), (int)
Constants.GOAL_CENTER.getY());
        Random r = new Random();
        int i = r.nextInt(3);
        if (i == 0) {
            pseudoBall = ball;
            pseudoTarget = Constants.GOAL_CENTER;
            toShoot = false;
        } else if (i == 1) {
            pseudoBall = new Ball(Constants.PENALTY_KICK,
Constants.PLAYER_SPEED, 0.0D);
            pseudoTarget = new Coordinate(Constants.GOAL_LEFT.getX() + 3,
Constants.GOAL_LEFT.getY());
        } else if (i == 2) {
            pseudoBall = new Ball(Constants.PENALTY_KICK,
Constants.PLAYER_SPEED, 0.0D);
            pseudoTarget = Constants.GOAL_RIGHT;
        }
    } else if (type == 3) {

```

```

Random r = new Random();
targetIndex = r.nextInt(3);
targetPositions[0] = new Coordinate(280, 320);
targetPositions[1] = new Coordinate(480, 320);
targetPositions[2] = new Coordinate(680, 320);
tutor2 = new GoalKeeper(Constants.START_POS_KEEPER,
Constants.PLAYER_SPEED,
    Math.PI / 2, true);
tutor = new AttackerAI(Constants.START_POS_ATTACKER1,
    Constants.PLAYER_SPEED, -Math.PI / 2, true);
ball = new Ball(Constants.START_POS_BALL,
Constants.PLAYER_SPEED, 0.0D);
goal = new Goal((int) Constants.GOAL_LEFT.getX(),
    (int) Constants.GOAL_RIGHT.getX(), (int)
Constants.GOAL_CENTER.getY());
}
}

public boolean isChallengeDone() {
switch (type) {
case 0: {
if (ball.checkIfOutOfBounds() || gameTime.getTime() == 0) {
success = false;
return true;
} else if (targetIndex == 4 && tutor.isHasBall()
    && tutor.getPosition().distanceTo(targetPositions[4]) < 20) {
success = true;
return true;
}
break;
}
case 1: {
if (ball.checkIfOutOfBounds() || defender.isHasBall()
    || gameTime.getTime() == 0) {
success = false;
return true;
} else if (teamMate.isHasBall()) {
success = true;
return true;
}
break;
}
case 2: {
if (ball.checkIfOutOfBounds() || (!tutor.isHasBall() && !ball.isMoving())
    || gameTime.getTime() == 0) {
success = false;
return true;
} else if (goal.checkIfGoal(ball)) {
success = true;
return true;
}
break;
}
case 3: {
if (ball.checkIfOutOfBounds() || (!tutor.isHasBall() && !ball.isMoving())
    || gameTime.getTime() == 0) {
success = true;
return true;
} else if (goal.checkIfGoal(ball)) {
success = false;
return true;
}
break;
}
default:
break;
}
return false;
}
}

```

```

@Override
public void mouseDragged(MouseEvent me) {
if (type < 2) {
if (controlled) {
tutor.setDirection(new Coordinate(me.getX(), me.getY()));
if (tutor.isHasBall())
tutor.setAction(AttackerActionType.DRIBBLE);
else
tutor.setAction(AttackerActionType.MOVE);
}
} else if (type > 2) {
if (controlled && tutor2.getCatchDelay() == 0) {
tutor2.setDirection(new Coordinate(me.getX(), me.getY()));
tutor2.setAction(GoalKeeperActionType.MOVE);
}
}
}

public void setHovers(int x, int y) {
hovers = new boolean[2];
if (next.contains(x, y)) {
hovers[0] = true;
return;
} else if (menu.contains(x, y)) {
hovers[1] = true;
return;
}
}

public int getHovers() {
if (hovers[0] == true) {
return 0;
} else if (hovers[1] == true) {
return 1;
} else
return -1;
}

@Override
public void mouseMoved(MouseEvent me) {
if (!controlled)
setHovers(me.getX(), me.getY());
}

@Override
public void mouseClicked(MouseEvent me) {
switch (currentScreen) { // demo
case 0: {
if (next.contains(me.getX(), me.getY())) { // start challenge
currentScreen = 4;
tutor = new Attacker(Constants.START_POS_ATTACKER1,
Constants.PLAYER_SPEED,
    -Math.PI / 2, true, false);
ball = new Ball(Constants.START_POS_BALL,
Constants.PLAYER_SPEED, 0.0D);
switch (type) {
case 0: {
break;
}
case 1: {
teamMate = new Attacker(650, 150, Constants.PLAYER_SPEED, -
Math.PI / 2,
    false, false);
defender = new Attacker(600, 220, Constants.PLAYER_SPEED - .9,
    -Math.PI / 2, false, false);
defender.moveFrame.setFrame(10);
teamMate.moveFrame.setFrame(10);
break;
}
case 2: {

```

```

    keeper = new GoalKeeperAI(479, 125, Constants.PLAYER_SPEED,
Math.PI / 2);
    tutor = new Attacker(Constants.PENALTY_KICK.getX(),
    Constants.PENALTY_KICK.getY() + 15, Constants.PLAYER_SPEED,
    -Math.PI / 2, true, false);
    ball = new Ball(Constants.PENALTY_KICK,
Constants.PLAYER_SPEED, 0.0D);
    goal = new Goal((int) Constants.GOAL_LEFT.getX(),
    (int) Constants.GOAL_RIGHT.getX(), (int)
Constants.GOAL_CENTER.getY());
    break;
}
case 3: {
    tutor2 = new GoalKeeper(Constants.START_POS_KEEPER,
    Constants.PLAYER_SPEED, Math.PI / 2, true);
    tutor = new AttackerAI(Constants.START_POS_ATTACKER1,
    Constants.PLAYER_SPEED, -Math.PI / 2, true);
    ball = new Ball(Constants.START_POS_BALL,
Constants.PLAYER_SPEED, 0.0D);
    break;
}
}
} else if (menu.contains(me.getX(), me.getY())) {
    endTutorial = true;
}
}
break;
}
}
case 4: {
    if (next.contains(me.getX(), me.getY())) { // start challenge
startChallenge();
} else if (menu.contains(me.getX(), me.getY())) {
    endTutorial = true;
}
}
break;
}
}
case 1: { // user has control
    if (type != 2) {
        if (tutor.isHasBall()) {
            tutor.setDirection(new Coordinate(me.getX(), me.getY()));
            tutor.setAction(AttackerActionType.PASS);
        }
    }
    break;
}
}
case 2: {
    if (menu.contains(me.getX(), me.getY())) {
        endTutorial = true;
    } else {
        if (!success) {
            if (next.contains(me.getX(), me.getY())) {
                currentScreen = 4;
                tutor = new Attacker(Constants.START_POS_ATTACKER1,
                Constants.PLAYER_SPEED, -Math.PI / 2, true, false);
                ball = new Ball(Constants.START_POS_BALL,
Constants.PLAYER_SPEED, 0.0D);
                switch (type) {
                    case 0: {
                        break;
                    }
                    case 1: {
                        currentScreen = 4;
                        teamMate = new Attacker(650, 150, Constants.PLAYER_SPEED, -
Math.PI / 2,
                        false, false);
                        defender = new Attacker(600, 220, Constants.PLAYER_SPEED - .9,
                        -Math.PI / 2, false, false);
                        teamMate.moveFrame.setFrame(10);
                        defender.moveFrame.setFrame(10);
                        break;
                    }
                }
            }
        }
    }
}
}

```

```

    case 2: {
        keeper = new GoalKeeperAI(479, 125, Constants.PLAYER_SPEED,
Math.PI / 2);
        tutor = new Attacker(Constants.PENALTY_KICK.getX(),
        Constants.PENALTY_KICK.getY() + 15, Constants.PLAYER_SPEED,
        -Math.PI / 2, true, false);
        ball = new Ball(Constants.PENALTY_KICK,
Constants.PLAYER_SPEED, 0.0D);
        break;
    }
}
case 3: {
    tutor2 = new GoalKeeper(Constants.START_POS_KEEPER,
    Constants.PLAYER_SPEED, Math.PI / 2, true);
    tutor = new AttackerAI(Constants.START_POS_ATTACKER1,
    Constants.PLAYER_SPEED, -Math.PI / 2, true);
    ball = new Ball(Constants.START_POS_BALL,
Constants.PLAYER_SPEED, 0.0D);
}
}
}
}
}
break;
}
}
default:
    break;
}
}
}

@Override
public void mouseEntered(MouseEvent arg0) {
}

@Override
public void mouseExited(MouseEvent arg0) {
}

@Override
public void mousePressed(MouseEvent me) {
    if (controlled) {
        if (type <= 2) {
            if (me.isMetaDown()) {
                if (tutor.isHasBall()) {
                    tutor.setDirection(new Coordinate(me.getX(), me.getY()));
                    tutor.setAction(AttackerActionType.KICK);
                } else {
                    tutor.setDirection(new Coordinate(me.getX(), me.getY()));
                    tutor.setAction(AttackerActionType.TACKLE);
                }
            } else if (me.isMetaDown()) {
                tutor2.setDirection(new Coordinate(me.getX(), me.getY()));
                tutor2.setAction(GoalKeeperActionType.CATCH);
            }
        }
    }
}

@Override
public void mouseReleased(MouseEvent arg0) {
}
}
}

```

Main.java

```
package soccerApplet;
import java.awt.BasicStroke;
import java.awt.Color;
import java.awt.Font;
import java.awt.Graphics;
import java.awt.Graphics2D;
import java.awt.Image;
import java.awt.Paint;
import java.awt.Rectangle;
import java.awt.Shape;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import java.awt.event.MouseEvent;
import java.awt.event.MouseListener;
import java.awt.event.MouseMotionListener;
import java.awt.font.GlyphVector;
import java.awt.geom.AffineTransform;
import java.awt.image.BufferedImage;
import java.awt.image.RescaleOp;
import java.util.Random;
import javax.swing.JApplet;
import javax.swing.Timer;
import netscape.javascript.JSObject;
import externalUtil.ImageUtil;

public class Main extends JApplet implements ActionListener,
MouseListener,
MouseMotionListener {

    final static int WIDTH = 960;
    final static int HEIGHT = 595;
    // For Double Buffering purposes
    Image offImage;
    Graphics offGraphics;
    BufferedImage titleImg;
    BufferedImage[] subMenuImg;
    BufferedImage[] mistImg;
    BufferedImage[] homeButt;
    BufferedImage[] menuButt;
    BufferedImage[] resetButt;
    BufferedImage[] keeperButt;
    BufferedImage[] strikerButt;
    BufferedImage[] twovs2Butt;
    BufferedImage[] twovs1Butt;
    BufferedImage[] onevs1Butt;
    BufferedImage[] symbolButt;
    BufferedImage[] dribbleButt;
    BufferedImage[] shootButt;
    BufferedImage[] passButt;
    BufferedImage[] goalkeepButt;
    BufferedImage[] dribbleText;
    BufferedImage[] passText;
    BufferedImage[] shootText;
    BufferedImage[] goalkeepText;
    BufferedImage[] typeHoverText;
    BufferedImage[] sideHoverText;
    BufferedImage[] homeHoverText;
    BufferedImage[] tutorialHoverText;
    BufferedImage[] labelText;
    BufferedImage[] charCircleImg;
    BufferedImage[] ballCircleImg;
    BufferedImage[] arrowsImg;
    BufferedImage[] keeperArrowsImg;
    BufferedImage[] symbolsImg;
    BufferedImage fieldImg;
    BufferedImage keeperImg;
    BufferedImage strikerImg;
    BufferedImage striker2Img;

    BufferedImage[] defenderImg;
    BufferedImage[] ballImg;
    Graphics2D seeThrough;
    RescaleOp rop;
    float opacity = .1f;
    float[] scales = { 1f, 1f, 1f, 0.5f };
    float[] offsets = new float[4];
    int graphicsDelay = 0;
    int translateOffset = 0;
    int mistDelay = 0;
    int mistIndex = 0;
    int circleDelay = 0;
    int circleIndex = 0;
    int ballIndex = 0;
    int ballDelay = 0;
    String simulationStr = "";
    int simStrOffset = 15;
    int currentScreen = 0;
    int currentLevel = 1;
    int[] currentScores = { 0, 0, 0, 0, 0 }; // current Total,
// level bonus, time
// bonus, random
// bonus, temp holder

    boolean levelFailed = false;
    boolean listenerSwitch = true;
    boolean gameRunning = false;
    boolean tutorialOn = false;
    int[] highScores = { 0, 0, 0, 0, 0 };
    Timer time;
    Soccer game;
    Soccer2 game2;
    Soccer3 game3;
    Tutorial tutorial;
    ButtonHandler butt = new ButtonHandler();

    public void init() {
        setLayout(null);
        this.setSize(WIDTH, HEIGHT);
        offImage = createImage(WIDTH, HEIGHT);
        offGraphics = offImage.getGraphics();
        loadMenuImages();
        loadGameImages();
        loadTextImages();
        addMouseListener(this);
        addMouseMotionListener(this);
    }

    @Override
    public void actionPerformed(ActionEvent arg0) {
        switch (currentScreen) {
            case 4: {
                if (tutorialOn) {
                    tutorial.run();
                }
                if (tutorial.endTutorial) {
                    tutorialOn = false;
                    switchListeners(tutorial, false);
                    currentScreen = 4;
                }
            }
            break;
            case 10: {
                game.run();
                if (game.isFinished() && gameRunning)
                    finishGame();
            }
            break;
            case 11: {
                game2.run();
                if (game2.isFinished() && gameRunning)

```



```

    finishGame();
break;
}
case 12: {
    game3.run();
    if (game3.isFinished() && gameRunning)
        finishGame();
    break;
}
case 13: {
    switch (currentLevel) {
    case 1: {
        game.run();
        if (game.isFinished() && gameRunning) {
            if (game.goal.isGoal()) {
                levelFailed = false;
            } else {
                levelFailed = true;
            }
            finishLevel();
        }
        break;
    }
    case 2: {
        game.run();
        if (game.isFinished() && gameRunning) {
            if (game.goal.isGoal()) {
                levelFailed = true;
            } else {
                levelFailed = false;
            }
            finishLevel();
        }
        break;
    }
    case 3: {
        game3.run();
        if (game3.isFinished() && gameRunning) {
            if (game3.goal.isGoal()) {
                levelFailed = true;
            } else {
                levelFailed = false;
            }
            finishLevel();
        }
        break;
    }
    case 4: {
        game3.run();
        if (game3.isFinished() && gameRunning) {
            if (game3.goal.isGoal()) {
                levelFailed = true;
            } else {
                levelFailed = false;
            }
            finishLevel();
        }
        break;
    }
    case 5: {
        game2.run();
        if (game2.isFinished() && gameRunning) {
            if (game2.goal.isGoal()) {
                levelFailed = false;
            } else {
                levelFailed = true;
            }
            finishLevel();
        }
        break;
    }
    }
}

}
default:
break;
}
break;
}
default:
break;
}
repaint();
}

@Override
public void update(Graphics g) {
    switch (currentScreen) {
    case 0: {
        paintHome(offGraphics);
        break;
    }
    case 1: { // choose side
        paintSide(offGraphics);
        break;
    }
    case 2: { // play attacker, choose number of players
        paintType(offGraphics);
        break;
    }
    case 3: { // play goalkeeper, choose number of players
        paintType(offGraphics);
        break;
    }
    case 4: { // tutorial
        if (!tutorialOn)
            paintTutorial(offGraphics);
        else {
            switch (tutorial.getType()) {
            case 0: {
                paintTutorialDribble(offGraphics);
                break;
            }
            case 1: {
                paintTutorialPass(offGraphics);
                break;
            }
            case 2: {
                paintTutorialShoot(offGraphics);
                break;
            }
            case 3: {
                paintTutorialGoalkeep(offGraphics);
                break;
            }
            default:
                break;
            }
        }
        break;
    }
    case 5: { // ai, choose number of players
        paintType(offGraphics);
        break;
    }
    case 6: { // highScores
        paintHighScores(offGraphics);
        break;
    }
    case 10: { // 1on1
        if (game.started) {
            paint1on1(offGraphics);
            if (!gameRunning && translateOffset <= -1200) {

```

```

    paintAfter(offGraphics);
}
} else { // ready screen
    paintReady(offGraphics);
}
break;
}
case 11: { // 2on1
    if (game2.started) {
        paint2on1(offGraphics);
        if (!gameRunning && translateOffset <= -1200) {
            paintAfter(offGraphics);
        }
    } else { // ready screen
        paintReady(offGraphics);
    }
    break;
}
case 12: { // 2on2
    if (game3.started) {
        paint2on2(offGraphics);
        if (!gameRunning && translateOffset <= -1200) {
            paintAfter(offGraphics);
        }
    } else { // ready screen
        paintReady(offGraphics);
    }
    break;
}
case 13: { // arcade
    switch (currentLevel) {
case 1: {
        if (game.started) {
            paint1on1(offGraphics);
            if (!gameRunning && translateOffset <= -1100) {
                if (!levelFailed) {
                    paintLevelScores(offGraphics);
                    paintNextLevel(offGraphics);
                } else {
                    paintGameOver(offGraphics);
                }
            } else {
                paintCurrentLevelAndScore(offGraphics);
            }
        } else { // ready screen
            paintReady(offGraphics);
        }
        break;
    }
case 2: {
        if (game.started) {
            paint1on1(offGraphics);
            if (!gameRunning && translateOffset <= -1100) {
                if (!levelFailed) {
                    paintLevelScores(offGraphics);
                    paintNextLevel(offGraphics);
                } else {
                    paintGameOver(offGraphics);
                }
            } else {
                paintCurrentLevelAndScore(offGraphics);
            }
        } else { // ready screen
            paintReady(offGraphics);
        }
        break;
    }
case 3: {
        if (game3.started) {
            paint2on2(offGraphics);
            if (!gameRunning && translateOffset <= -1100) {
                if (!levelFailed) {
                    paintLevelScores(offGraphics);
                    paintNextLevel(offGraphics);
                } else {
                    paintGameOver(offGraphics);
                }
            } else {
                paintCurrentLevelAndScore(offGraphics);
            }
        } else { // ready screen
            paintReady(offGraphics);
        }
        break;
    }
case 4: {
        if (game3.started) {
            paint2on2(offGraphics);
            if (!gameRunning && translateOffset <= -1100) {
                if (!levelFailed) {
                    paintLevelScores(offGraphics);
                    paintNextLevel(offGraphics);
                } else {
                    paintGameOver(offGraphics);
                }
            } else {
                paintCurrentLevelAndScore(offGraphics);
            }
        } else { // ready screen
            paintReady(offGraphics);
        }
        break;
    }
case 5: {
        if (game2.started) {
            paint2on1(offGraphics);
            if (!gameRunning && translateOffset <= -1100) {
                if (!levelFailed) {
                    paintLevelScores(offGraphics);
                    paintNextLevel(offGraphics);
                } else {
                    paintGameOver(offGraphics);
                }
            } else {
                paintCurrentLevelAndScore(offGraphics);
            }
        } else { // ready screen
            paintReady(offGraphics);
        }
        break;
    }
default:
        break;
    }
default:
        break;
    }
    g.drawImage(offImage, 0, 0, null);
}

@Override
public void start() {
    time = new Timer(25, this);
    time.start();
    repaint();
}

@Override

```

```

public void stop() {
// offImage = null;
// field = null;
// offGraphics = null;
}

public void loadMenuImages() {
titleImg = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/background/titlescreen.png"),
    new Color(0, 115, 0));
BufferedImage img = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/buttons/buttonhome.png"), new Color(0, 115, 0));
homeButt = ImageUtil.splitImage(img, 1, 5);
mistImg = new BufferedImage[21];
for (int i = 0; i < 21; i++) {
if (i * 2 < 10)
mistImg[i] = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/mist/Mist0" + (i * 2) + ".png"),
    new Color(0, 115, 0));
else
mistImg[i] = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/mist/Mist" + (i * 2) + ".png"),
    new Color(0, 115, 0));
}
subMenuImg = new BufferedImage[4];
subMenuImg[0] = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/background/sidebg.png"), new
Color(0,
    115, 0));
subMenuImg[1] = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/background/typebg.png"), new
Color(0,
    115, 0));
subMenuImg[2] = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/background/skillbg.png"), new
Color(0,
    115, 0));
subMenuImg[3] = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/background/scoresbg.png"), new
Color(0,
    115, 0));
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/buttons/buttonmenu.png"), new
Color(0,
    115, 0));
menuButt = ImageUtil.splitImage(img, 1, 3);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/buttons/buttonreset.png"), new
Color(0,
    115, 0));
resetButt = ImageUtil.splitImage(img, 1, 3);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/buttons/buttonstriker.png"), new
Color(
    0, 115, 0));
strikerButt = ImageUtil.splitImage(img, 1, 3);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/buttons/buttongoalkeeper.png"),
    new Color(0, 115, 0));
keeperButt = ImageUtil.splitImage(img, 1, 3);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/buttons/button2vs2.png"), new
Color(0,
    115, 0));
twovs2Butt = ImageUtil.splitImage(img, 1, 3);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/buttons/button2vs1.png"), new
Color(0,
    115, 0));
twovs1Butt = ImageUtil.splitImage(img, 1, 3);

```

```

img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/buttons/button1vs1.png"), new
Color(0,
    115, 0));
onevs1Butt = ImageUtil.splitImage(img, 1, 3);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/buttons/buttosymbol.png"), new
Color(
    0, 115, 0));
symbolButt = ImageUtil.splitImage(img, 3, 3);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/buttons/buttondribble.png"), new
Color(
    0, 115, 0));
dribbleButt = ImageUtil.splitImage(img, 1, 3);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/buttons/buttonshoot.png"), new
Color(0,
    115, 0));
shootButt = ImageUtil.splitImage(img, 1, 3);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/buttons/buttonpass.png"), new
Color(0,
    115, 0));
passButt = ImageUtil.splitImage(img, 1, 3);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/buttons/buttongoalkeep.png"),
    new Color(0, 115, 0));
goalkeepButt = ImageUtil.splitImage(img, 1, 3);
}

public void loadGameImages() {
// fieldImg = getImage(getCodeBase(), "images/pitch.png");
fieldImg = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/pitch.png"), new Color(0, 115, 0));
BufferedImage img = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/mobileobjects/striker.png"), new Color(0, 115, 0));
strikerImg = ImageUtil.splitImage(img, 8, 6);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/mobileobjects/striker2.png"),
    new Color(0, 115, 0));
striker2Img = ImageUtil.splitImage(img, 8, 6);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/mobileobjects/defender.png"),
    new Color(0, 115, 0));
defenderImg = ImageUtil.splitImage(img, 8, 6);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/mobileobjects/goalkeeper.png"),
    new Color(0, 115, 0));
keeperImg = ImageUtil.splitImage(img, 8, 6);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/mobileobjects/ball.png"), new
Color(0,
    115, 0));
ballImg = ImageUtil.splitImage(img, 4, 1);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/symbols/circle.png"), new Color(0,
115,
    0));
charCircleImg = ImageUtil.splitImage(img, 4, 1);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/symbols/ballcircle.png"), new
Color(0,
    115, 0));
ballCircleImg = ImageUtil.splitImage(img, 4, 1);
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/symbols/arrows.png"), new Color(0,
115,
    0));
arrowsImg = ImageUtil.splitImage(img, 4, 10);

```

```

img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/symbols/arrows2.png"), new
Color(0,
    115, 0));
keeperArrowsImg = ImageUtil.splitImage(img, 4, 2);
symbolsImg = new BufferedImage[3];
img = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/symbols/checkcross.png"), new
Color(0,
    115, 0));
symbolsImg = ImageUtil.splitImage(img, 2, 1);
symbolsImg[2] = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/symbols/red circle.png"), new
Color(0,
    115, 0));
}

public void loadTextImages() {
dribbleText = new BufferedImage[5];
for (int i = 0; i < 4; i++)
dribbleText[i] = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/text/dribble" + (i + 1) + ".png"),
    new Color(0, 115, 0));
passText = new BufferedImage[4];
for (int i = 0; i < 4; i++)
passText[i] = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/text/pass" + (i + 1) + ".png"),
    new Color(0, 115, 0));
shootText = new BufferedImage[4];
for (int i = 0; i < 4; i++)
shootText[i] = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/text/shoot" + (i + 1) + ".png"),
    new Color(0, 115, 0));
goalkeepText = new BufferedImage[4];
for (int i = 0; i < 4; i++)
goalkeepText[i] = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/text/goalkeep" + (i + 1) + ".png"), new Color(0,
115,
    0));
typeHoverText = new BufferedImage[3];
typeHoverText[0] = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/text/1on1hover.png"), new Color(0, 115, 0));
typeHoverText[1] = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/text/2on1hover.png"), new Color(0, 115, 0));
typeHoverText[2] = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/text/2on2hover.png"), new Color(0, 115, 0));
sideHoverText = new BufferedImage[2];
sideHoverText[0] = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/text/strikerhover.png"), new Color(0, 115, 0));
sideHoverText[1] = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/text/goalkeeperhover.png"), new Color(0, 115, 0));
homeHoverText = new BufferedImage[5];
homeHoverText[0] = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/text/arcadehover.png"), new Color(0, 115, 0));
homeHoverText[1] = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/text/customhover.png"), new Color(0, 115, 0));
homeHoverText[2] = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/text/simulatehover.png"), new Color(0, 115, 0));
homeHoverText[3] = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/text/tutorialhover.png"), new Color(0, 115, 0));
homeHoverText[4] = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/text/scoreshover.png"), new Color(0, 115, 0));
labelText = new BufferedImage[3];
labelText[0] = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/text/strikerlabel.png"), new Color(0,
115, 0));
labelText[1] = ImageUtil.makeColorTransparent(
    this.getClass().getResource("images/text/keeperlabel.png"), new Color(0,
115, 0));
labelText[2] = ImageUtil.makeColorTransparent(

```

```

    this.getClass().getResource("images/text/defenderlabel.png"), new
Color(0,
    115, 0));
tutorialHoverText = new BufferedImage[4];
tutorialHoverText[0] = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/text/dribblehover.png"), new Color(0, 115, 0));
tutorialHoverText[1] = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/text/passhover.png"), new Color(0, 115, 0));
tutorialHoverText[2] = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/text/shoothover.png"), new Color(0, 115, 0));
tutorialHoverText[3] = ImageUtil.makeColorTransparent(this.getClass()
    .getResource("images/text/goalkeeperhover.png"), new Color(0, 115, 0));
}

```

```

@Override
public void paint(Graphics g) {
update(g); // remove flickers
}

```

```

public void paintReady(Graphics g) { // ready screen
g.setColor(Color.WHITE);
g.fillRect(0, 0, WIDTH, HEIGHT);
setOpacity(opacity);
opacity += .05f;
seeThrough = (Graphics2D) g;
seeThrough.drawImage(fieldImg, rop, 0, 0);
if (opacity < .75f)
    paintReadyString(g);
else
    paintStartString(g);
}

```

```

public void paintReadyString(Graphics g1) {
Graphics2D g = (Graphics2D) g1;
Color color = new Color(0, 33, 15, 125);
Font font = new Font("Serif", Font.BOLD, 10); // a basic font
Font bigfont = // a scaled up version
font.deriveFont(AffineTransform.getScaleInstance(22.0, 22.0));
GlyphVector gv = bigfont.createGlyphVector(g.getFontRenderContext(),
"READY");
// shapes of each letter
Shape r = gv.getGlyphOutline(0);
Shape e = gv.getGlyphOutline(1);
Shape a = gv.getGlyphOutline(2);
Shape d = gv.getGlyphOutline(3);
Shape y = gv.getGlyphOutline(4);
g.setStroke(new BasicStroke(5.0f));
Paint shadowPaint = new Color(0, 0, 0, 100); // Translucent black
AffineTransform shadowTransform = AffineTransform.getShearInstance(-
1.0, 0.0); // Shear
// to
// the
// right
shadowTransform.scale(1.0, 0.5); // Scale height by 1/2
// Move to the baseline of our first letter
g.translate(75, 350);
// Draw the shadow of the R shape
g.setPaint(shadowPaint);
g.fill(shadowTransform.createTransformedShape(r));
g.setPaint(color);
g.fill(r); // Fill the shape
g.setPaint(Color.black); // Switch to solid back
g.draw(r); // Draw the outline
// letter E
g.translate(15, 0); // Move to the right
g.setPaint(shadowPaint);
g.fill(shadowTransform.createTransformedShape(e)); // draw shadow
g.setPaint(color);
g.fill(e); // Fill the shape
g.setPaint(Color.black); // Switch to solid back

```

```

g.draw(e); // Draw the outline
// letter A
g.translate(10, 0); // Move to the right
g.setPaint(shadowPaint); // Set shadow color
g.fill(shadowTransform.createTransformedShape(a)); // draw shadow
g.setPaint(color);
g.fill(a); // Fill the shape
g.setPaint(Color.black); // Switch to solid back
g.draw(a); // Draw the outline
// letter D
g.translate(15, 0); // Move to the right
g.setPaint(shadowPaint); // Set shadow color
g.fill(shadowTransform.createTransformedShape(d)); // draw shadow
g.setPaint(color);
g.fill(d); // Fill the shape
g.setPaint(Color.black); // Switch to solid back
g.draw(d); // Draw the outline
// letter Y
g.translate(0, 0); // Move to the right
g.setPaint(shadowPaint); // Set shadow color
g.fill(shadowTransform.createTransformedShape(y)); // draw shadow
g.setPaint(color);
g.fill(y); // Fill the shape
g.setPaint(Color.black); // Switch to solid back
g.draw(y); // Draw the outline
/** IMPORTANT: TRANSLATE EVERYTHING BACK!!! */
g.translate(-115, -350);
}

public void paintStartString(Graphics g1) {
Graphics2D g = (Graphics2D) g1;
Color color = new Color(0, 33, 15, 125);
Font font = new Font("Serif", Font.BOLD, 10); // a basic font
Font bigfont = // a scaled up version
font.deriveFont(AffineTransform.getScaleInstance(22.0, 22.0));
GlyphVector gv = bigfont.createGlyphVector(g.getFontRenderContext(),
"START");
// shapes of each letter
Shape r = gv.getGlyphOutline(0);
Shape e = gv.getGlyphOutline(1);
Shape a = gv.getGlyphOutline(2);
Shape d = gv.getGlyphOutline(3);
Shape y = gv.getGlyphOutline(4);
g.setStroke(new BasicStroke(5.0f));
Paint shadowPaint = new Color(0, 0, 0, 100); // Translucent black
AffineTransform shadowTransform = AffineTransform.getShearInstance(-
1.0, 0.0); // Shear
// to
// the
// right
shadowTransform.scale(1.0, 0.5); // Scale height by 1/2
// Move to the baseline of our first letter
g.translate(80, 350);
// Draw the shadow of the S shape
g.setPaint(shadowPaint);
g.fill(shadowTransform.createTransformedShape(r));
g.setPaint(color);
g.fill(r); // Fill the shape
g.setPaint(Color.black); // Switch to solid back
g.draw(r); // Draw the outline
// letter T
g.translate(25, 0); // Move to the right
g.setPaint(shadowPaint);
g.fill(shadowTransform.createTransformedShape(e)); // draw shadow
g.setPaint(color);
g.fill(e); // Fill the shape
g.setPaint(Color.black); // Switch to solid back
g.draw(e); // Draw the outline
// letter A
g.translate(30, 0); // Move to the right

```

```

g.setPaint(shadowPaint); // Set shadow color
g.fill(shadowTransform.createTransformedShape(a)); // draw shadow
g.setPaint(color);
g.fill(a); // Fill the shape
g.setPaint(Color.black); // Switch to solid back
g.draw(a); // Draw the outline
// letter R
g.translate(15, 0); // Move to the right
g.setPaint(shadowPaint); // Set shadow color
g.fill(shadowTransform.createTransformedShape(d)); // draw shadow
g.setPaint(color);
g.fill(d); // Fill the shape
g.setPaint(Color.black); // Switch to solid back
g.draw(d); // Draw the outline
// letter T
g.translate(15, 0); // Move to the right
g.setPaint(shadowPaint); // Set shadow color
g.fill(shadowTransform.createTransformedShape(y)); // draw shadow
g.setPaint(color);
g.fill(y); // Fill the shape
g.setPaint(Color.black); // Switch to solid back
g.draw(y); // Draw the outline
/** IMPORTANT: TRANSLATE EVERYTHING BACK!!! */
g.translate(-165, -350);
}

public void paintGoalString(Graphics g1) {
Graphics2D g = (Graphics2D) g1;
Color color = new Color(140, 33, 15, 125);
Font font = new Font("Serif", Font.BOLD, 10); // a basic font
Font bigfont = // a scaled up version
font.deriveFont(AffineTransform.getScaleInstance(30.0, 50.0));
GlyphVector gv = bigfont.createGlyphVector(g.getFontRenderContext(),
"GOAL!");
// shapes of each letter
Shape r = gv.getGlyphOutline(0);
Shape e = gv.getGlyphOutline(1);
Shape a = gv.getGlyphOutline(2);
Shape d = gv.getGlyphOutline(3);
Shape y = gv.getGlyphOutline(4);
g.setStroke(new BasicStroke(5.0f));
Paint shadowPaint = new Color(0, 0, 0, 100); // Translucent black
AffineTransform shadowTransform = AffineTransform.getShearInstance(-
1.0, 0.0); // Shear
// to
// the
// right
shadowTransform.scale(1.0, 0.5); // Scale height by 1/2
// Move to the baseline of our first letter
g.translate(20 + translateOffset, 430);
// Draw the shadow of the G shape
g.setPaint(shadowPaint);
g.fill(shadowTransform.createTransformedShape(r));
g.setPaint(color);
g.fill(r); // Fill the shape
g.setPaint(Color.black); // Switch to solid back
g.draw(r); // Draw the outline
// letter O
g.translate(15, 0); // Move to the right
g.setPaint(shadowPaint);
g.fill(shadowTransform.createTransformedShape(e)); // draw shadow
g.setPaint(color);
g.fill(e); // Fill the shape
g.setPaint(Color.black); // Switch to solid back
g.draw(e); // Draw the outline
// letter A
g.translate(10, 0); // Move to the right
g.setPaint(shadowPaint); // Set shadow color
g.fill(shadowTransform.createTransformedShape(a)); // draw shadow
g.setPaint(color);

```

```

g.fill(a); // Fill the shape
g.setPaint(Color.black); // Switch to solid back
g.draw(a); // Draw the outline
// letter L
g.translate(15, 0); // Move to the right
g.setPaint(shadowPaint); // Set shadow color
g.fill(shadowTransform.createTransformedShape(d)); // draw shadow
g.setPaint(color);
g.fill(d); // Fill the shape
g.setPaint(Color.black); // Switch to solid back
g.draw(d); // Draw the outline
// character !
g.translate(0, 0); // Move to the right
g.setPaint(shadowPaint); // Set shadow color
g.fill(shadowTransform.createTransformedShape(y)); // draw shadow
g.setPaint(color);
g.fill(y); // Fill the shape
g.setPaint(Color.black); // Switch to solid back
g.draw(y); // Draw the outline
/** IMPORTANT: TRANSLATE EVERYTHING BACK!!! */
g.translate(-(60 + translateOffset), -430);
}

public void paintHome(Graphics g) {
g.drawImage(titleImg, 0, 0, null);
paintMist(g);
g.drawImage(homeButt[0], butt.buttHome[0].x, butt.buttHome[0].y, null);
g.drawImage(homeButt[1], butt.buttHome[1].x, butt.buttHome[1].y, null);
g.drawImage(homeButt[2], butt.buttHome[2].x, butt.buttHome[2].y, null);
g.drawImage(homeButt[3], butt.buttHome[3].x, butt.buttHome[3].y, null);
g.drawImage(homeButt[4], butt.buttHome[4].x, butt.buttHome[4].y, null);
switch (butt.getHomeButton(false)) {
case 0: {
g.drawImage(homeHoverText[0], 0, 0, null);
break;
}
case 1: {
g.drawImage(homeHoverText[1], 0, 0, null);
break;
}
case 2: {
g.drawImage(homeHoverText[2], 0, 0, null);
break;
}
case 3: {
g.drawImage(homeHoverText[3], 0, 0, null);
break;
}
case 4: {
g.drawImage(homeHoverText[4], 0, 0, null);
break;
}
default:
break;
}
/*
* switch(butt.getbutRectButton(true)){ case 0: { g.setColor(new Color(46,
* 55, 133)); g.drawString("Arcade",butt.buttRect[0].x,
* butt.buttRect[0].y+40); break; } case 1: { g.setColor(new Color(46, 55,
* 133)); g.drawString("Custom Game",butt.buttRect[1].x,
* butt.buttRect[1].y+40); break; }
*
* case 2: { g.setColor(new Color(46, 55, 133));
* g.drawString("Simulate",butt.buttRect[2].x, butt.buttRect[2].y+40);
break;
* }
*
* case 3: { g.setColor(new Color(46, 55, 133));
* g.drawString("Tutorial",butt.buttRect[3].x, butt.buttRect[3].y+40);
break;
* }
*/
}

```

```

* }
*
* case 4: { g.setColor(new Color(46, 55, 133));
* g.drawString("High Scores",butt.buttRect[4].x, butt.buttRect[4].y+40);
* break; } default: break; }
*/
}

public void paintMist(Graphics g) {
mistDelay++;
g.drawImage(mistImg[mistIndex], -15, 365, null);
if (mistDelay > 2) {
if (mistIndex < 20)
mistIndex++;
else
mistIndex = 0;
mistDelay = 0;
}
}

public void paintSide(Graphics g) {
g.drawImage(titleImg, 0, 0, null);
paintMist(g);
g.drawImage(subMenuImg[0], 180, 20, null);
g.drawImage(strikerButt[0], butt.buttRect[1].x, butt.buttRect[1].y, null);
g.drawImage(keeperButt[0], butt.buttRect[2].x, butt.buttRect[2].y, null);
g.drawImage(menuButt[0], butt.buttRect[4].x, butt.buttRect[4].y, null);
switch (butt.getbutRectButton(false)) { // hover
case 1: {
g.drawImage(strikerButt[1], butt.buttRect[1].x, butt.buttRect[1].y, null);
g.drawImage(sideHoverText[0], 180, 20, null);
break;
}
case 2: {
g.drawImage(keeperButt[1], butt.buttRect[2].x, butt.buttRect[2].y, null);
g.drawImage(sideHoverText[1], 180, 20, null);
break;
}
case 4: {
g.drawImage(menuButt[1], butt.buttRect[4].x, butt.buttRect[4].y, null);
break;
}
default:
break;
}
switch (butt.getbutRectButton(true)) { // onclick
case 1: {
g.drawImage(strikerButt[2], butt.buttRect[1].x, butt.buttRect[1].y, null);
break;
}
case 2: {
g.drawImage(keeperButt[2], butt.buttRect[2].x, butt.buttRect[2].y, null);
break;
}
case 4: {
g.drawImage(menuButt[2], butt.buttRect[4].x, butt.buttRect[4].y, null);
break;
}
default:
break;
}
}

```

```

// menu for choosing game type ( number of players )
public void paintType(Graphics g) {
g.drawImage(titleImg, 0, 0, null);
paintMist(g);
g.drawImage(subMenuImg[1], 180, 20, null);
g.drawImage(ones1Butt[0], butt.buttRect[0].x, butt.buttRect[0].y, null);
g.drawImage(twovs1Butt[0], butt.buttRect[1].x, butt.buttRect[1].y, null);

```

```

g.drawImage(twovs2Butt[0], butt.buttRect[2].x, butt.buttRect[2].y, null);
g.drawImage(menuButt[0], butt.buttRect[4].x, butt.buttRect[4].y, null);
switch (butt.getbuttRectButton(false)) { // hover
case 0: {
g.drawImage(onevs1Butt[1], butt.buttRect[0].x, butt.buttRect[0].y, null);
g.drawImage(typeHoverText[0], 180, 20, null);
break;
}
case 1: {
g.drawImage(twovs1Butt[1], butt.buttRect[1].x, butt.buttRect[1].y, null);
g.drawImage(typeHoverText[1], 180, 20, null);
break;
}
case 2: {
g.drawImage(twovs2Butt[1], butt.buttRect[2].x, butt.buttRect[2].y, null);
g.drawImage(typeHoverText[2], 180, 20, null);
break;
}
case 4: {
g.drawImage(menuButt[1], butt.buttRect[4].x, butt.buttRect[4].y, null);
break;
}
default:
break;
}
switch (butt.getbuttRectButton(true)) { // onclick
case 0: {
g.drawImage(onevs1Butt[2], butt.buttRect[0].x, butt.buttRect[0].y, null);
break;
}
case 1: {
g.drawImage(twovs1Butt[2], butt.buttRect[1].x, butt.buttRect[1].y, null);
break;
}
case 2: {
g.drawImage(twovs2Butt[2], butt.buttRect[2].x, butt.buttRect[2].y, null);
break;
}
case 4: {
g.drawImage(menuButt[2], butt.buttRect[4].x, butt.buttRect[4].y, null);
break;
}
default:
break;
}
}

public void paintTutorial(Graphics g) {
g.drawImage(titleImg, 0, 0, null);
paintMist(g);
g.drawImage(subMenuImg[2], 180, 20, null);
g.drawImage(dribbleButt[0], butt.buttRect[0].x, butt.buttRect[0].y, null);
g.drawImage(passButt[0], butt.buttRect[1].x, butt.buttRect[1].y, null);
g.drawImage(shootButt[0], butt.buttRect[2].x, butt.buttRect[2].y, null);
g.drawImage(goalkeepButt[0], butt.buttRect[3].x, butt.buttRect[3].y, null);
g.drawImage(menuButt[0], butt.buttRect[4].x, butt.buttRect[4].y, null);
switch (butt.getbuttRectButton(false)) { // hover
case 0: {
g.drawImage(dribbleButt[1], butt.buttRect[0].x, butt.buttRect[0].y, null);
g.drawImage(tutorialHoverText[0], 180, 20, null);
break;
}
case 1: {
g.drawImage(passButt[1], butt.buttRect[1].x, butt.buttRect[1].y, null);
g.drawImage(tutorialHoverText[1], 180, 20, null);
break;
}
case 2: {
g.drawImage(shootButt[1], butt.buttRect[2].x, butt.buttRect[2].y, null);
g.drawImage(tutorialHoverText[2], 180, 20, null);

```

```

break;
}
case 3: {
g.drawImage(goalkeepButt[1], butt.buttRect[3].x, butt.buttRect[3].y, null);
g.drawImage(tutorialHoverText[3], 180, 20, null);
break;
}
case 4: {
g.drawImage(menuButt[1], butt.buttRect[4].x, butt.buttRect[4].y, null);
break;
}
default:
break;
}
switch (butt.getbuttRectButton(true)) { // onclick
case 0: {
g.drawImage(dribbleButt[2], butt.buttRect[0].x, butt.buttRect[0].y, null);
break;
}
case 1: {
g.drawImage(passButt[2], butt.buttRect[1].x, butt.buttRect[1].y, null);
break;
}
case 2: {
g.drawImage(shootButt[2], butt.buttRect[2].x, butt.buttRect[2].y, null);
break;
}
case 3: {
g.drawImage(goalkeepButt[2], butt.buttRect[3].x, butt.buttRect[3].y, null);
break;
}
case 4: {
g.drawImage(menuButt[2], butt.buttRect[4].x, butt.buttRect[4].y, null);
break;
}
default:
break;
}
}

public void paintTutorialDribble(Graphics g) {
g.drawImage(fieldImg, 0, 0, null);
seeThrough = (Graphics2D) g;
Paint shadowPaint = new Color(0, 0, 0, 180);
seeThrough.setPaint(shadowPaint);
// g.setColor(Color.GRAY);
seeThrough.fillRect(0, 0, 250, HEIGHT);
if (tutorial.getCurrentScreen() != 1) { // if ai is running
if (tutorial.getCurrentScreen() == 0) {
g.drawImage(keeperImg[44], 459, 130, null);
g.drawImage(labelText[1], 459 - 5, 130 + 30, null);
g.drawImage(defenderImg[28], 670, 377, null);
g.drawImage(labelText[2], 670 - 5, 377 + 30, null);
g.drawImage(striker2Img[12], 800, 377, null);
g.drawImage(labelText[0], 800 - 5, 377 + 30, null);
g.drawImage(dribbleText[0], 0, 0, null);
g.drawImage(symbolButt[1], tutorial.next.x, tutorial.next.y, null);
if (!tutorial.aiRunning) {
if (tutorial.aiPauseDelay < 100) {
if (tutorial.aiPauseDelay > 0)
g.drawImage(arrowsImg[((tutorial.arrowIndex) % 4) + (4 * 3)], 459,
320,
null);
if (tutorial.aiPauseDelay > 10)
g.drawImage(arrowsImg[((tutorial.arrowIndex + 1) % 4) + (4 * 3)], 459,
270, null);
if (tutorial.aiPauseDelay > 20)
g.drawImage(arrowsImg[((tutorial.arrowIndex + 2) % 4) + (4 * 3)], 459,
220, null);
if (tutorial.aiPauseDelay > 30)

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    g.drawImage(symbolsImg[1], 454, 170, null);
if (tutorial.aiPauseDelay > 50)
    g.drawImage(arrowsImg[((tutorial.arrowIndex) % 4)], 490, 377, null);
if (tutorial.aiPauseDelay > 60)
    g.drawImage(arrowsImg[((tutorial.arrowIndex + 1) % 4)], 540, 377,
null);
if (tutorial.aiPauseDelay > 70)
    g.drawImage(arrowsImg[((tutorial.arrowIndex + 2) % 4)], 590, 377,
null);
if (tutorial.aiPauseDelay > 80)
    g.drawImage(symbolsImg[1], 630, 377, null);
} else if (tutorial.aiPauseDelay > 100) {
if (tutorial.aiPauseDelay > 100 + 0)
    g.drawImage(arrowsImg[((tutorial.arrowIndex) % 4) + (4 * 4)], 600,
180,
null);
if (tutorial.aiPauseDelay > 100 + 10)
    g.drawImage(arrowsImg[((tutorial.arrowIndex + 1) % 4) + (4 * 4)],
600 - 33, 180 - 30, null);
if (tutorial.aiPauseDelay > 100 + 20)
    g.drawImage(arrowsImg[((tutorial.arrowIndex + 2) % 4) + (4 * 4)],
600 - 66, 180 - 60, null);
if (tutorial.aiPauseDelay > 100 + 30)
    g.drawImage(arrowsImg[((tutorial.arrowIndex + 3) % 4) + (4 * 4)],
600 - 99, 180 - 90, null);
if (tutorial.aiPauseDelay > 100 + 40)
    g.drawImage(symbolsImg[0], 474, 60, null);
if (tutorial.aiPauseDelay > 100 + 60)
    g.drawImage(arrowsImg[((tutorial.arrowIndex) % 4) + (4 * 7)], 650,
230,
null);
if (tutorial.aiPauseDelay > 100 + 70)
    g.drawImage(arrowsImg[((tutorial.arrowIndex + 1) % 4) + (4 * 7)],
650 + 33, 230 + 30, null);
if (tutorial.aiPauseDelay > 100 + 80)
    g.drawImage(arrowsImg[((tutorial.arrowIndex + 2) % 4) + (4 * 7)],
650 + 66, 230 + 60, null);
if (tutorial.aiPauseDelay > 100 + 90)
    g.drawImage(arrowsImg[((tutorial.arrowIndex + 3) % 4) + (4 * 7)],
650 + 99, 230 + 90, null);
if (tutorial.aiPauseDelay > 100 + 100)
    g.drawImage(symbolsImg[0], 780, 350, null);
}
}
} else if (tutorial.getCurrentScreen() == 4) {
    g.drawImage(dribbleText[1], 0, 0, null);
    g.drawImage(symbolButt[1], tutorial.next.x, tutorial.next.y, null);
    g.drawImage(symbolsImg[2], (int) tutorial.targetPositions[2].getX() - 25,
(int) tutorial.targetPositions[2].getY() - 25, null);
} else if (tutorial.getCurrentScreen() == 2 && !tutorial.isSuccess()) {
    g.drawImage(dribbleText[3], 0, 0, null);
    g.drawImage(symbolButt[4], tutorial.next.x, tutorial.next.y, null);
} else {
    g.drawImage(dribbleText[2], 0, 0, null);
}
g.drawImage(symbolButt[7], tutorial.menu.x, tutorial.menu.y, null);
switch (tutorial.getHovers()) { // hover
case 0: {
if (tutorial.getCurrentScreen() == 0 || tutorial.getCurrentScreen() == 4)
    g.drawImage(symbolButt[0], tutorial.next.x, tutorial.next.y, null);
else if (tutorial.getCurrentScreen() == 2 && !tutorial.isSuccess()) {
    g.drawImage(symbolButt[3], tutorial.next.x, tutorial.next.y, null);
}
} break;
}
case 1: {
    g.drawImage(symbolButt[6], tutorial.menu.x, tutorial.menu.y, null);
} break;
}
default:

```

```

break;
}
} else { // if challenge is running
    g.drawImage(dribbleText[1], 0, 0, null);
    g.setFont(new Font("Dialog", Font.BOLD, 24));
    g.setColor(Color.BLACK);
    g.drawString("Time Left: " + tutorial.gameTime.getTime(), 800, 35);
    g.setColor(new Color(225, 255, 203));
    if (tutorial.gameTime.getTime() <= 5 && tutorial.gameTime.getTime() >
0
    && System.currentTimeMillis() % 5 == 0) {
        g.setColor(new Color(255, 55, 23));
    }
    g.drawString("Time Left: " + tutorial.gameTime.getTime(), 800 - 2, 35 -
2);
    g.drawImage(symbolsImg[2],
(int) tutorial.targetPositions[tutorial.targetIndex].getX() - 25,
(int) tutorial.targetPositions[tutorial.targetIndex].getY() - 25, null);
}
    paintBallCircle(g, tutorial.ball);
    paintPlayerCircle(g, tutorial.tutor);
    g.drawImage(ballImg[tutorial.ball.getFrame()], tutorial.ball.getRect().x,
tutorial.ball.getRect().y, null);
    g.drawImage(strikerImg[tutorial.tutor.getFrame()],
tutorial.tutor.getRect().x, tutorial.tutor.getRect().y, null);
}

public void paintTutorialShoot(Graphics g) {
    g.drawImage(fieldImg, 0, 0, null);
    seeThrough = (Graphics2D) g;
    Paint shadowPaint = new Color(0, 0, 0, 180);
    seeThrough.setPaint(shadowPaint);
    // g.setColor(Color.GRAY);
    seeThrough.fillRect(0, 0, 250, HEIGHT);
    if (tutorial.getCurrentScreen() != 1) { // if ai is running
        if (tutorial.getCurrentScreen() == 0) {
            g.drawImage(shootText[0], 0, 0, null);
            g.drawImage(symbolButt[1], tutorial.next.x, tutorial.next.y, null);
            if (!tutorial.aiRunning) {
                if (tutorial.aiPauseDelay < 50) {
                    if (tutorial.aiPauseDelay > 0)
                        g.drawImage(arrowsImg[((tutorial.arrowIndex) % 4) + (4 * 6)], 367,
217,
null);
                    if (tutorial.aiPauseDelay > 10)
                        g.drawImage(arrowsImg[((tutorial.arrowIndex + 1) % 4) + (4 * 6)],
367 + 35, 217 - 35, null);
                    if (tutorial.aiPauseDelay > 20)
                        g.drawImage(symbolsImg[1], 430, 145, null);
                }
                if (tutorial.aiPauseDelay < 100) {
                    if (tutorial.aiPauseDelay > 50)
                        g.drawImage(arrowsImg[((tutorial.arrowIndex) % 4) + (4 * 4)], 605,
210,
null);
                    if (tutorial.aiPauseDelay > 60)
                        g.drawImage(arrowsImg[((tutorial.arrowIndex + 1) % 4) + (4 * 4)],
605 - 35, 210 - 35, null);
                    if (tutorial.aiPauseDelay > 70)
                        g.drawImage(symbolsImg[1], 605 - 75, 210 - 70, null);
                }
                if (tutorial.aiPauseDelay < 170) {
                    if (tutorial.aiPauseDelay > 100)
                        g.drawImage(arrowsImg[((tutorial.arrowIndex) % 4) + (4 * 8)], 460,
260,
null);
                    if (tutorial.aiPauseDelay > 110)
                        g.drawImage(arrowsImg[((tutorial.arrowIndex + 1) % 4) + (4 * 8)],
460 - 20, 260 - 50, null);
                    if (tutorial.aiPauseDelay > 120)

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    g.drawImage(arrowsImg[((tutorial.arrowIndex + 2) % 4) + (4 * 8)],
        460 - 40, 260 - 100, null);
if (tutorial.aiPauseDelay > 130)
    g.drawImage(arrowsImg[((tutorial.arrowIndex + 3) % 4) + (4 * 8)],
        460 - 60, 260 - 150, null);
if (tutorial.aiPauseDelay > 140)
    g.drawImage(symbolsImg[0], 460 - 73, 270 - 210, null);
}
}
else if (tutorial.getCurrentScreen() == 4) {
    g.drawImage(shootText[1], 0, 0, null);
    g.drawImage(symbolButt[1], tutorial.next.x, tutorial.next.y, null);
} else if (tutorial.getCurrentScreen() == 2 && !tutorial.isSuccess()) {
    g.drawImage(shootText[3], 0, 0, null);
    g.drawImage(symbolButt[4], tutorial.next.x, tutorial.next.y, null);
} else {
    g.drawImage(shootText[2], 0, 0, null);
}
g.drawImage(symbolButt[7], tutorial.menu.x, tutorial.menu.y, null);
switch (tutorial.getHovers()) { // hover
case 0: {
    if (tutorial.getCurrentScreen() == 0 || tutorial.getCurrentScreen() == 4) {
        g.drawImage(symbolButt[0], tutorial.next.x, tutorial.next.y, null);
    } else if (tutorial.getCurrentScreen() == 2 && !tutorial.isSuccess()) {
        g.drawImage(symbolButt[3], tutorial.next.x, tutorial.next.y, null);
    }
    break;
}
case 1: {
    g.drawImage(symbolButt[6], tutorial.menu.x, tutorial.menu.y, null);
    break;
}
default:
    break;
}
} else { // if challenge is running
    g.drawImage(shootText[1], 0, 0, null);
    g.setFont(new Font("Dialog", Font.BOLD, 24));
    g.setColor(Color.BLACK);
    g.drawString("Time Left: " + tutorial.gameTime.getTime(), 800, 35);
    g.setColor(new Color(225, 255, 203));
    if (tutorial.gameTime.getTime() <= 5 && tutorial.gameTime.getTime() >
0
        && System.currentTimeMillis() % 5 == 0) {
        g.setColor(new Color(255, 55, 23));
    }
    g.drawString("Time Left: " + tutorial.gameTime.getTime(), 800 - 2, 35 -
2);
}
g.drawImage(labelText[1], tutorial.keeper.getRect().x - 5,
    tutorial.keeper.getRect().y + 30, null);
paintPlayerCircle(g, tutorial.tutor);
paintBallCircle(g, tutorial.ball);
g.drawImage(strikerImg[tutorial.tutor.getFrame()],
    tutorial.tutor.getRect().x, tutorial.tutor.getRect().y, null);
g.drawImage(keeperImg[tutorial.keeper.getFrame()],
    tutorial.keeper.getRect().x, tutorial.keeper.getRect().y, null);
g.drawImage(ballImg[tutorial.ball.getFrame()], tutorial.ball.getRect().x,
    tutorial.ball.getRect().y, null);
}

public void paintTutorialGoalkeep(Graphics g) {
    g.drawImage(fieldImg, 0, 0, null);
    seeThrough = (Graphics2D) g;
    Paint shadowPaint = new Color(0, 0, 180);
    seeThrough.setPaint(shadowPaint);
    // g.setColor(Color.GRAY);
    seeThrough.fillRect(0, 0, 250, HEIGHT);
    if (tutorial.getCurrentScreen() != 1) { // if ai is running
    if (tutorial.getCurrentScreen() == 0) {
        g.drawImage(goalkeepText[0], 0, 0, null);
        g.drawImage(symbolButt[1], tutorial.next.x, tutorial.next.y, null);
        if (!tutorial.aiRunning) {
            if (tutorial.aiPauseDelay < 80) {
                if (tutorial.aiPauseDelay > 0) {
                    g.drawImage(arrowsImg[((tutorial.arrowIndex) % 4) + (4 * 3)], 375,
470,
                        null);
                    g.drawImage(keeperArrowsImg[((tutorial.arrowIndex + 3) % 4) + 4],
439,
                        75, null);
                }
                if (tutorial.aiPauseDelay > 10) {
                    g.drawImage(arrowsImg[((tutorial.arrowIndex + 1) % 4) + (4 * 3)], 375,
470 - 80, null);
                    g.drawImage(keeperArrowsImg[((tutorial.arrowIndex + 2) % 4) + 4],
439 - 20, 75, null);
                }
                if (tutorial.aiPauseDelay > 20) {
                    switch (tutorial.getHovers()) { // hover
                    case 0: {
                        g.drawImage(arrowsImg[((tutorial.arrowIndex + 2) % 4) + (4 * 3)], 375,
470 - 160, null);
                        g.drawImage(keeperArrowsImg[((tutorial.arrowIndex + 1) % 4) + 4],
439 - 40, 75, null);
                    }
                    if (tutorial.aiPauseDelay > 30) {
                        g.drawImage(arrowsImg[((tutorial.arrowIndex + 3) % 4) + (4 * 3)], 375,
470 - 240, null);
                        g.drawImage(keeperArrowsImg[((tutorial.arrowIndex + 0) % 4) + 4],
439 - 60, 75, null);
                    }
                    if (tutorial.aiPauseDelay > 40)
                        g.drawImage(arrowsImg[((tutorial.arrowIndex + 0) % 4) + (4 * 3)], 375,
470 - 320, null);
                    if (tutorial.aiPauseDelay > 50)
                        g.drawImage(arrowsImg[((tutorial.arrowIndex + 1) % 4) + (4 * 3)], 375,
470 - 400, null);
                    if (tutorial.aiPauseDelay > 60)
                        g.drawImage(symbolsImg[0], 375, 50, null);
                }
                if (tutorial.aiPauseDelay < 130) {
                    if (tutorial.aiPauseDelay > 80) {
                        g.drawImage(arrowsImg[((tutorial.arrowIndex) % 4) + (4 * 4)], 580,
157,
                            null);
                        g.drawImage(keeperArrowsImg[((tutorial.arrowIndex + 3) % 4)], 499,
75,
                            null);
                    }
                    if (tutorial.aiPauseDelay > 90)
                        g.drawImage(arrowsImg[((tutorial.arrowIndex + 2) % 4) + (4 * 4)],
580 - 40, 157 - 40, null);
                    if (tutorial.aiPauseDelay > 100)
                        g.drawImage(arrowsImg[((tutorial.arrowIndex + 2) % 4) + (4 * 4)],
580 - 80, 157 - 80, null);
                    if (tutorial.aiPauseDelay > 110)
                        g.drawImage(symbolsImg[0], 580 - 90, 157 - 110, null);
                }
                if (tutorial.aiPauseDelay < 180) {
                    if (tutorial.aiPauseDelay > 130) {
                        g.drawImage(arrowsImg[((tutorial.arrowIndex) % 4) + (4 * 9)], 465,
210,
                            null);
                        g.drawImage(keeperArrowsImg[((tutorial.arrowIndex + 3) % 4)], 489,
75,
                            null);
                    }
                    if (tutorial.aiPauseDelay > 140) {
                        g.drawImage(arrowsImg[((tutorial.arrowIndex + 1) % 4) + (4 * 9)],
465 + 25, 210 - 70, null);
                    }
                }
            }
        }
    }
}

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    g.drawImage(keeperArrowsImg[((tutorial.arrowIndex + 3) % 4)], 489 +
20,
    75, null);
}
if (tutorial.aiPauseDelay > 150)
g.drawImage(arrowsImg[((tutorial.arrowIndex + 2) % 4) + (4 * 9)],
465 + 50, 210 - 140, null);
if (tutorial.aiPauseDelay > 160)
g.drawImage(symbolsImg[1], 465 + 60, 210 - 180, null);
}
} else if (tutorial.getCurrentScreen() == 4) {
g.drawImage(goalkeepText[1], 0, 0, null);
g.drawImage(symbolButt[1], tutorial.next.x, tutorial.next.y, null);
} else if (tutorial.getCurrentScreen() == 2 && !tutorial.isSuccess()) {
g.drawImage(goalkeepText[3], 0, 0, null);
g.drawImage(symbolButt[4], tutorial.next.x, tutorial.next.y, null);
} else {
g.drawImage(goalkeepText[2], 0, 0, null);
}
g.drawImage(symbolButt[7], tutorial.menu.x, tutorial.menu.y, null);
switch (tutorial.getHovers()) { // hover
case 0: {
if (tutorial.getCurrentScreen() == 0)
g.drawImage(symbolButt[0], tutorial.next.x, tutorial.next.y, null);
else if (tutorial.getCurrentScreen() == 2 && !tutorial.isSuccess()) {
g.drawImage(symbolButt[3], tutorial.next.x, tutorial.next.y, null);
}
break;
}
case 1: {
g.drawImage(symbolButt[6], tutorial.menu.x, tutorial.menu.y, null);
break;
}
default:
break;
}
} else { // if challenge is running
g.drawImage(goalkeepText[1], 0, 0, null);
g.setFont(new Font("Dialog", Font.BOLD, 24));
g.setColor(Color.BLACK);
g.drawString("Time Left: " + tutorial.gameTime.getTime(), 800, 35);
g.setColor(new Color(225, 255, 203));
if (tutorial.gameTime.getTime() <= 5 && tutorial.gameTime.getTime() >
0
&& System.currentTimeMillis() % 5 == 0) {
g.setColor(new Color(255, 55, 23));
}
g.drawString("Time Left: " + tutorial.gameTime.getTime(), 800 - 2, 35 -
2);
}
paintPlayerCircle(g, tutorial.tutor2);
paintBallCircle(g, tutorial.ball);
g.drawImage(ballImg[tutorial.ball.getFrame()], tutorial.ball.getRect().x,
tutorial.ball.getRect().y, null);
g.drawImage(strikerImg[tutorial.tutor.getFrame()],
tutorial.tutor.getRect().x, tutorial.tutor.getRect().y, null);
g.drawImage(labelText[0], tutorial.tutor.getRect().x - 5,
tutorial.tutor.getRect().y + 30, null);
g.drawImage(keeperImg[tutorial.tutor2.getFrame()],
tutorial.tutor2.getRect().x, tutorial.tutor2.getRect().y, null);
}

public void paintTutorialPass(Graphics g) {
g.drawImage(fieldImg, 0, 0, null);
seeThrough = (Graphics2D) g;
Paint shadowPaint = new Color(0, 0, 0, 180);
seeThrough.setPaint(shadowPaint);
// g.setColor(Color.GRAY);
seeThrough.fillRect(0, 0, 250, HEIGHT);

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if (tutorial.getCurrentScreen() != 1) { // if ai is running
if (tutorial.getCurrentScreen() == 0) {
g.drawImage(keeperImg[44], 459, 130, null);
g.drawImage(labelText[1], 459 - 5, 130 + 30, null);
if (tutorial.aiPauseDelay > 0)
g.drawImage(arrowsImg[((tutorial.arrowIndex) % 4) + (4 * 4)], 630, 140,
null);
if (tutorial.aiPauseDelay > +10)
g.drawImage(arrowsImg[((tutorial.arrowIndex + 1) % 4) + (4 * 4)],
630 - 33, 140 - 30, null);
if (tutorial.aiPauseDelay > +20)
g.drawImage(arrowsImg[((tutorial.arrowIndex + 2) % 4) + (4 * 4)],
630 - 66, 140 - 60, null);
if (tutorial.aiPauseDelay > +30)
g.drawImage(arrowsImg[((tutorial.arrowIndex + 3) % 4) + (4 * 4)],
630 - 99, 140 - 90, null);
if (tutorial.aiPauseDelay > +40)
g.drawImage(symbolsImg[0], 494, 20, null);
g.drawImage(passText[0], 0, 0, null);
g.drawImage(symbolButt[1], tutorial.next.x, tutorial.next.y, null);
} else if (tutorial.getCurrentScreen() == 4) {
g.drawImage(passText[1], 0, 0, null);
g.drawImage(symbolButt[1], tutorial.next.x, tutorial.next.y, null);
} else if (tutorial.getCurrentScreen() == 2 && !tutorial.isSuccess()) {
g.drawImage(passText[3], 0, 0, null);
g.drawImage(symbolButt[4], tutorial.next.x, tutorial.next.y, null);
} else {
g.drawImage(passText[2], 0, 0, null);
}
g.drawImage(symbolButt[7], tutorial.menu.x, tutorial.menu.y, null);
switch (tutorial.getHovers()) { // hover
case 0: {
if (tutorial.getCurrentScreen() == 0 || tutorial.getCurrentScreen() == 4)
g.drawImage(symbolButt[0], tutorial.next.x, tutorial.next.y, null);
else if (tutorial.getCurrentScreen() == 2 && !tutorial.isSuccess()) {
g.drawImage(symbolButt[3], tutorial.next.x, tutorial.next.y, null);
}
break;
}
case 1: {
g.drawImage(symbolButt[6], tutorial.menu.x, tutorial.menu.y, null);
break;
}
default:
break;
}
} else { // if challenge is running
g.drawImage(passText[1], 0, 0, null);
g.setFont(new Font("Dialog", Font.BOLD, 24));
g.setColor(Color.BLACK);
g.drawString("Time Left: " + tutorial.gameTime.getTime(), 800, 35);
g.setColor(new Color(225, 255, 203));
if (tutorial.gameTime.getTime() <= 5 && tutorial.gameTime.getTime() >
0
&& System.currentTimeMillis() % 5 == 0) {
g.setColor(new Color(255, 55, 23));
}
g.drawString("Time Left: " + tutorial.gameTime.getTime(), 800 - 2, 35 -
2);
}
g.drawImage(labelText[0], tutorial.teamMate.getRect().x - 5,
tutorial.teamMate.getRect().y + 30, null);
g.drawImage(labelText[2], tutorial.defender.getRect().x - 6,
tutorial.defender.getRect().y + 30, null);
paintBallCircle(g, tutorial.ball);
paintPlayerCircle(g, tutorial.tutor);
g.drawImage(ballImg[tutorial.ball.getFrame()], tutorial.ball.getRect().x,
tutorial.ball.getRect().y, null);
g.drawImage(strikerImg[tutorial.tutor.getFrame()],
tutorial.tutor.getRect().x, tutorial.tutor.getRect().y, null);

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g.drawImage(striker2Img[tutorial.teamMate.getFrame()],
tutorial.teamMate.getRect().x, tutorial.teamMate.getRect().y, null);
g.drawImage(defenderImg[tutorial.defender.getFrame()],
tutorial.defender.getRect().x, tutorial.defender.getRect().y, null);
}

public void paintHighScores(Graphics g) {
g.drawImage(titleImg, 0, 0, null);
paintMist(g);
g.drawImage(subMenuImg[3], 180, 20, null);
g.setColor(Color.WHITE);
g.setFont(new Font("Serif", Font.BOLD, 24));
g.drawString("" + highScores[0], 450, 130);
g.drawString("" + highScores[1], 450, 160);
g.drawString("" + highScores[2], 450, 190);
g.drawString("" + highScores[3], 450, 220);
g.drawString("" + highScores[4], 450, 250);
g.drawImage(resetButt[0], butt.butRect[3].x, butt.butRect[3].y, null);
g.drawImage(menuButt[0], butt.butRect[4].x, butt.butRect[4].y, null);
switch (butt.getButtRectButton(false)) { // hover
case 3: {
g.drawImage(resetButt[1], butt.butRect[3].x, butt.butRect[3].y, null);
break;
}
case 4: {
g.drawImage(menuButt[1], butt.butRect[4].x, butt.butRect[4].y, null);
break;
}
default:
break;
}
switch (butt.getButtRectButton(true)) { // onclick
case 3: {
g.drawImage(resetButt[2], butt.butRect[3].x, butt.butRect[3].y, null);
break;
}
case 4: {
g.drawImage(menuButt[2], butt.butRect[4].x, butt.butRect[4].y, null);
break;
}
default:
break;
}
}

public void paintAfter(Graphics g) {
g.drawImage(symbolButt[4], butt.butBack[0].x, butt.butBack[0].y, null);
g.drawImage(symbolButt[7], butt.butBack[1].x, butt.butBack[1].y, null);
switch (butt.getBackButton(false)) { // hover
case 0: {
g.drawImage(symbolButt[3], butt.butBack[0].x, butt.butBack[0].y, null);
break;
}
case 1: {
g.drawImage(symbolButt[6], butt.butBack[1].x, butt.butBack[1].y, null);
break;
}
default:
break;
}
switch (butt.getBackButton(true)) { // onclick
case 0: {
g.drawImage(symbolButt[5], butt.butBack[0].x, butt.butBack[0].y, null);
break;
}
case 1: {
g.drawImage(symbolButt[8], butt.butBack[1].x, butt.butBack[1].y, null);
break;
}
default:

```

```

break;
}
}

public void paintNextLevel(Graphics g) {
if (currentLevel != 5)
g.drawImage(symbolButt[1], butt.butBack[0].x, butt.butBack[0].y, null);
g.drawImage(symbolButt[7], butt.butBack[1].x, butt.butBack[1].y, null);
switch (butt.getBackButton(false)) { // hover
case 0: {
if (currentLevel != 5)
g.drawImage(symbolButt[0], butt.butBack[0].x, butt.butBack[0].y, null);
break;
}
case 1: {
g.drawImage(symbolButt[6], butt.butBack[1].x, butt.butBack[1].y, null);
break;
}
default:
break;
}
switch (butt.getBackButton(true)) { // onclick
case 0: {
if (currentLevel != 5)
g.drawImage(symbolButt[2], butt.butBack[0].x, butt.butBack[0].y, null);
break;
}
case 1: {
g.drawImage(symbolButt[8], butt.butBack[1].x, butt.butBack[1].y, null);
break;
}
default:
break;
}
}

public void paintLevelScores(Graphics g) {
graphicsDelay++;
seeThrough = (Graphics2D) g;
Paint shadowPaint = new Color(0, 0, 0, 180);
seeThrough.setPaint(shadowPaint);
// g.setColor(Color.GRAY);
seeThrough.fillRect(160, 0, 630, HEIGHT);
// g.setColor(Color.BLACK);
// g.drawRect(160,100, 630, HEIGHT );
g.setColor(Color.WHITE);
g.setFont(new Font("Serif", Font.BOLD, 64));
g.drawString("LEVEL CLEARED!", 200, 100);
g.setFont(new Font("Dialog", Font.BOLD, 22));
if (graphicsDelay >= 15) {
g.drawString("Level Bonus:", 200, 200);
g.drawString("" + currentScores[1], 680, 200);
}
if (graphicsDelay >= 30) {
g.drawString("Time Bonus:", 200, 230);
g.drawString("" + currentScores[2], 680, 230);
}
if (graphicsDelay >= 45) {
g.drawString("Extra Bonus:", 200, 260);
g.drawString("" + currentScores[3], 680, 260);
}
if (graphicsDelay >= 60) {
g.drawString("Current Score:", 200, 320);
g.drawString("" + currentScores[0], 680, 320);
if (graphicsDelay >= 75) {
if (currentScores[0] + 20 < currentScores[4])
currentScores[0] += 19;
else
currentScores[0] = currentScores[4];
}
}

```

```

}
}

public void paintGameOver(Graphics g) {
    graphicsDelay++;
    seeThrough = (Graphics2D) g;
    Paint shadowPaint = new Color(0, 0, 0, 180);
    seeThrough.setPaint(shadowPaint);
    // g.setColor(Color.GRAY);
    seeThrough.fillRect(160, 0, 630, HEIGHT);
    g.setColor(Color.WHITE);
    g.setFont(new Font("Serif", Font.BOLD, 64));
    g.drawString("GAME OVER", 280, 100);
    g.setFont(new Font("Dialog", Font.BOLD, 30));
    g.drawString("Your Score:", 350, 250);
    g.drawString("" + currentScores[0], 550, 250);
    g.drawImage(symbolBut[4], butt.back[0].x, butt.back[0].y, null);
    g.drawImage(symbolBut[7], butt.back[1].x, butt.back[1].y, null);
    switch (butt.getBackButton(false)) { // hover
    case 0: {
        g.drawImage(symbolBut[3], butt.back[0].x, butt.back[0].y, null);
        break;
    }
    case 1: {
        g.drawImage(symbolBut[6], butt.back[1].x, butt.back[1].y, null);
        break;
    }
    default:
        break;
    }
    switch (butt.getBackButton(true)) { // onclick
    case 0: {
        g.drawImage(symbolBut[5], butt.back[0].x, butt.back[0].y, null);
        break;
    }
    case 1: {
        g.drawImage(symbolBut[8], butt.back[1].x, butt.back[1].y, null);
        break;
    }
    default:
        break;
    }
}

public void paintCurrentLevelAndScore(Graphics g) {
    g.setFont(new Font("Serif", Font.BOLD, 24));
    g.setColor(Color.BLACK);
    g.drawString("Level " + currentLevel, 10, 30);
    g.setColor(new Color(55, 255, 223));
    g.drawString("Level " + currentLevel, 10 - 2, 30 - 2);
    g.setFont(new Font("Serif", Font.BOLD, 24));
    g.setColor(Color.BLACK);
    g.drawString("Score: " + currentScores[0], 10, 55);
    g.setColor(new Color(155, 255, 223));
    g.drawString("Score: " + currentScores[0], 10 - 2, 55 - 2);
}

public void paint1on1(Graphics g) {
    g.drawImage(fieldImg, 0, 0, null);
    // Time
    if (game2.gameTime.getTime() <= Constants.GAME_TIME) {
        g.setFont(new Font("Dialog", Font.BOLD, 24));
        g.setColor(Color.BLACK);
        g.drawString("Time Left: " + game2.gameTime.getTime(), 800, 35);
        g.setColor(new Color(225, 255, 203));
        if (game2.gameTime.getTime() <= 5 && game2.gameTime.getTime() > 0
            && System.currentTimeMillis() % 5 == 0) {
            g.setColor(new Color(255, 55, 23));
        }
        g.drawString("Time Left: " + game2.gameTime.getTime(), 800 - 2, 35 - 2);
    }
}

```

```

if (!game2.striker.isControlled() && !game2.keeper.isControlled()) {
    paintSimulation(g);
} else {
    if (game2.keeper.isControlled()) {
        paintPlayerCircle(g, game2.keeper);
    } else if (game2.striker.isControlled()) {
        paintPlayerCircle(g, game2.striker);
    }
}
}

paintBallCircle(g, game2.ball);
g.drawImage(keeperImg[game2.keeper.getFrame()],
game2.keeper.getRect().x,
    game2.keeper.getRect().y, null);
g.drawImage(ballImg[game2.ball.getFrame()], game2.ball.getRect().x,
    game2.ball.getRect().y, null);
g.drawImage(strikerImg[game2.striker.getFrame()],
game2.striker.getRect().x,
    game2.striker.getRect().y, null);
if (game2.isFinished()) {
    if (game2.goal.isGoal()) {
        paintGoalString(offGraphics);
    } else {
        Paint shadowPaint = new Color(110, 30, 120, 170); // Translucent black
        Graphics2D g1 = (Graphics2D) g;
        g1.setPaint(shadowPaint);
        g1.setFont(new Font("Dialog", Font.BOLD, 120));
        if (game2.gameTime.getTime() == 0) {
            g1.drawString("Time's Up!", translateOffset, 550);
        } else if (game2.ball.checkIfOutOfBounds()) {
            g1.drawString("Out of Play!", translateOffset, 550);
        } else if (game2.keeper.isHasBall()) {
            g1.drawString("Ball Caught!", translateOffset, 550);
        }
    }
}
if (translateOffset > -1200)
    translateOffset -= 25;
}
}

public void paint2on1(Graphics g) {
    g.drawImage(fieldImg, 0, 0, null);
    // Time
    if (game2.gameTime.getTime() <= Constants.GAME_TIME) {
        g.setFont(new Font("Dialog", Font.BOLD, 24));
        g.setColor(Color.BLACK);
        g.drawString("Time Left: " + game2.gameTime.getTime(), 800, 35);
        g.setColor(new Color(225, 255, 203));
        if (game2.gameTime.getTime() <= 5 && game2.gameTime.getTime() > 0
            && System.currentTimeMillis() % 5 == 0) {
            g.setColor(new Color(255, 55, 23));
        }
        g.drawString("Time Left: " + game2.gameTime.getTime(), 800 - 2, 35 - 2);
    }
    if (!game2.striker.isControlled() && !game2.keeper.isControlled()) {
        paintSimulation(g);
    } else {
        if (game2.keeper.isControlled()) {
            paintPlayerCircle(g, game2.keeper);
        } else if (game2.striker.isControlled()) {
            paintPlayerCircle(g, game2.striker);
        }
    }
}
// Mobile Objects
paintBallCircle(g, game2.ball);
g.drawImage(keeperImg[game2.keeper.getFrame()],
game2.keeper.getRect().x,
    game2.keeper.getRect().y, null);
g.drawImage(ballImg[game2.ball.getFrame()], game2.ball.getRect().x,

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    game2.ball.getRect().y, null);
g.drawImage(striker2Img[game2.teamMate.getFrame()],
    game2.teamMate.getRect().x, game2.teamMate.getRect().y, null);
g.drawImage(striker1Img[game2.striker.getFrame()],
    game2.striker.getRect().x,
    game2.striker.getRect().y, null);
if (game2.isFinished()) {
    if (game2.goal.isGoal()) {
        paintGoalString(offGraphics);
    } else {
        Paint shadowPaint = new Color(110, 30, 120, 170); // Translucent black
        Graphics2D g1 = (Graphics2D) g;
        g1.setPaint(shadowPaint);
        g1.setFont(new Font("Dialog", Font.BOLD, 120));
        if (game2.gameTime.getTime() == 0) {
            g1.drawString("Time's Up!", translateOffset, 550);
        } else if (game2.ball.checkIfOutOfBounds()) {
            g1.drawString("Out of Play!", translateOffset, 550);
        } else if (game2.keeper.isHasBall()) {
            g1.drawString("Ball Caught!", translateOffset, 550);
        }
    }
    if (translateOffset > -1200)
        translateOffset -= 25;
}

public void paint2on2(Graphics g) {
    g.drawImage(fieldImg, 0, 0, null);
    // Time
    if (game3.gameTime.getTime() <= Constants.GAME_TIME) {
        g.setFont(new Font("Dialog", Font.BOLD, 24));
        g.setColor(Color.BLACK);
        g.drawString("Time Left: " + game3.gameTime.getTime(), 800, 35);
        g.setColor(new Color(225, 255, 203));
        if (game3.gameTime.getTime() <= 5 && game3.gameTime.getTime() > 0
            && System.currentTimeMillis() % 5 == 0) {
            g.setColor(new Color(255, 55, 23));
        }
        g.drawString("Time Left: " + game3.gameTime.getTime(), 800 - 2, 35 -
2);
        if (!game3.striker.isControlled() && !game3.keeper.isControlled()) {
            paintSimulation(g);
        } else {
            if (game3.keeper.isControlled()) {
                paintPlayerCircle(g, game3.keeper);
            } else if (game3.striker.isControlled()) {
                paintPlayerCircle(g, game3.striker);
            }
        }
    }
    // Mobile Objects
    paintBallCircle(g, game3.ball);
    g.drawImage(keeperImg[game3.keeper.getFrame()],
        game3.keeper.getRect().x,
        game3.keeper.getRect().y, null);
    g.drawImage(ballImg[game3.ball.getFrame()], game3.ball.getRect().x,
        game3.ball.getRect().y, null);
    g.drawImage(striker2Img[game3.teamMate.getFrame()],
        game3.teamMate.getRect().x, game3.teamMate.getRect().y, null);
    g.drawImage(defenderImg[game3.defender.getFrame()],
        game3.defender.getRect().x, game3.defender.getRect().y, null);
    g.drawImage(striker1Img[game3.striker.getFrame()],
        game3.striker.getRect().x,
        game3.striker.getRect().y, null);
    if (game3.isFinished()) {
        g.drawImage(ballImg[game3.ball.getFrame()], game3.ball.getRect().x,
            game3.ball.getRect().y, null);
        if (game3.goal.isGoal()) {
            paintGoalString(offGraphics);

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        } else {
            Paint shadowPaint = new Color(110, 30, 120, 170); // Translucent black
            Graphics2D g1 = (Graphics2D) g;
            g1.setPaint(shadowPaint);
            g1.setFont(new Font("Dialog", Font.BOLD, 120));
            if (game3.gameTime.getTime() == 0) {
                g1.drawString("Time's Up!", translateOffset, 550);
            } else if (game3.ball.checkIfOutOfBounds()) {
                g1.drawString("Out of Play!", translateOffset, 550);
            } else if (game3.keeper.isHasBall()) {
                g1.drawString("Ball Caught!", translateOffset, 550);
            }
        }
        if (translateOffset > -1200)
            translateOffset -= 25;
    }
}

public void paintBallCircle(Graphics g, final Ball b) {
    if (ballIndex > 3)
        ballIndex = 0;
    g.drawImage(ballCircleImg[ballIndex], b.getRect().x - 4, b.getRect().y - 4,
        null);
    ballDelay++;
    int maxDelay;
    if (b.getSpeed() < 4)
        maxDelay = 3;
    else if (b.getSpeed() >= 4 && b.getSpeed() < 8)
        maxDelay = 2;
    else
        maxDelay = 1;
    if (ballDelay > maxDelay) {
        ballDelay = 0;
        ballIndex++;
    }
}

public void paintPlayerCircle(Graphics g, final Player p) {
    if (circleIndex < 0)
        circleIndex = 3;
    g.drawImage(charCircleImg[circleIndex], p.getRect().x + 8,
        p.getRect().y + 20, null);
    circleDelay++;
    if (circleDelay > 3) {
        circleDelay = 0;
        circleIndex--;
    }
}

public void paintSimulation(Graphics g) {
    switch (currentScreen) {
        case 10: {
            Graphics2D g1 = (Graphics2D) g;
            Paint shadowPaint = new Color(0, 0, 0, 180);
            g1.setPaint(shadowPaint);
            g1.fillRect(0, 565, WIDTH, 25);
            g.setFont(new Font("Serif", Font.ITALIC, 16));
            g.setColor(Color.WHITE);
            g.drawString(simulationStr, simStrOffset, 582);
            g.drawImage(labelText[0], game.striker.getRect().x - 5,
                game.striker.getRect().y + 30, null);
            g.drawImage(labelText[1], game.keeper.getRect().x - 5,
                game.keeper.getRect().y + 30, null);
            break;
        }
        case 11: {
            Graphics2D g1 = (Graphics2D) g;
            Paint shadowPaint = new Color(0, 0, 0, 180);
            g1.setPaint(shadowPaint);
            g1.fillRect(0, 565, WIDTH, 25);

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g.setFont(new Font("Serif", Font.ITALIC, 16));
g.setColor(Color.WHITE);
g.drawString(simulationStr, simStrOffset, 582);
g.drawImage(labelText[0], game2.striker.getRect().x - 5,
    game2.striker.getRect().y + 30, null);
g.drawImage(labelText[1], game2.keeper.getRect().x - 5,
    game2.keeper.getRect().y + 30, null);
g.drawImage(labelText[0], game2.teamMate.getRect().x - 5,
    game2.teamMate.getRect().y + 30, null);
break;
}
case 12: {
Graphics2D g1 = (Graphics2D) g;
Paint shadowPaint = new Color(0, 0, 0, 180);
g1.setPaint(shadowPaint);
g1.fillRect(0, 565, WIDTH, 25);
g.setFont(new Font("Serif", Font.ITALIC, 16));
g.setColor(Color.WHITE);
g.drawString(simulationStr, simStrOffset, 582);
g.drawImage(labelText[0], game3.striker.getRect().x - 5,
    game3.striker.getRect().y + 30, null);
g.drawImage(labelText[1], game3.keeper.getRect().x - 5,
    game3.keeper.getRect().y + 30, null);
g.drawImage(labelText[0], game3.teamMate.getRect().x - 5,
    game3.teamMate.getRect().y + 30, null);
g.drawImage(labelText[2], game3.defender.getRect().x - 6,
    game3.defender.getRect().y + 30, null);
break;
}
default:
break;
}
}

public void startGame(int gameType) {
removeMouseListener(this);
removeMouseMotionListener(this);
game = new Soccer(gameType);
addMouseMotionListener(game);
addMouseListener(game);
game.start();
gameRunning = true;
translateOffset = 900;
if (gameType == 0) {
Random r = new Random();
int i = r.nextInt(4);
switch (i) {
case 0: {
simulationStr = "Even when a striker successfully penetrated the defenses
of the opposing team, "
+ "there's still someone waiting for him at the goal - the goalkeeper.";
simStrOffset = 15;
break;
}
case 1: {
simulationStr = "A 'breakaway' is when a striker with the ball approaches
the goal undefended; "
+ "this exciting play pits a sole striker against the goalkeeper in a 1-on-
1.";
simStrOffset = 3;
break;
}
case 2: {
simulationStr = "5% of all goals are 1-on-1 against the goalkeeper. "
+ "Get the ball into the penalty area ASAP to give yourself the best
chance of hitting the target.";
simStrOffset = 15;
break;
}
case 3: {

```

```

simulationStr = "The goalkeeper comes out of the goal several feet to
make "
+ "himself closer and larger to an attacker, leaving the attacker less net to
shoot at.";
simStrOffset = 25;
}
}
}
}

public void startGame2(int gameType) {
removeMouseListener(this);
removeMouseMotionListener(this);
game2 = new Soccer2(gameType);
addMouseMotionListener(game2);
addMouseListener(game2);
game2.start();
gameRunning = true;
translateOffset = 900;
if (gameType == 0) {
Random r = new Random();
int i = r.nextInt(3);
switch (i) {
case 0: {
simulationStr = "Numbers up' occurs when you have more players than "
+ "the opponent in the attacking or defensive third. You want to be in
this in any ends of the field";
simStrOffset = 0;
break;
}
case 1: {
simulationStr = "Two players against a goalkeeper results to a score
ALOT. "
+ "It is the defenders' fault and probably the most infuriating part of
playing keeper.";
simStrOffset = 25;
break;
}
case 2: {
simulationStr = "In some cases defense doesn't work as expected. How
improbable "
+ "it may seem it is possible that the opponents are just too fast: a 2-on-1
scenario. ";
simStrOffset = 10;
break;
}
}
}
}

public void startGame3(int gameType) {
removeMouseListener(this);
removeMouseMotionListener(this);
game3 = new Soccer3(gameType);
addMouseMotionListener(game3);
addMouseListener(game3);
game3.start();
gameRunning = true;
translateOffset = 900;
if (gameType == 0) {
Random r = new Random();
int i = r.nextInt(3);
switch (i) {
case 0: {
simulationStr = "Once the ball is in the attacking third of the field, "
+ "the attackers must try to keep it there by making it as hard as possible
for the defender to clear it.";
simStrOffset = 1;
break;
}
}
}
}
}

```

```

case 1: {
simulationStr = "A very common yet tricky scenario. The strikers"
+ " should be very wary against the remaining defender. "
+ "A sound goal attempt should be executed ASAP!";
simStrOffset = 0;
break;
}
case 2: {
simulationStr = "In these kind of situations when there is only one
defender left, he must"
+ " coordinate well with the goalkeeper to successfully guard the two
attackers.";
simStrOffset = 10;
break;
}
}
}

public void switchListeners(MouseMotionListener m, boolean fromThis) {
if (fromThis) { // if from the applet
removeMouseListener(this);
removeMouseMotionListener(this);
addMouseListener((MouseListener) m);
addMouseMotionListener(m);
} else { // if from the external listeners
removeMouseListener((MouseListener) m);
removeMouseMotionListener(m);
addMouseListener(this);
addMouseMotionListener(this);
}
}
}

```

```

public void finishGame() {
switch (currentScreen) {
case 10: {
removeMouseListener(game);
removeMouseMotionListener(game);
break;
}
case 11: {
removeMouseListener(game2);
removeMouseMotionListener(game2);
break;
}
case 12: {
removeMouseListener(game3);
removeMouseMotionListener(game3);
break;
}
default: {
break;
}
}
gameRunning = false;
opacity = 0.1f;
addMouseMotionListener(this);
addMouseListener(this);
}
}

```

```

public void finishLevel() {
switch (currentLevel) {
case 1: {
removeMouseListener(game);
removeMouseMotionListener(game);
break;
}
case 2: {
removeMouseListener(game);
removeMouseMotionListener(game);
}
}
}

```

```

break;
}
case 3: {
removeMouseListener(game3);
removeMouseMotionListener(game3);
break;
}
case 4: {
removeMouseListener(game3);
removeMouseMotionListener(game3);
break;
}
case 5: {
removeMouseListener(game2);
removeMouseMotionListener(game2);
break;
}
default: {
break;
}
}
gameRunning = false;
opacity = 0.1f;
addMouseMotionListener(this);
addMouseListener(this);
updateCurrentScores();
adjustHighScores(currentScores[4]);
}
}

```

```

public void updateCurrentScores() {
switch (currentLevel) { // time bonus
case 1: {
currentScores[2] = game.gameTime.getTime() * 50;
break;
}
case 2: {
currentScores[2] = game.gameTime.getTime() * 50;
break;
}
case 3: {
currentScores[2] = game3.gameTime.getTime() * 50;
break;
}
case 4: {
currentScores[2] = game3.gameTime.getTime() * 50;
break;
}
case 5: {
currentScores[2] = game2.gameTime.getTime() * 50;
break;
}
default:
break;
}
currentScores[1] = currentLevel * 200; // level bonus
Random r = new Random();
double min = currentLevel * 20;
double max = (1000 - currentScores[2]) / 2;
currentScores[3] = (int) (min + r.nextDouble() * (max - min)); // random
bonus
currentScores[4] = currentScores[0] + currentScores[1] + currentScores[2]
+ currentScores[3];
}
}

```

```

public void resetCurrentScores() {
currentScores = new int[5];
}

@Override
public void mouseMoved(MouseEvent me) {
}
}

```

```

if (currentScreen == 0) {
    butt.setHomeButton(me.getX(), me.getY(), false);
} else if (currentScreen >= 10) {
    butt.setBackButton(me.getX(), me.getY(), false);
} else
    butt.setbuttRectButton(me.getX(), me.getY(), false);
}

@Override
public void mouseClicked(MouseEvent me) {
    if (currentScreen == 0) {
        butt.setHomeButton(me.getX(), me.getY(), true);
        switch (butt.getHomeButton(true)) {
        case 0: {
            currentScreen = 13; // arcade
            resetCurrentScores();
            startGame(1);
            break;
        }
        case 1: {
            currentScreen = 1; // play screen
            break;
        }
        case 2: {
            currentScreen = 5; // watch AI screen
            break;
        }
        case 3: {
            currentScreen = 4; // controls screen
            break;
        }
        case 4: {
            currentScreen = 6; // high scores screen
        }
        default:
            break;
        }
    } else if (currentScreen >= 10) {
        butt.setBackButton(me.getX(), me.getY(), true);
        switch (currentScreen) {
        case 10: { // Play again screen
            switch (butt.getBackButton(true)) {
            case 0: { // play again
                if (game.striker.isControlled())
                    startGame(1);
                else if (game.keeper.isControlled())
                    startGame(2);
                else
                    startGame(0);
                break;
            }
            case 1: { // Main Menu
                currentScreen = 0;
                break;
            }
            default: {
                break;
            }
        }
        break;
        }
    }
    case 11: { // Play again screen
        switch (butt.getBackButton(true)) {
        case 0: { // play again
            if (game2.striker.isControlled())
                startGame2(1);
            else if (game2.keeper.isControlled())
                startGame2(2);
            else
                startGame2(0);
        }
    }

```

```

        break;
    }
    case 1: { // Main Menu
        currentScreen = 0;
        break;
    }
    default: {
        break;
    }
}
break;
}
case 12: { // Play again screen
    switch (butt.getBackButton(true)) {
    case 0: { // play again
        if (game3.striker.isControlled())
            startGame3(1);
        else if (game3.keeper.isControlled())
            startGame3(2);
        else
            startGame3(0);
        break;
    }
    case 1: { // Main Menu
        currentScreen = 0;
        break;
    }
    default: {
        break;
    }
}
break;
}
case 13: { // After Level Screen
    switch (butt.getBackButton(true)) {
    case 0: { // next level OR game over
        switch (currentLevel) {
        case 1: {
            if (!levelFailed) {
                startGame(2);
                currentLevel = 2;
                graphicsDelay = 0;
            } else {
                resetCurrentScores();
                startGame(1);
                currentLevel = 1;
                graphicsDelay = 0;
            }
            break;
        }
        case 2: {
            if (!levelFailed) {
                startGame3(2);
                currentLevel = 3;
                graphicsDelay = 0;
            } else {
                resetCurrentScores();
                startGame(1);
                currentLevel = 1;
                graphicsDelay = 0;
            }
            break;
        }
        case 3: {
            if (!levelFailed) {
                startGame3(1);
                currentLevel = 4;
                graphicsDelay = 0;
            } else {
                resetCurrentScores();
            }
        }
    }
}

```



```

startGame(1);
currentLevel = 1;
graphicsDelay = 0;
}
break;
}
case 4: {
if (!levelFailed) {
startGame2(2);
currentLevel = 5;
graphicsDelay = 0;
} else {
resetCurrentScores();
startGame(1);
currentLevel = 1;
graphicsDelay = 0;
}
break;
}
case 5: {
currentScreen = 6;
graphicsDelay = 0;
break;
}
default:
break;
}
break;
}
case 1: { // Main Menu
currentScreen = 0;
break;
}
default: {
break;
}
}
break;
}
} else {
butt.setbuttRectButton(me.getX(), me.getY(), true);
switch (currentScreen) {
case 1: { // play, choose side screen
switch (butt.getbuttRectButton(true)) {
case 1: { // play attacker
currentScreen = 2;
break;
}
case 2: { // play goalkeeper
currentScreen = 3;
break;
}
case 4: { // back to home
currentScreen = 0;
break;
}
default: {
break;
}
}
break;
}
case 2: { // play Attacker, choose how many players screen
switch (butt.getbuttRectButton(true)) {
case 0: { // 1on1
currentScreen = 10;
startGame(1);
break;
}
case 1: { // 2on1
currentScreen = 11;
startGame2(1);
break;
}
}
}
case 2: { // 2on2
currentScreen = 12;
startGame3(1);
break;
}
}
case 4: { // back to main menu
currentScreen = 0;
break;
}
default: {
break;
}
}
break;
}
case 3: { // play GoalKeeper, choose how many players screen
switch (butt.getbuttRectButton(true)) {
case 0: { // 1on1
currentScreen = 10;
startGame(2);
break;
}
case 1: { // 2on1
currentScreen = 11;
startGame2(2);
break;
}
case 2: { // 2on2
currentScreen = 12;
startGame3(2);
break;
}
case 4: { // back to main menu
currentScreen = 0;
break;
}
default: {
break;
}
}
break;
}
case 4: { // tutorial screen
switch (butt.getbuttRectButton(true)) {
case 0: { // dribble
tutorial = new Tutorial(0);
tutorialOn = true;
switchListeners(tutorial, true);
break;
}
case 1: { // pass
tutorial = new Tutorial(1);
tutorialOn = true;
switchListeners(tutorial, true);
break;
}
case 2: { // shoot
tutorial = new Tutorial(2);
tutorialOn = true;
switchListeners(tutorial, true);
break;
}
case 3: { // goalkeep
tutorial = new Tutorial(3);
tutorialOn = true;
}
}
}

```

```

switchListeners(tutorial, true);
break;
}
case 4: { // back to home
currentScreen = 0;
tutorialOn = false;
break;
}
default: {
break;
}
}
break;
}
case 5: { // watch AI, choose how many players Screen
switch (butt.getbuttRectButton(true)) {
case 0: { // 1on1
currentScreen = 10;
startGame(0);
break;
}
case 1: { // 2on1
currentScreen = 11;
startGame2(0);
break;
}
case 2: { // 2on2
currentScreen = 12;
startGame3(0);
break;
}
case 4: { // back to home
currentScreen = 0;
break;
}
default: {
break;
}
}
break;
}
case 6: { // High Scores Screen
switch (butt.getbuttRectButton(true)) {
case 3: { // reset scores
resetHighScores();
break;
}
case 4: { // Main Menu
currentScreen = 0;
break;
}
default: {
break;
}
}
break;
}
default:
break;
}
}
}
}

```

```

@Override
public void mouseDragged(MouseEvent me) {
}

```

```

@Override
public void mouseEntered(MouseEvent me) {
}

```

```

@Override
public void mouseExited(MouseEvent me) {
}

```

```

@Override
public void mousePressed(MouseEvent me) {
}

```

```

@Override
public void mouseReleased(MouseEvent me) {
}

```

```

/*-----FOR "SEE-THROUGH"/OPACITY GRAPHICAL
PURPOSES-----*/
/* USED BY METHODS: paintReady(), paintReadyStrin() etc.-----
----- */

```

```

public void setOpacity(float opacity) {
scales[3] = opacity;
rop = new RescaleOp(scales, offsets, null);
}
/*-----END "SEE-THROUGH"/OPACITY -----
----*/

```

```

/*-----FOR HIGHSCORES PURPOSES-----
*/
/*-----ACCESSES BROWSER COOKIES-----
-*/

```

```

public void adjustHighScores(int newScore) {
int index = 5;
for (int i = 0; i < 5; i++) {
if (highScores[i] < newScore) {
index = i;
break;
}
}
if (index < 5) {
for (int i = 4; i > index; i--) {
highScores[i] = highScores[i - 1];
}
highScores[index] = newScore;
}
}
}

```

```

public void resetHighScores() {
highScores = new int[5];
}

```

```

public String getCookie() {
/*
** get all cookies for a document
*/
try {
JSONObject myBrowser = (JSONObject) JSONObject.getWindow(this);
JSONObject myDocument = (JSONObject)
myBrowser.getMember("document");
String myCookie = (String) myDocument.getMember("cookie");
if (myCookie.length() > 0)
return myCookie;
} catch (Exception e) {
e.printStackTrace();
}
return "?";
}
}

```

```

public String getCookie(String name) {
String myCookie = getCookie();
String search = name + "=";
if (myCookie.length() > 0) {
int offset = myCookie.indexOf(search);
}
}

```

```

if (offset != -1) {
    offset += search.length();
    int end = myCookie.indexOf(";", offset);
    if (end == -1)
        end = myCookie.length();
    return myCookie.substring(offset, end);
} else
    return "1000";
}
return "1000";
}

public void readHighScoresCookie() {
    for (int i = 0; i < 5; i++) {
        highScores[i] = (int) Double.parseDouble(getCookie("highScore" + (i +
1)));
    }
}

public void writeHighScoresCookie() {
    for (int i = 0; i < 5; i++) {
        Object[] params = { "highScore" + (i + 1), "" + highScores[i] * 2, "30" };
        callJavascriptFunction("setCookie", params);
    }
}

private void callJavascriptFunction(String funcName, Object[] params) {
    try {
        JScript window = JScript.getWindow(this);
        window.call(funcName, params);
    } catch (Exception e) {
        e.printStackTrace();
    }
}
/*-----END OF HIGHSCORES-----*/

/*-----FOR MENU BUTTON PURPOSES-----*/
public class ButtonHandler {

    public final Rectangle buttRect[] = {
        new Rectangle(430, 100, 100, 45),
        new Rectangle(430, 155, 100, 45),
        new Rectangle(430, 210, 100, 45),
        new Rectangle(430, 265, 100, 45),
        new Rectangle(430, 400, 100, 45) };

    public final Rectangle buttHome[] = {
        new Rectangle(375, 220, 216, 24),
        new Rectangle(375, 247, 216, 24),
        new Rectangle(375, 274, 216, 24),
        new Rectangle(375, 301, 216, 24),
        new Rectangle(375, 328, 216, 24) };

    public final Rectangle buttBack[] = { new Rectangle(450, 347, 65,
65),
        new Rectangle(450, 444, 65, 65) };

    public boolean    buttBackHover[] = new boolean[2];
    public boolean    buttBackClicked[] = new boolean[2];
    public boolean    buttHomeHover[] = new boolean[5];
    public boolean    buttHomeClicked[] = new boolean[5];
    public boolean    buttRectHover[] = new boolean[5];
    public boolean    buttRectClicked[] = new boolean[5];

    public ButtonHandler() {
    }

    private void reset() {
        buttRectHover = new boolean[5];
        buttRectClicked = new boolean[5];
        buttHomeHover = new boolean[5];
        buttHomeClicked = new boolean[5];
        buttBackHover = new boolean[2];
    }

    buttBackClicked = new boolean[2];
}

public void setBackButton(int x, int y, boolean onClick) {
    reset();
    for (int i = 0; i < 2; i++) {
        if (buttBack[i].contains(x, y)) {
            if (onClick)
                buttBackClicked[i] = true;
            else
                buttBackHover[i] = true;
            return;
        }
    }
}

public int getBackButton(boolean onClick) {
    int index = -1;
    if (onClick) {
        for (int i = 0; i < 2; i++) {
            if (buttBackClicked[i]) {
                index = i;
            }
        }
    } else {
        for (int i = 0; i < 2; i++) {
            if (buttBackHover[i])
                index = i;
        }
    }
    return index;
}

public void setHomeButton(int x, int y, boolean onClick) {
    reset();
    for (int i = 0; i < 5; i++) {
        if (buttHome[i].contains(x, y)) {
            if (onClick)
                buttHomeClicked[i] = true;
            else
                buttHomeHover[i] = true;
            return;
        }
    }
}

public int getHomeButton(boolean onClick) {
    int index = -1;
    if (onClick) {
        for (int i = 0; i < 5; i++) {
            if (buttHomeClicked[i]) {
                index = i;
            }
        }
    } else {
        for (int i = 0; i < 5; i++) {
            if (buttHomeHover[i])
                index = i;
        }
    }
    return index;
}

public void setbuttRectButton(int x, int y, boolean onClick) {
    reset();
    for (int i = 0; i < 5; i++) {
        if (buttRect[i].contains(x, y)) {
            if (onClick)
                buttRectClicked[i] = true;
            else

```

```

        buttRectHover[i] = true;
    }
    return;
}
}

public int getbuttRectButton(boolean onClick) {
    int index = -1;
    if (onClick) {
        for (int i = 0; i < 5; i++) {
            if (buttRectClicked[i]) {
                index = i;
            }
        }
    } else {
        for (int i = 0; i < 5; i++) {
            if (buttRectHover[i])
                index = i;
        }
    }
    return index;
}
}
}

```

DataSample.java

```

package training;
import java.math.BigDecimal;
import soccerApplet.Ball;
import soccerApplet.Constants;
import soccerApplet.GoalKeeper;

```

```

public class DataSample {

```

```

    protected double ballX;
    protected double ballY;
    protected double keeperX;
    protected double keeperY;
    protected double distance;
    protected double angle;
    protected int out;
    protected int section;
    protected String output;

```

```

DataSample(Ball b, GoalKeeper k, boolean results[]) {
    ballX = round(b.getPosition().getX(), 4);
    ballY = round(b.getPosition().getY(), 4);
    keeperX = round(k.getPosition().getX(), 4);
    keeperY = round(k.getPosition().getY(), 4);
    distance = round(b.distanceTo(Constants.GOAL_CENTER), 4);
    angle = round(
        Math.abs(90 - b.getPosition().directionOf(Constants.GOAL_CENTER)),
        4);
    // angle = round(b.getPosition().directionOf(Constants.GOAL_CENTER),
    4);
    setOutput(results);
}

```

```

/**
 * @param g
 */

```

```

public void setOutput(boolean results[]) {
    int currCount = 0, bestSection = 0, bestCount = 0;
    for (int i = 0; i < results.length; i++) {
        if (results[i]) {
            currCount++;
            if (currCount > bestCount) {
                bestCount = currCount;

```

```

                bestSection = i;
            }
        } else {
            currCount = 0;
        }
    }
    if (bestCount > 0) {
        bestSection = bestSection - bestCount / 2;
        /*
         * -----IMPORANT-----
         * transforms the goal section
         * range from [0,29] into [1,30]
         */
        bestSection++;
        section = bestSection;
        output = Integer.toBinaryString(bestSection);
        while (output.length() < 5)
            output = "0" + output;
        out = 1;
        output = output + "1";
    } else {
        out = 0;
        section = -1;
        output = "000000";
    }
}

```

```

public void setOutput2(boolean results[]) {
    int currCount = 0, bestSection = 0, bestCount = 0;
    for (int i = 0; i < results.length; i++) {
        if (results[i]) {
            currCount++;
            if (currCount > bestCount) {
                bestCount = currCount;
                bestSection = i;
            }
        } else {
            currCount = 0;
        }
    }
    if (bestCount > 0) {
        bestSection = bestSection - bestCount / 2;
        output = Integer.toBinaryString(bestSection);
        while (output.length() < 5)
            output = "0" + output;
        out = 1;
    } else {
        out = 0;
        output = "000000";
    }
}

```

```

public int getOut() {
    return out;
}

```

```

public int getSection() {
    return section;
}

```

```

public double getValue(boolean isInput, int column) {
    if (isInput) {
        switch (column) {
            case 0: {
                return ballX;
            }
            case 1: {
                return ballY;
            }
            case 2: {

```

```

    return keeperX;
}
case 3: {
    return keeperY;
}
case 4: {
    return distance;
}
default: {
    return angle;
}
} else {
    char[] array = output.toCharArray();
    return Double.parseDouble("" + array[column]);
}
}

public String toString() {
    return "INPUT: Bx=" + ballX + " By=" + ballY + " Kx=" + keeperX + "
Ky="
    + keeperY + " Dist=" + distance + " Angle=" + angle + "\nOUTPUT: "
    + output.toString();
}

public static double round(double d, int decimalPlace) {
    BigDecimal bd = new BigDecimal(d);
    bd = bd.setScale(decimalPlace, BigDecimal.ROUND_HALF_UP);
    return bd.doubleValue();
}
}

```

Episode.java

```

package training;
import java.util.Random;
import soccerApplet.Ball;
import soccerApplet.Constants;
import soccerApplet.Coordinate;
import soccerApplet.Goal;
import soccerApplet.GoalKeeperAI;

public class Episode implements Runnable {

    Goal goal;
    private boolean results[];
    private int goalSection;
    Ball ball, ballCopy;
    AttackerTrainer striker, strikerCopy;
    GoalKeeperAI keeper, keeperCopy;
    boolean kickBall;
    boolean startTrial;
    private boolean episodeEnd;

    public Episode(int keeperZone, int strikerQuadrant) {
        initPositions(keeperZone, strikerQuadrant);
        goal = new Goal((int) Constants.GOAL_LEFT.getX(),
            (int) Constants.GOAL_RIGHT.getX(), (int)
            Constants.GOAL_CENTER.getY());
        Constants.GOAL_CENTER.getY());
        results = new boolean[30];
        goalSection = 0;
        kickBall = false;
        startTrial = true;
        episodeEnd = false;
    }

    @Override
    public void run() {
        if (!episodeEnd) {
            if (startTrial)
                startTrial();
            runTrial();
        } else
            System.out.println("episode end");
    }

    private void startTrial() {
        startTrial = false;
        copyStates();
        kickBall = true;
    }

    private void runTrial() {
        if (kickBall) {
            ball = striker.kick(goalSection);
            kickBall = false;
        }
        keeper.execute(ball);
        if (ball.checkCollision(keeper)) {
            keeper.setHasBall(true);
            ball.setPossessed(true);
            ball.setIsMoving(false);
        }
        ball.update();
        if (goal.checkIfGoal(ball) || (!striker.isHasBall() && !ball.isMoving())
            || ball.checkIfOutOfBounds()) {
            results[goalSection] = goal.checkIfGoal(ball);
            goalSection++;
            goal.resetGoal();
            if (goalSection < 30)
                startTrial = true;
            else
                episodeEnd = true;
        }
    }

    private void initPositions(int zone, int quadrant) {
        keeperCopy = new GoalKeeperAI(randomizeKeeper(zone),
            Constants.PLAYER_SPEED,
            Math.PI / 2);
        strikerCopy = new AttackerTrainer(randomizeStriker(quadrant));
        ballCopy = new Ball(strikerCopy.getPosition().getX()
            + (Constants.PLAYER_KICK_REACH *
            Math.cos(strikerCopy.getDirection())),
            strikerCopy.getPosition().getY()
            + (Constants.PLAYER_KICK_REACH *
            Math.sin(strikerCopy.getDirection())),
            Constants.PLAYER_SPEED, 0.0D);
        copyStates();
    }

    private Coordinate randomizeStriker(int quadrant) {
        Random r = new Random();
        double startX = 0, endX = 0, startY = 0, endY = 0;
        switch (quadrant) { // origin is Constants.penalty_kick
            case 1: { // upper right
                startX = Constants.GOAL_CENTER.getX();
                startY = Constants.GOAL_CENTER.getY() + 20; // some offset
                endX = Constants.FIELD_LOWER_RIGHT.getX() - 20; // some offset
                endY = Constants.PENALTY_KICK.getY();
                break;
            }
            case 2: { // lower right
                startX = Constants.GOAL_CENTER.getX();
                startY = Constants.PENALTY_KICK.getY();
                endX = Constants.FIELD_LOWER_RIGHT.getX() - 20; // some offset
                endY = Constants.FIELD_LOWER_RIGHT.getY() - 20; // some offset
                break;
            }
        }
    }
}

```

```

case 3: { // lower left
startX = Constants.FIELD_LOWER_LEFT.getX() + 20;// some offset
startY = Constants.PENALTY_KICK.getY();
endX = Constants.PENALTY_KICK.getX();
endY = Constants.FIELD_LOWER_LEFT.getY() - 20; // some offset
break;
}
case 4: { // upper left
startX = Constants.FIELD_LOWER_LEFT.getX() + 20;// some offset
startY = Constants.GOAL_CENTER.getY() + 20; // some offset
endX = Constants.PENALTY_KICK.getX();
endY = Constants.PENALTY_KICK.getY();
break;
}
}
return new Coordinate(startX + r.nextDouble() * (endX - startX), startY
+ r.nextDouble() * (endY - startY));
}

private Coordinate randomizeKeeper(int zone) {
Random r = new Random();
double startX = 0, endX = 0, startY = 0, endY = 0;
switch (zone) {
case 1: { // right side of goal area
startX = Constants.GOAL_CENTER.getX();
startY = Constants.GOAL_CENTER.getY(); // some offset
endX = Constants.GOAL_RIGHT.getX();
endY = Constants.GOAL_AREA_RIGHT.getY();
break;
}
case 2: { // left side of goal area
startX = Constants.GOAL_LEFT.getX();
startY = Constants.GOAL_CENTER.getY();
endX = Constants.GOAL_CENTER.getX();
endY = Constants.GOAL_AREA_LEFT.getY();
break;
}
case 3: { // right side of goal area
startX = Constants.GOAL_CENTER.getX();
startY = Constants.GOAL_CENTER.getY(); // some offset
endX = Constants.GOAL_AREA_RIGHT.getX();
endY = Constants.GOAL_AREA_RIGHT.getY();
break;
}
case 4: { // left side of goal area
startX = Constants.GOAL_AREA_LEFT.getX();
startY = Constants.GOAL_CENTER.getY();
endX = Constants.GOAL_CENTER.getX();
endY = Constants.GOAL_AREA_LEFT.getY();
break;
}
default:
break;
}
return new Coordinate(startX + r.nextDouble() * (endX - startX), startY
+ r.nextDouble() * (endY - startY));
}

private void copyStates() {
keeper = new GoalKeeperAI(keeperCopy.getPosition(),
keeperCopy.getSpeed(),
keeperCopy.getDirection());
striker = new AttackerTrainer(strikerCopy.getPosition());
ball = new Ball(ballCopy.getPosition(), ballCopy.getSpeed(),
ballCopy.getDirection());
}

public boolean[] getResults() {
return results;
}
}

```

```

public int getGoalSection() {
return goalSection;
}

public boolean isEpisodeEnd() {
return episodeEnd;
}
}

```

AttackerTrainer.java

```

package training;
import soccerApplet.Attacker;
import soccerApplet.Ball;
import soccerApplet.Constants;
import soccerApplet.Coordinate;
import soccerApplet.NeuralNetwork;

public class AttackerTrainer extends Attacker {

protected int targetSection;

protected AttackerTrainer(Coordinate c) {
super(c, Constants.PLAYER_SPEED, 1, true, false);
setDirection(Constants.GOAL_CENTER);
setAttackRect(c);
}

public Ball kick(int targetSection) {
Ball b = new Ball(getPosition(), speed, direction);
double x = Constants.GOAL_LEFT.getX() + targetSection
* (Constants.BALL_DIAMETER) + Constants.BALL_DIAMETER / 2;
double y = Constants.GOAL_LEFT.getY() - Constants.BALL_DIAMETER
/ 2;
b.setDirection(new Coordinate(x, y));
b.setSpeed(Constants.PLAYER_KICK);
b.setPossessed(false);
b.setIsMoving(true);
setHasBall(false);
return b;
}

protected boolean isShootable(Ball b, Coordinate k) {
double[] params = { b.getPosition().getX(), b.getPosition().getY(),
k.getX(),
k.getY(), b.distanceTo(Constants.GOAL_CENTER),
b.getPosition().directionOf(Constants.GOAL_CENTER) };
int[] output = NeuralNetwork.getOutput(params);
if (output[5] == 1) { // shoot
int value = 0;
for (int i = 0; i < 5; i++) {
value += output[i] * Math.pow(2, 5 - i - 1);
}
if (value < 1)
value = 1;
else if (value > 30)
value = 30;
targetSection = value - 1;
double x = Constants.GOAL_LEFT.getX() + targetSection
* (Constants.BALL_DIAMETER) + 4;
double y = Constants.GOAL_LEFT.getY() - Constants.BALL_DIAMETER
/ 2;
setDirection(new Coordinate(x, y));
return true;
}
return false;
}
}
}

```

SampleCollector.java

```
package training;
import java.io.File;
import java.io.IOException;
import jxl.Workbook;
import jxl.write.Number;
import jxl.write.WritableSheet;
import jxl.write.WritableWorkbook;
import jxl.write.WriteException;
import jxl.write.biff.RowsExceededException;

public class SampleCollector {

    Episode episode;
    boolean startEpisode;
    DataSample[] samples;
    int currSample;
    int zone;
    int quadrant;

    public SampleCollector(int numberOfSamples) {
        samples = new DataSample[numberOfSamples];
        zone = 1;
        quadrant = 1;
        startEpisode = true;
        currSample = 0;
    }

    public DataSample[] generateSamples() {
        int num = samples.length / 16;
        for (int zone = 1; zone <= 4; zone++) {
            for (int quadrant = 1; quadrant <= 4; quadrant++) {
                this.zone = zone;
                this.quadrant = quadrant;
                /*
                 * while(currSample < (quadrant+zone*zone-2+zone)*num){
                 */
                while (currSample < ((zone * 4) - (4 - quadrant)) * num) {
                    if (startEpisode)
                        startEpisode();
                    episode.run();
                    if (episode.isEpisodeEnd()) {
                        endEpisode();
                    }
                }
            }
        }
        return samples;
    }

    protected void getSample() {
        samples[currSample] = new DataSample(episode.ballCopy,
        episode.keeperCopy,
        episode.getResults());
    }

    protected void startEpisode() {
        episode = new Episode(zone, quadrant);
        startEpisode = false;
    }

    protected void endEpisode() {
        getSample();
        printLog();
        currSample++;
        startEpisode = true;
    }

    public void printLog() {
        System.out.println("SAMPLE: " + (currSample + 1));
        System.out.println("Results:");
        for (int i = 0; i < 30; i++) {
            if (episode.getResults()[i])
                System.out.print("1");
            else
                System.out.print("0");
        }
        System.out.print(" Input:");
        for (int i = 0; i < 6; i++) {
            System.out.print(" " + samples[currSample].getValue(true, i));
        }
        System.out.print(" OUTPUT:");
        for (int i = 0; i < 6; i++) {
            System.out.print(" " + (int) samples[currSample].getValue(false, i));
        }
        System.out.println();
    }

    static class ExcelWriter {

        public static void writeSamples(DataSample[] samples) throws
        IOException,
        RowsExceededException, WriteException {
            System.out.println("Writing data samples to excel file...");
            WritableWorkbook workbook = Workbook.createWorkbook(new
            File("data.xls"));
            WritableSheet inputsSheet = workbook.createSheet("Inputs", 0);
            WritableSheet outputsSheet = workbook.createSheet("Outputs", 1);
            WritableSheet decimalSheet = workbook.createSheet("Decimal", 2);
            for (int rows = 0; rows < samples.length; rows++) {
                for (int cols = 0; cols < 6; cols++) {
                    Number inputCell = new Number(cols, rows,
                    samples[rows].getValue(true,
                    cols));
                    inputsSheet.addCell(inputCell);
                    Number outputCell = new Number(cols, rows,
                    samples[rows].getValue(false,
                    cols));
                    outputsSheet.addCell(outputCell);
                }
                Number decimalCell = new Number(0, rows,
                samples[rows].getSection());
                decimalSheet.addCell(decimalCell);
            }
            workbook.write();
            workbook.close();
            System.out.println("Data samples successfully written to data.xls!");
        }

        public static void writeSamples2(DataSample[] samples) throws
        IOException,
        RowsExceededException, WriteException {
            System.out.println("Writing data samples to excel file...");
            WritableWorkbook workbook = Workbook.createWorkbook(new
            File("data.xls"));
            WritableSheet inputsSheet = workbook.createSheet("Inputs", 0);
            WritableSheet outputsSheet = workbook.createSheet("Outputs", 1);
            WritableSheet decimalSheet = workbook.createSheet("Decimal", 2);
            Number inputCell, outputCell;
            for (int rows = 0; rows < samples.length; rows++) {
                for (int cols = 0; cols < 6; cols++) {
                    inputCell = new Number(cols, rows, samples[rows].getValue(true,
                    cols));
                    inputsSheet.addCell(inputCell);
                    if (samples[rows].getOut() == 1) {
                        if (samples[rows].getValue(false, cols) == 1)
                            outputCell = new Number(cols + 6, rows, .9);
                        else
                            outputCell = new Number(cols + 6, rows, .1);
                    }
                }
            }
        }
    }
}
```

```

        inputsSheet.addCell(outputCell);
        outputCell = new Number(cols, rows, samples[rows].getValue(false,
cols));
        outputsSheet.addCell(outputCell);
    } else {
        if (cols == 5) {
            outputCell = new Number(cols + 6, rows, .1);
            inputsSheet.addCell(outputCell);
            outputCell = new Number(cols, rows, samples[rows].getValue(false,
cols));
            outputsSheet.addCell(outputCell);
        }
    }
    Number decimalCell = new Number(0, rows,
samples[rows].getSection());
    decimalSheet.addCell(decimalCell);
}
workbook.write();
workbook.close();
System.out.println("Data samples successfully written to data.xls!");
}
}

```

```

public static void main(String args[]) {
    SampleCollector s = new SampleCollector(5600);
    try {
        ExcelWriter.writeSamples2(s.generateSamples());
    } catch (RowsExceededException e) {
        // TODO Auto-generated catch block
        e.printStackTrace();
    } catch (WriteException e) {
        // TODO Auto-generated catch block
        e.printStackTrace();
    } catch (IOException e) {
        // TODO Auto-generated catch block
        e.printStackTrace();
    }
}
}

```

NeuralNetTester.java

```

package training;
import soccerApplet.NeuralNetwork;

public class NeuralNetTester extends SampleCollector {

    private boolean[] testResults;
    private enum resultType {
        TP, FP, TN, FN
    };
    private resultType currType;
    private int[] output;
    private int tPCount, fPCount, tNCount, fNCount;

    public NeuralNetTester(int numberOfSamples) {
        super(numberOfSamples);
        testResults = new boolean[numberOfSamples];
        tPCount = 0;
        fPCount = 0;
        tNCount = 0;
        fNCount = 0;
        currType = resultType.TP;
        output = new int[6];
    }

    @Override
    protected void getSample() {

```

```

        samples[currSample] = new DataSample(episode.ballCopy,
episode.keeperCopy,
        episode.getResults());
        networkTest(samples[currSample]);
    }
}

```

```

public void networkTest(DataSample d) {
    double[] params = new double[6];
    for (int j = 0; j < 6; j++) {
        params[j] = d.getValue(true, j);
    }
    output = NeuralNetwork.getOutput(params);
    if (output[5] == 1) { // shoot
        int value = 0;
        for (int k = 0; k < 5; k++) {
            value += output[k] * Math.pow(2, 5 - k - 1);
        }
        if (value > 30)
            value = 30;
        if (value < 1)
            value = 1;
        int target = value - 1;
        if (episode.getResults()[target]) {
            currType = resultType.TP;
            tPCount++;
        } else {
            currType = resultType.FP;
            fPCount++;
        }
        testResults[currSample] = episode.getResults()[target];
    } else {
        boolean success = true;
        for (int i = 0; i < 30; i++) {
            if (episode.getResults()[i]) {
                currType = resultType.FN;
                fNCount++;
                testResults[currSample] = false;
                success = false;
                break;
            }
        }
        if (success) {
            currType = resultType.TN;
            tNCount++;
        }
        testResults[currSample] = true;
    }
}
}

```

```

public int getSuccessCount() {
    return tNCount + tPCount;
}

```

```

public int getFailCount() {
    return fNCount + fPCount;
}

```

```

public int getTPCount() {
    return tPCount;
}

```

```

public int getFPCount() {
    return fPCount;
}

```

```

public int getTNCOUNT() {
    return tNCount;
}

```



```

public int getFNCount() {
    return fNCount;
}

public String currTestResult() {
    switch (currType) {
    case TP: {
        return "True Positive";
    }
    case TN: {
        return "True Negative";
    }
    case FP: {
        return "False Positive";
    }
    case FN: {
        return "False Negative";
    }
    default:
        return "";
    }
}

public void printLog() {
    System.out.println("TEST: " + (currSample + 1));
    System.out.print("Results:");
    for (int i = 0; i < 30; i++) {
        if (episode.getResults()[i])
            System.out.print("1");
        else
            System.out.print("0");
    }
    System.out.print(" Input:");
    for (int i = 0; i < 6; i++) {
        System.out.print(" " + samples[currSample].getValue(true, i));
    }
    System.out.print(" Target:");
    for (int i = 0; i < 6; i++) {
        System.out.print(" " + (int) samples[currSample].getValue(false, i));
    }
    System.out.println();
    System.out.print("Network Output:");
    for (int i = 0; i < 6; i++) {
        System.out.print(" " + output[i]);
    }
    System.out.print(" Section: ");
    if (output[5] == 1) {
        int value = 0;
        for (int k = 0; k < 5; k++) {
            value += output[k] * Math.pow(2, 5 - k - 1);
        }
        if (value > 30)
            value = 30;
        if (value < 1)
            value = 1;
        System.out.print(value);
    } else {
        System.out.print("NA");
    }
    System.out.print(" Evaluation: " + currTestResult());
    System.out.println();
}

public void printSummary() {
    System.out.println("-----");
    System.out.println("True Positive Count: " + getTPCount());
    System.out.println("True Negative Count: " + getTNCount());
    System.out.println("False Positive Count: " + getFPCount());
    System.out.println("False Negative Count: " + getFNCount());
}

```

```

System.out.println("Number of Successful Predictions: " +
getSuccessCount());
System.out.println("Number of Fail Predictions: " + getFailCount());
}

public static void main(String args[]) {
    NeuralNetTester test = new NeuralNetTester(1600);
    test.generateSamples();
    test.printSummary();
}
}

```

Simulator.java

```

package training;
import externalUtil.ImageUtil;
import java.awt.Color;
import java.awt.Dimension;
import java.awt.Font;
import java.awt.Graphics;
import java.awt.Graphics2D;
import java.awt.Image;
import java.awt.Paint;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import java.awt.event.MouseEvent;
import java.awt.event.MouseListener;
import java.awt.image.BufferedImage;
import javax.swing.JApplet;
import javax.swing.Timer;
import soccerApplet.Constants;

/**
 * Simulates data gathering
 */
public class Simulator extends JApplet implements ActionListener,
MouseListener {

    final static int WIDTH = 955;
    final static int HEIGHT = 595;
    Episode episode;
    DataSample data;
    Dimension offDimension;
    Image offImage;
    Image field;
    Image keeperImg[];
    Image strikerImg[];
    Image ballImg[];
    Graphics offGraphics;
    Timer time;
    boolean start = false;
    int counter = 0;

    public void init() {
        setLayout(null);
        this.setSize(WIDTH, HEIGHT);
        field = getImage(getDocumentBase(), "images/no net.png");
        BufferedImage img = ImageUtil.makeColorTransparent(this.getClass()
            .getResource("attacker.png"), new Color(0, 115, 0));
        strikerImg = ImageUtil.splitImage(img, 8, 5);
        img = ImageUtil.makeColorTransparent(
            this.getClass().getResource("goalkeeper.png"), new Color(0, 115, 0));
        keeperImg = ImageUtil.splitImage(img, 8, 6);
        img =
        ImageUtil.makeColorTransparent(this.getClass().getResource("ball.png"),
            new Color(0, 115, 0));
        ballImg = ImageUtil.splitImage(img, 4, 1);
        episode = new Episode(3, 2);
        offImage = createImage(WIDTH, HEIGHT);
    }
}

```

```

offGraphics = offImage.getGraphics();
addMouseListener(this);
}

public void start() {
time = new Timer(1, this);
time.start();
// repaint();
}

public void stop() {
// offImage = null;
// field = null;
// offGraphics = null;
}

public void paint(Graphics g) {
update(g);
}

public void update(Graphics g) {
offGraphics.drawImage(field, 0, 0, this);
paintComponent(offGraphics);
g.drawImage(offImage, 0, 0, null);
}

public void paintComponent(Graphics g) {
Graphics2D seeThrough = (Graphics2D) g;
Paint shadowPaint = new Color(0, 0, 0, 180);
seeThrough.setPaint(shadowPaint);
seeThrough.fillRect(0, 0, 250, HEIGHT);
g.setColor(Color.GREEN);
g.setFont(new Font("Serif", Font.BOLD, 36));
g.drawString("EPISODE", 40, 50);
g.setColor(Color.PINK);
g.setFont(new Font("Serif", Font.BOLD, 24));
g.drawString("Results:", 20, 90);
g.setColor(Color.WHITE);
g.setFont(new Font("Dialog", Font.BOLD, 12));
if (episode.getGoalSection() > 0) {
for (int i = 0; i < episode.getGoalSection(); i++) {
if (i < 15)
g.drawString("Section " + (i + 1) + ": " + episode.getResults()[i], 20,
110 + 20 * i);
else
g.drawString("Section " + (i + 1) + ": " + episode.getResults()[i], 130,
110 + 20 * (i - 15));
}
}
g.setColor(Color.PINK);
g.setFont(new Font("Serif", Font.BOLD, 24));
g.drawString("Training Sample:", 20, 440);
if (episode.isEpisodeEnd()) {
g.setColor(Color.WHITE);
g.setFont(new Font("Dialog", Font.BOLD, 12));
for (int i = 0; i < 6; i++) {
if (i < 3)
g.drawString("Input " + (i + 1) + ": " + data.getValue(true, i), 20,
460 + 20 * i);
else
g.drawString("Input " + (i + 1) + ": " + data.getValue(true, i), 130,
460 + 20 * (i - 3));
}
g.drawString("TARGET " + ":", 20, 530);
for (int i = 0; i < 6; i++) {
g.drawString(" " + (int) data.getValue(false, i), 80 + 10 * i, 530);
}
if (data.getSection() >= 0)
g.drawString("(Section " + data.getSection() + ")", 150, 530);
else

```

```

g.drawString("(No Section)", 150, 530);
}
g.setColor(Color.BLACK);
g.fillRect(episode.goal.left, episode.goal.y - Constants.GOAL_HEIGHT,
Constants.GOAL_WIDTH, Constants.GOAL_HEIGHT);
g.setColor(Color.GRAY);
for (int i = 0; i < 30; i++) {
g.drawRect(episode.goal.left + i * Constants.BALL_DIAMETER,
episode.goal.y
- Constants.GOAL_HEIGHT, Constants.BALL_DIAMETER,
Constants.GOAL_HEIGHT);
}
if (episode.getGoalSection() >= 0 && episode.getGoalSection() < 30) {
g.setColor(Color.YELLOW);
g.fillRect(episode.goal.left + episode.getGoalSection()
* Constants.BALL_DIAMETER, episode.goal.y -
Constants.GOAL_HEIGHT,
Constants.GOAL_WIDTH / 30, Constants.GOAL_HEIGHT);
} else if (episode.getGoalSection() >= 30) {
g.setColor(Color.YELLOW);
g.fillRect(episode.goal.left + 29 * Constants.BALL_DIAMETER,
episode.goal.y
- Constants.GOAL_HEIGHT, Constants.GOAL_WIDTH / 30,
Constants.GOAL_HEIGHT);
}
g.setColor(Color.RED);
g.fillRect(episode.keeper.getRect().x, episode.keeper.getRect().y,
episode.keeper.getRect().width, episode.keeper.getRect().height);
g.setColor(Color.BLUE);
g.fillRect(episode.striker.getRect().x, episode.striker.getRect().y,
episode.striker.getRect().width, episode.striker.getRect().height);
g.setColor(Color.CYAN);
g.fillRect(episode.striker.getAttackRect().x,
episode.striker.getAttackRect().y, episode.striker.getAttackRect().width,
episode.striker.getAttackRect().height);
g.drawImage(keeperImg[episode.keeper.getFrame()],
episode.keeper.getRect().x,
episode.keeper.getRect().y, null);
g.drawImage(ballImg[episode.ball.getFrame()], episode.ball.getRect().x,
episode.ball.getRect().y, null);
g.drawImage(strikerImg[episode.striker.getFrame()],
episode.striker.getRect().x, episode.striker.getRect().y, null);
}

@Override
public void actionPerformed(ActionEvent ae) {
if (start)
episode.run();
if (episode.isEpisodeEnd()) {
data = new DataSample(episode.ballCopy, episode.keeperCopy,
episode.getResults());
time.stop();
}
repaint();
}

@Override
public void mouseClicked(MouseEvent arg0) {
start = !start;
}

@Override
public void mouseEntered(MouseEvent arg0) {
// TODO Auto-generated method stub
}

@Override
public void mouseExited(MouseEvent arg0) {
// TODO Auto-generated method stub
}

```

```
@Override
public void mousePressed(MouseEvent arg0) {
}
```

```
@Override
public void mouseReleased(MouseEvent arg0) {
// TODO Auto-generated method stub
}
}
```

TestSimulator.java

```
package training;
import java.awt.Color;
import java.awt.Dimension;
import java.awt.Font;
import java.awt.Graphics;
import java.awt.Graphics2D;
import java.awt.Image;
import java.awt.Paint;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import java.awt.event.MouseEvent;
import java.awt.event.MouseListener;
import java.awt.image.BufferedImage;
import javax.swing.JApplet;
import javax.swing.Timer;
import soccerApplet.Constants;
import soccerApplet.NeuralNetwork;
import externalUtil.ImageUtil;

/**
 * Simulates the testing of the network
 */
public class TestSimulator extends JApplet implements ActionListener,
MouseListener {

    final static int WIDTH = 955;
    final static int HEIGHT = 595;
    Episode episode;
    DataSample data;
    Dimension offDimension;
    Image offImage;
    Image field;
    Image keeperImg[];
    Image strikerImg[];
    Image ballImg[];
    Graphics offGraphics;
    Timer time;
    boolean start = false;
    int counter = 0;
    int[] output = new int[6];
    int targetSection = 0;
    int eval = 0; // TP=0,TN=1,FP=2,FN=3

    public void init() {
        setLayout(null);
        this.setSize(WIDTH, HEIGHT);
        field = getImage(getDocumentBase(), "images/no net.png");
        BufferedImage img = ImageUtil.makeColorTransparent(this.getClass()
            .getResource("attacker.png"), new Color(0, 115, 0));
        strikerImg = ImageUtil.splitImage(img, 8, 5);
        img = ImageUtil.makeColorTransparent(
            this.getClass().getResource("goalkeeper.png"), new Color(0, 115, 0));
        keeperImg = ImageUtil.splitImage(img, 8, 6);
        img =
            ImageUtil.makeColorTransparent(this.getClass().getResource("ball.png"),
                new Color(0, 115, 0));
```

```
ballImg = ImageUtil.splitImage(img, 4, 1);
episode = new Episode(4, 2);
data = new DataSample(episode.ballCopy, episode.keeperCopy,
    episode.getResults());
networkTest(data);
offImage = createImage(WIDTH, HEIGHT);
offGraphics = offImage.getGraphics();
addMouseListener(this);
}
```

```
public void networkTest(DataSample d) {
    double[] params = new double[6];
    for (int j = 0; j < 6; j++) {
        params[j] = d.getValue(true, j);
    }
    output = NeuralNetwork.getOutput(params);
    if (output[5] == 1) { // shoot
        int value = 0;
        for (int k = 0; k < 5; k++) {
            value += output[k] * Math.pow(2, 5 - k - 1);
        }
        if (value > 30)
            value = 30;
        if (value < 1)
            value = 1;
        targetSection = value - 1;
        if (episode.getResults()[targetSection]) {
            eval = 0;
        } else {
            eval = 2;
        }
    } else {
        boolean success = true;
        for (int i = 0; i < 30; i++) {
            if (episode.getResults()[i]) {
                eval = 3;
                success = false;
                break;
            }
        }
        if (success) {
            eval = 1;
        }
    }
}
```

```
public void start() {
    time = new Timer(1, this);
    time.start();
    // repaint();
}
```

```
public void stop() {
    // offImage = null;
    // field = null;
    // offGraphics = null;
}
```

```
public void paint(Graphics g) {
    update(g);
}
```

```
public void update(Graphics g) {
    offGraphics.drawImage(field, 0, 0, this);
    paintComponent(offGraphics);
    g.drawImage(offImage, 0, 0, null);
}
```

```
public void paintComponent(Graphics g) {
    Graphics2D seeThrough = (Graphics2D) g;
```

```

Paint shadowPaint = new Color(0, 0, 0, 180);
seeThrough.setPaint(shadowPaint);
seeThrough.fillRect(0, 0, 250, HEIGHT);
g.setColor(Color.GREEN);
g.setFont(new Font("Serif", Font.BOLD, 36));
g.drawString("EPISODE", 40, 50);
g.setColor(Color.PINK);
g.setFont(new Font("Serif", Font.BOLD, 24));
g.drawString("Results:", 20, 210);
g.setColor(Color.WHITE);
g.setFont(new Font("Dialog", Font.BOLD, 12));
if (episode.getGoalSection() > 0) {
for (int i = 0; i < episode.getGoalSection(); i++) {
if (i < 15)
g.drawString("Section " + (i + 1) + ": " + episode.getResults()[i], 20,
230 + 20 * i);
else
g.drawString("Section " + (i + 1) + ": " + episode.getResults()[i], 130,
230 + 20 * (i - 15));
}
}
g.setColor(Color.PINK);
g.setFont(new Font("Serif", Font.BOLD, 24));
g.drawString("Neural Network:", 20, 90);
g.setColor(Color.WHITE);
g.setFont(new Font("Dialog", Font.BOLD, 12));
for (int i = 0; i < 6; i++) {
if (i < 3)
g.drawString("Input " + (i + 1) + ": " + data.getValue(true, i), 20,
110 + 20 * i);
else
g.drawString("Input " + (i + 1) + ": " + data.getValue(true, i), 130,
110 + 20 * (i - 3));
}
g.drawString("Output " + ": ", 20, 180);
for (int i = 0; i < 6; i++) {
g.drawString("" + output[i], 80 + 10 * i, 180);
}
if (output[5] == 1) {
g.drawString("(Section " + (targetSection + 1) + ")", 150, 180);
} else
g.drawString("(No Section)", 150, 180);
g.setColor(Color.PINK);
g.setFont(new Font("Serif", Font.BOLD, 24));
g.drawString("Evaluation:", 20, 550);
if (episode.isEpisodeEnd()) {
g.setColor(Color.WHITE);
g.setFont(new Font("Dialog", Font.BOLD, 12));
switch (eval) {
case 0: {
g.drawString("SUCCESS! (TRUE POSITIVE)", 20, 570);
break;
}
case 1: {
g.drawString("SUCCESS! (TRUE NEGATIVE)", 20, 570);
break;
}
case 2: {
g.drawString("FAILURE! (FALSE POSITIVE)", 20, 570);
break;
}
case 3: {
g.drawString("FAILURE! (FALSE NEGATIVE)", 20, 570);
break;
}
default:
break;
}
}
g.setColor(Color.BLACK);

```

```

g.fillRect(episode.goal.left, episode.goal.y - Constants.GOAL_HEIGHT,
Constants.GOAL_WIDTH, Constants.GOAL_HEIGHT);
g.setColor(Color.GRAY);
for (int i = 0; i < 30; i++) {
g.drawRect(episode.goal.left + i * Constants.BALL_DIAMETER,
episode.goal.y
- Constants.GOAL_HEIGHT, Constants.BALL_DIAMETER,
Constants.GOAL_HEIGHT);
}
if (episode.getGoalSection() >= 0 && episode.getGoalSection() < 30) {
g.setColor(Color.YELLOW);
g.fillRect(episode.goal.left + episode.getGoalSection()
* Constants.BALL_DIAMETER, episode.goal.y -
Constants.GOAL_HEIGHT,
Constants.GOAL_WIDTH / 30, Constants.GOAL_HEIGHT);
} else if (episode.getGoalSection() >= 30) {
g.setColor(Color.YELLOW);
g.fillRect(episode.goal.left + 29 * Constants.BALL_DIAMETER,
episode.goal.y
- Constants.GOAL_HEIGHT, Constants.GOAL_WIDTH / 30,
Constants.GOAL_HEIGHT);
}
g.setColor(Color.RED);
g.fillRect(episode.keeper.getRect().x, episode.keeper.getRect().y,
episode.keeper.getRect().width, episode.keeper.getRect().height);
g.setColor(Color.BLUE);
g.fillRect(episode.striker.getRect().x, episode.striker.getRect().y,
episode.striker.getRect().width, episode.striker.getRect().height);
g.setColor(Color.CYAN);
g.fillRect(episode.striker.getAttackRect().x,
episode.striker.getAttackRect().y, episode.striker.getAttackRect().width,
episode.striker.getAttackRect().height);
g.drawImage(keeperImg[episode.keeper.getFrame()],
episode.keeper.getRect().x,
episode.keeper.getRect().y, null);
g.drawImage(ballImg[episode.ball.getFrame()], episode.ball.getRect().x,
episode.ball.getRect().y, null);
g.drawImage(strikerImg[episode.striker.getFrame()],
episode.striker.getRect().x, episode.striker.getRect().y, null);
}

@Override
public void actionPerformed(ActionEvent ae) {
if (start)
episode.run();
if (episode.isEpisodeEnd()) {
data = new DataSample(episode.ballCopy, episode.keeperCopy,
episode.getResults());
networkTest(data);
time.stop();
}
repaint();
}

@Override
public void mouseClicked(MouseEvent arg0) {
start = !start;
}

@Override
public void mouseEntered(MouseEvent arg0) {
// TODO Auto-generated method stub
}

@Override
public void mouseExited(MouseEvent arg0) {
// TODO Auto-generated method stub
}

@Override

```

```

public void mousePressed(MouseEvent arg0) {
}

@Override
public void mouseReleased(MouseEvent arg0) {
// TODO Auto-generated method stub
}
}

```

ImageUtil.java

```

package externalUtil;
import java.awt.AlphaComposite;
import java.awt.Color;
import java.awt.Graphics2D;
import java.awt.RenderingHints;
import java.awt.image.BufferedImage;
import java.net.URL;
import javax.imageio.ImageIO;

/**
 * @author Josiah Hester from
 * http://www.javalobby.org/articles/ultimate-image/#13
 */
public class ImageUtil {

    public static BufferedImage loadImage(URL ref) {
        BufferedImage bimg = null;
        try {
            bimg = ImageIO.read(ref);
        } catch (Exception e) {
            e.printStackTrace();
        }
        return bimg;
    }

    public static BufferedImage loadTranslucentImage(URL url, float
transperancy) {
        // Load the image
        BufferedImage loaded = loadImage(url);
        // Create the image using the
        BufferedImage aimg = new BufferedImage(loaded.getWidth(),
loaded.getHeight(),
        BufferedImage.TRANSLUCENT);
        // Get the images graphics
        Graphics2D g = aimg.createGraphics();
        // Set the Graphics composite to Alpha
        g.setComposite(AlphaComposite.getInstance(AlphaComposite.SRC_OVER,
transperancy));
        // Draw the LOADED img into the prepared receiver image
        g.drawImage(loaded, null, 0, 0);
        // let go of all system resources in this Graphics
        g.dispose();
        // Return the image
        return aimg;
    }

    public static BufferedImage makeColorTransparent(URL ref, Color color)
{
        BufferedImage image = loadImage(ref);
        BufferedImage dimg = new BufferedImage(image.getWidth(),
image.getHeight(),
        BufferedImage.TYPE_INT_ARGB);
        Graphics2D g = dimg.createGraphics();
        g.setComposite(AlphaComposite.Src);
        g.drawImage(image, null, 0, 0);
        g.dispose();
        for (int i = 0; i < dimg.getHeight(); i++) {

```

```

for (int j = 0; j < dimg.getWidth(); j++) {
    if (dimg.getRGB(j, i) == color.getRGB()) {
        dimg.setRGB(j, i, 0x8F1C1C);
    }
}
}
return dimg;
}

```

```

public static BufferedImage horizontalFlip(BufferedImage img) {
    int w = img.getWidth();
    int h = img.getHeight();
    BufferedImage dimg = new BufferedImage(w, h, img.getType());
    Graphics2D g = dimg.createGraphics();
    g.drawImage(img, 0, 0, w, h, 0, 0, h, null);
    g.dispose();
    return dimg;
}

```

```

public static BufferedImage verticalFlip(BufferedImage img) {
    int w = img.getWidth();
    int h = img.getHeight();
    BufferedImage dimg = dimg = new BufferedImage(w, h,
img.getColorModel().
    _getTransparency());
    Graphics2D g = dimg.createGraphics();
    g.drawImage(img, 0, 0, w, h, 0, h, w, 0, null);
    g.dispose();
    return dimg;
}

```

```

public static BufferedImage rotate(BufferedImage img, int angle) {
    int w = img.getWidth();
    int h = img.getHeight();
    BufferedImage dimg = dimg = new BufferedImage(w, h, img.getType());
    Graphics2D g = dimg.createGraphics();
    g.rotate(Math.toRadians(angle), w / 2, h / 2);
    g.drawImage(img, null, 0, 0);
    return dimg;
}

```

```

public static BufferedImage resize(BufferedImage img, int newW, int
newH) {
    int w = img.getWidth();
    int h = img.getHeight();
    BufferedImage dimg = dimg = new BufferedImage(newW, newH,
img.getType());
    Graphics2D g = dimg.createGraphics();
    g.setRenderingHint(RenderingHints.KEY_INTERPOLATION,
        RenderingHints.VALUE_INTERPOLATION_BILINEAR);
    g.drawImage(img, 0, 0, newW, newH, 0, 0, w, h, null);
    g.dispose();
    return dimg;
}

```

```

public static BufferedImage[] splitImage(BufferedImage img, int cols, int
rows) {
    int w = img.getWidth() / cols;
    int h = img.getHeight() / rows;
    int num = 0;
    BufferedImage imgs[] = new BufferedImage[w * h];
    for (int y = 0; y < rows; y++) {
        for (int x = 0; x < cols; x++) {
            imgs[num] = new BufferedImage(w, h, img.getType());
            // Tell the graphics to draw only one block of the image
            Graphics2D g = imgs[num].createGraphics();
            g.drawImage(img, 0, 0, w, h, w * x, h * y, w * x + w, h * y + h, null);
            g.dispose();
            num++;
        }
    }
}

```

```

    }
    return imgs;
}

public static BufferedImage[][] split(BufferedImage img, int cols, int
rows) {
    int w = img.getWidth() / cols;
    int h = img.getHeight() / rows;
    int num = 0;
    BufferedImage imgs[][] = new BufferedImage[rows][cols];
    for (int y = 0; y < rows; y++) {
        for (int x = 0; x < cols; x++) {
            imgs[y][x] = new BufferedImage(w, h, img.getType());
            // Tell the graphics to draw only one block of the image
            Graphics2D g = imgs[y][x].createGraphics();
            g.drawImage(img, 0, 0, w, h, w * x, h * y, w * x + w, h * y + h, null);
            g.dispose();
            num++;
        }
    }
    return imgs;
}
}

```

```

    return TOO_BIG;
} else {
    return d;
}
}

/**
 * A bounded version of Math.exp.
 *
 * @param d
 *     What to calculate.
 * @return The result.
 */
public static double exp(final double d) {
    return bound(Math.exp(d));
}
}

```

BoundNumbers.java

```

package externalUtil;
/**
 * Introduction to Neural Networks with Java, 2nd Edition
 * Copyright 2008 by Heaton Research, Inc.
 * http://www.heatonresearch.com/books/java-neural-2/
 *
 * ISBN13: 978-1-60439-008-7
 * ISBN: 1-60439-008-5
 *
 * This class is released under the:
 * GNU Lesser General Public License (LGPL)
 * http://www.gnu.org/copyleft/lesser.html
 */
/**
 * BoundNumbers: A simple class that prevents numbers from getting either
 too
 * big or too small.
 *
 * @author Jeff Heaton
 * @version 2.1
 */
public class BoundNumbers {

    /**
     * Too small of a number.
     */
    public static final double TOO_SMALL = -1.0E20;
    /**
     * Too big of a number.
     */
    public static final double TOO_BIG = 1.0E20;

    /**
     * Bound the number so that it does not become too big or too small.
     *
     * @param d
     *     The number to check.
     * @return The new number. Only changed if it was too big or too small.
     */
    public static double bound(final double d) {
        if (d < TOO_SMALL) {
            return TOO_SMALL;
        } else if (d > TOO_BIG) {

```

10.2 Matlab (R2011b) Codes

PreAnalysis.m

```
%-----READ THE DATA-----
data = xlsread('data.xls',1);
inputs = [data(1,:);data(2,:);data(3,:);data(4,:);data(5,:);data(6,:)];
targets = xlsread('data.xls',2);
sections = xlsread('data.xls',3);

%-----HISTOGRAMS-----
hist(inputs(1,:),100)
title('X Coordinates of the Ball', 'fontsize', 14)
hist(inputs(2,:),100)
title('Y Coordinates of the Ball', 'fontsize', 14)
hist(inputs(3,:),100)
title('X Coordinates of the Goalkeeper', 'fontsize', 14)
hist(inputs(4,:),100)
title('Y Coordinates of the Goalkeeper', 'fontsize', 14)
hist(inputs(5,:),100)
title('Distances of Ball from Goal', 'fontsize', 14)
hist(inputs(6,:),100)
title('Angles of Ball from Goal', 'fontsize', 14)

[N,binCenters] = hist(sections,31);
hBar = bar(binCenters,N,'hist');
title('Best Sections in the Goal (-1 for "dont shoot" cases)', 'fontsize', 14);
index = (binCenters+.5) < diff(binCenters(1:2))/2; %# Find the index of the
        %# bin containing 0.7
colors = [index(:) ... %# Create a matrix of RGB colors to make
        zeros(numel(index),1) ... %# the indexed bin red and the other bins
        0.5.*(~index(:)); %# dark blue
set(hBar,'FaceVertexCData',colors); %# Re-color the bins

%-----SCATTER PLOTS-----
scatter(inputs(1,:),sections,5,sections,'filled')
lsline;
xlabel('X Coordinate of Ball')
ylabel('Best Section in Goal (-1 if none)')

scatter(inputs(2,:),sections,5,sections,'filled')
lsline;
xlabel('Y Coordinate of Ball')
ylabel('Best Section in Goal (-1 if none)')

scatter(inputs(3,:),sections,5,sections,'filled')
lsline;
xlabel('X Coordinate of Goalkeeper')
ylabel('Best Section in Goal (-1 if none)')

scatter(inputs(4,:),sections,5,sections,'filled')
lsline;
xlabel('Y Coordinate of Goalkeeper')
ylabel('Best Section in Goal (-1 if none)')

scatter(inputs(5,:),sections,5,sections,'filled')
lsline;
xlabel('Distance of Ball from Goal')
ylabel('Best Section in Goal (-1 if none)')

scatter(inputs(6,:),sections,5,sections,'filled')
lsline;
xlabel('Angle of Ball from Goal')
ylabel('Best Section in Goal (-1 if none)')
```

```
%-----CORRELATIONS-----
corr(inputs')
corr(inputs',targets')

%---READ DATA "SHOOTABLE" CASES ONLY---
data = xlsread('dataarrangedsuccess.xls',1);
inputs = [data(1,:);data(2,:);data(3,:);data(4,:);data(5,:);data(6,:)];
targets = [data(7,:);data(8,:);data(9,:);data(10,:);data(11,:);data(12,:)];
sections = data(19,:);

%-----HISTOGRAM 2-----
[N,binCenters] = hist(sections,30);
hBar = bar(binCenters,N,'hist');

title('Best Sections in the Goal ("shootable" cases only)', 'fontsize', 14);
index = (binCenters+.5) < diff(binCenters(1:2))/2; %# Find the index of the
        %# bin containing 0.7
colors = [index(:) ... %# Create a matrix of RGB colors to make
        zeros(numel(index),1) ... %# the indexed bin red and the other bins
        0.5.*(~index(:)); %# dark blue
set(hBar,'FaceVertexCData',colors); %# Re-color the bins
```

Training.m

```
%-----READ THE DATA-----
data = xlsread('data.xls',1);
inputs = [data(1,:);data(2,:);data(3,:);data(4,:);data(5,:);data(6,:)];
targets = [data(7,:);data(8,:);data(9,:);data(10,:);data(11,:);data(12,:)];

%-----CREATE NETWORK-----
H = 5;
TF = {'tansig','logsig'};
BTF = 'traingdm';
BLF = 'learnngdm';
PF = 'mse';
IPF = {};
OPF = {};
DDF = 'dividerand';
net = newff(inputs,targets,H,TF,BTF,BLF,PF,IPF,OPF,DDF);

%-----CHANGE NETWORK PROPERTIES-----
net.plotFcns = {'plotperform','plottrainstate','ploterrhist'};
net.trainParam.goal = 0.01;
net.trainParam.max_fail=50;
net.trainParam.epochs = 50000;
net.trainParam.min_grad = 1.0e-10;
net.trainParam.showCommandLine=true;
net.trainParam.show=100;
net.trainParam.lr=1;
net.trainParam.mc=9;

%-----INITIALIZE WEIGHTS AND BIASES-----
net.IW{1} = rand(5,6)-.5;
net.LW{2} = rand(6,5)-.5;
net.b{1} = rand(5,1)-.5;
net.b{2} = rand(6,1)-.5;

%-----TRAIN NETWORK-----
inputs=mapminmax(inputs);
net = train(net,inputs,targets);

%-----GET WEIGHTS AND BIASES-----
net.IW{1}
net.LW{2}
```

```
net.b{1}
net.b{2}
```

PostAnalysis.m

```
%-----READ THE DATA-----
data = xlsread('data.xls',1);
inputs = [data(1,:);data(2,:);data(3,:);data(4,:);data(5,:);data(6,:)];
targets = [data(7,:);data(8,:);data(9,:);data(10,:);data(11,:);data(12,:)];

%-----LOAD TRAINED NETWORK-----
load('D:\Program Files\MATLAB\R2011b\bin\nnets\GDM.mat')

%-----GET NETWORK OUTPUTS-----
outputs = round(sim(net,inputs));

%-----CONFUSION MATRICES-----
plotconfusion(round(targets(6,:)),outputs(6,:))
title('Target-Output 6: Confusion Matrix', 'fontsize', 14);
plotconfusion(round(targets(1,:)),outputs(1,:))
title('Target-Output 1: Confusion Matrix', 'fontsize', 14);
plotconfusion(round(targets(2,:)),outputs(2,:))
title('Target-Output 2: Confusion Matrix', 'fontsize', 14);
plotconfusion(round(targets(3,:)),outputs(3,:))
title('Target-Output 3: Confusion Matrix', 'fontsize', 14);
plotconfusion(round(targets(4,:)),outputs(4,:))
title('Target-Output 4: Confusion Matrix', 'fontsize', 14);
plotconfusion(round(targets(5,:)),outputs(5,:))
title('Target-Output 5: Confusion Matrix', 'fontsize', 14);

%-----CORRELATION-----
corr(targets(6,:),outputs(6,:))

%----READ DATA "SHOOTABLE" CASES ONLY---
data = xlsread('dataarrangedsuccess.xls',1);
inputs = [data(1,:);data(2,:);data(3,:);data(4,:);data(5,:);data(6,:)];
targets = [data(7,:);data(8,:);data(9,:);data(10,:);data(11,:);data(12,:)];

%----HISTOGRAM OF NETWORK OUTPUTS-----
outputs = round(sim(net,inputs));
sections = [outputs(1,:);outputs(2,:);outputs(3,:);outputs(4,:);outputs(5,:)];
d = bi2de(round(sections),'left-msb');
hist(d,30);
title('Histogram of Network Outputs 1-5 (best sections)', 'fontsize', 14);
```


century long existence in its current (professional) form, soccer continually evolved into an all-skills sport. In order to be a good soccer player, you can't simply focus on a single skill. You could be an extraordinary free kick taker and score every one of two close range kicks, but if you have no passing or receiving skills for example, no coach will risk throwing you in the team and literally playing 10 versus 11.

The basic skills are not "seen" during a match, but they allow you to build upon them and perform moves that would otherwise be impossible.

This section is an examination of the basic soccer skills. If players can't pass and catch the ball in basketball, they can't play the game. If they can't pass and receive the ball in soccer, they are useless. It should be emphasized that these skills are critical to be successful. Repetition of these skills is the key to learning and mastering them.

But still remember, only reading these will never be enough. You need to practice, practice and practice for thousands of hours.

Having said those, let's now take a look at the main soccer fundamental skills that are required in a modern day player.

Begin

Navigation

- Skills
- Passing
- Heading
- Receiving
- Dribbling
- Shooting
- Strategy
- Positions
- Formations
- Tactics
- Conditioning
- Fitness
- Nutrition
- Injuries

Footbox

This site is made for the purpose of.

References

The information on these site were obtained from the following.

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- Twitter
- Facebook
- Forrst
- Flickr

Designmoo

Have a Laugh

Ryan Giggs

Celebrities

Dora the Explorer

Gay Ronaldo

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UP Manila

Design by

Renz Rollon

learnskillspass.html

```
<!DOCTYPE html><title>WASMS I Fundamentals</title><meta
charset="utf-8"/><link rel="stylesheet" href="styles/elegant-press.css"
type="text/css"/><script src="scripts/elegant-press.js"
type="text/javascript"/></script><link rel="stylesheet" type="text/css"
href="styles/leanbackPlayer.default.css"/><script type="text/javascript"
src="scripts/leanbackPlayer.pack.js"/></script><script type="text/javascript"
src="scripts/leanbackPlayer.en.js"/></script><script type="text/javascript"
src="scripts/leanbackPlayer.de.js"/></script></head><body><div
class="main-container"><header><h1><a href="index.html">W A S M
S</a></h1><p id="tagline"><strong>Soccer Motivation
Tool</strong></p></header></div><div class="main-container"><div
id="sub-headline"></div></div><div class="main-container"><div id="nav-
container"><nav><ul class="nav"><li><a href="index.html"> Home
</a></li><li><a href="overview.html"> Soccer Overview </a></li><li><a
href="rules.html"> Laws of the Game </a></li><li class="active"><a
href="learn.html"> Fundamentals</a></li><li><a href="local.html"> Local
Setting </a></li><li><a href="game.html"> Play </a></li><li
class="last"><a href="questions.html"> Quiz </a></li></ul></nav><div
class="clear"></div></div></div><div class="main-container"><div
class="container1"><div id="breadcrumb"><ul><li class="first">You Are
Here</li><li></li></ul></div><div id="index.html">Homepage</div><div id="learn.html">Fundamentals</div><div id="skills.html">Skills</div><div id="passing.html">Passing</div></div></div><div class="box"><div
class="content"><h1>Passing</h1><div class="portfolio"><div
class="leanback-player-video"><video width="600" height="420"
preload="metadata" ><source src="videos/pass.webm"
type=video/webm;codecs=vp8, vorbis"/><!-- <source src="videos.mp4"
type=video/mp4;codecs=avc1.42E01E, mp4a.40.2"/><source
src=../folder/video.webm" type=video/webm;codecs=vp8,
vorbis"/><source src=../folder/video.ogv" type=video/ogg;codecs="theora,
vorbis"/></video></div></div><br><p>Everyone
likes to see great dribbling skills, long range shots and flying headers but all
professionals know that in order to make this all happen, you need to know
how to <strong>pass the ball</strong>. Passing allows your team to keep
possession of the ball and find holes in the opposing team's defense. As a
team, try to keep the ball moving and spread the defense, taking advantage
of open spaces. </p><br><p>A player in possession of the ball should have
a range of passing options open to him. He has to assess all options and
decide which is the right pass to make. Depending on how fast the defenders
close you down, you may have a lot of time to decide, but sometimes you
have no time at all.</p><br><p>The game is all about getting the ball
into advanced positions. If a forward pass is on, that should be the preferred
option. However, if a sideways pass or a backwards pass means that you
won't lose the ball then these can be valuable too. Great soccer players have
great awareness of what is going on around them, even before they receive
the ball. That way they can make decisions quicker giving them the
edge.</p><br><p><strong>Timing a pass perfectly is crucial</strong>.
Even if a pass is executed perfectly, it can go wrong if it is made too soon or
too late. The receiver must make himself available to receive a pass and the
player with the ball must time the pass precisely. </p><!--<p>There are
different types of passing that you can use for different
situations.</p></div></div><h6>To-Foot Pass</h6><p>The to-foot pass is
probably the most simple of passes and most common. The proper way to
use do this pass is to first put the foot, the one that you are not passing the
ball with, even with the ball. Next use the inside of your foot to pass the ball.
This pass is best when no one is marking a player or the field is clear of
player that could block the pass. Remember to keep the ball on the
ground.</p><br></li><li><h6>Through Pass</h6><p>The through
pass is a pass in which the ball is played into space and a defender runs on to
it. Through balls are a great way to get behind the defense and work best
with a fast player. Using the same ways that you used in the to-feet pass,
play the ball into space. Make sure the player is ready for the through pass.
```

Also, remember that a through pass doesn't have to be on the ground. Through passes are perfect when a player is being marked tight or you see gaps in the defense.

Chip Pass

A chip pass is like a through pass but you chip the ball over a defender. To perform a chip pass lock your ankle. Place your opposite foot behind the ball and hit under the ball to get air on it. The chipped ball should have backspin on it. Great to use when there is a player between the receiver and the passer.

One Touch Pass

A one touch pass is passing it immediately once you get the ball without another touch. There will be many times in which you need to use this in a game. Obviously the best time is when there is a quick opening for a through ball or when you are under pressure. When doing a one touch pass get ready to pass the ball at the right angle before the ball comes. Remember if you don't need to put as much power on a one touch ball.

Navigation

- Skills
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- Heading
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- Shooting
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- Injuries

Featured: Crazy Back Pass



Cristiano Ronaldo is one of the greatest players to show unorthodox soccer moves like the "backpassing", or passing the ball with your back, literally. In this one, CR had blasted a shot towards goal only for the opponent goal keeper to punch the ball skywards. As the ball dropped down, Cristiano arched forwards and let it bounce off his back and straight into the path of his teammate.

Contact Us

Contact us at...
References
The information on these site were obtained from the following..

- Twitter
- Facebook
- Forrst
- Flickr
- Designmoo

Latest Gallery

Have a Laugh

- Ryan Giggs
- Celebrities
- memeB
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WASMS I Fundamentals

Soccer Motivation

Soccer Motivation

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Home
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Fundamentals

Local Setting

Game

Quiz

breadcrumb

Homepage

Fundamentals

- Skills
- Heading
- Content

Portfolio

leanback-player-video

video

source

video/webm; codecs=vp8, vorbis

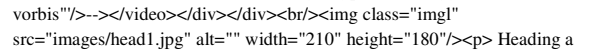
video/mp4; codecs=avc1.42E01E, mp4a.40.2

folder/video.webm

video/webm; codecs=vp8, vorbis

folder/video.ogv

video/ogg; codecs=theora, vorbis



Heading

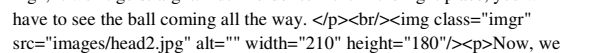
Heading a soccer ball is a forced mechanics that you will probably have hard time learning at first. This is because as humans, we are naturally afraid of hitting an object that's moving towards us with our heads. In order to learn how to head a soccer ball correctly, you'll first have to overcome this fear.

Remember how the ball hurt your head the first time you tried heading it? That's most likely because you let the ball hit your head and not vice versa.

If you charge at the ball and hit it first, it's the ball that will take most of the shock and not your head. Just try it a couple of times on your next practice and you'll notice it's not all that painful.

Another important aspect of heading correctly is learning where to hit the ball and hitting it with the correct part of your forehead. The area you should try hitting the ball with is the upper part of your forehead, the part where the skull is slightly bumped outwards. This area is tough and is composed simply of skin and bone, so there's no pain involved when hitting the ball with it.

You should focus on hitting the ball around its equator. Otherwise, if you hit it too low or too high, it won't go straight. But in order to hit it in the right place, you will have to see the ball coming all the way.



Now, we have a natural instinct to close our eyes when hitting something with our heads and that's the second instinct you'll have to suppress. If you can't see

the ball, you can't hit it right and there's a chance it might even smack you in the face! Trust me, you don't want that.

Lastly, we should learn how to apply force to a header. It might seem that the strength in a soccer header comes from the neck, but in truth, the neck plays a very small role in the final force formula. It's actually your **back** and your abdominal muscles that do most of the work, with the neck playing a secondary role. So if you want to obtain strong headers, make sure you work your lower back and abdomen extensively.

Now that you know how to head a soccer ball correctly, let's see the heading arsenal you have available as a soccer player.

Standard Header

This will be the most used heading technique in a match, regardless of the position you play on. You'll be using the heading technique explained above: arch your back, hit the ball with the upper forehead, etc. Standard headers can be used to push the ball in the back of the net, pass or redirect a flying ball or as a defensive clearance.

Glancing Header

The glancing header is mostly used as a finish move, although you might also want to use this technique as a pass. It involves turning your head in the direction you want to pass on the ball to, without actually hitting the ball, but simply glancing it to give it a slight deflection. Glancing headers should usually be used in situations where the cross has enough force to make a simple deflection dangerous enough.

Diving Header

Probably the hardest type of header in your arsenal, but nevertheless a very efficient and spectacular one. You can try a diving header when the cross is too far out to be reached with your foot and usually closer to the goal than 11-12 yards, or else the diving header might be in vain. When performing a diving header, make sure you extend your arms forward to help you land on them, otherwise it could get ugly. At the same time, make sure you don't commit handball by extending them forth like that.

The flick header is a sort of reversed standard header.

You'll be arching your body backwards, not forward like you would do in a standard header and you will have to hit the ball with the back of your head, instead of the upper part of your forehead.

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Boot in the Face



Wolves midfielder Emmanuel Frimpong was taken to hospital with an eye injury he suffered during the 3-2 defeat by Aston Villa. The 20-year-old was struck by the boot of Villa's Stilian Petrov's as he attempted a diving header. "I can't remember too much about it to be honest," Frimpong said afterwards. "I remember heading the ball and, from what I heard, I then got a kick in the face. We'll just have to give it a couple of days and wait for it to settle down."

Outgoing

F. Y. I.

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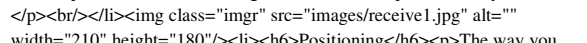
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control is a pretty general term in itself, but a good definition for this skill would be the ability to gain full control of the ball, without giving your opponent the chance for a decisive tackle. In order for you to gain this kind of control over the ball, you'll want to learn how to glue it to your feet as soon as possible, without making use of too much space around you



Positioning

The way you position your body when receiving a ball is extremely important, if you want to excel in this skill. This means that you will have to position yourself in such a way that gives the defender no chance of touching the ball, but also making sure that you can follow-up the game flow with a pass, dribble or shot.

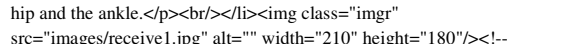
Vision

If you're static when receiving the ball, you have no chance of developing the play other than back to the initial passer, or some free defender. Before moving in to receive the ball, you have to quickly scan the field around you for the best way to move, so that you can open yourself a position for a pass, or in some cases, for a dribble.

Ways of receiving the soccer ball:

Inside/Outside of Foot Receiving

This is the most common type of soccer receiving you'll have to use in a match, since most of the passes you will handle will be low ground ones that you can control with your foot. Most of the mechanics of receiving the ball with either sides of your foot are done with the help of the hip and the ankle.



Sole Receiving

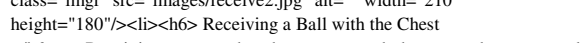
This type is not usually recommended in professional soccer. It's more suitable in futsal (indoor soccer), where the sole of your foot is clear of studs that could hinder the receiving and where there's no chance that the ball could slip from under your foot due to wet grass.

Instep Receiving

Instep receiving is useful when you're trying to control a long ball falling in at a steep angle, or when you're trying to ground a loose ball in the air. It's important to lock the ball and quickly determine its trajectory, so you can move in position to cushion it down with the upper part of your foot. Try to stretch your ankle to the place where the ball will fall and at the exact moment when it makes contact with your foot, pull your ankle backwards a bit, reducing the force the ball hits the ground.

Receiving a Ball with the Thighs

This is an alternative way to receive high balls and it has several advantages and disadvantages over instep receiving. You can cushion the ball easier with your thigh than you would with your foot. However, the main disadvantage in comparison is that the ball will still not be on the ground after receiving it, so you'll have to make an additional move in order to make full use of it.



Receiving a Ball with the Chest

Receiving on your chest has pretty much the same advantages and disadvantages as receiving on your thigh, in comparison with the instep move. However, in some cases controlling the ball with the chest will be your only option, for example when the ball is high and you don't have the time or space to position yourself so you can control it with your foot.

Receiving a Ball with your Head

This might be a bit tricky, since the head offers less cushioning and surface to control the ball with when compared to the thigh, chest or even foot. If you want to receive a high ball with your head, you'll have to use the same cushioning technique as with the instep move, using your neck to dampen the ball's force rather than your foot. You can redirect the ball with your head and then follow up the move with a sprint, or you could try to bring it down to your feet in a static position, by bending your knees and leaning slightly forward.

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Beckham Crossing



Without a doubt David Beckham is one, if not the best crosser of the ball in World. He combines a fantastic, almost unique technique, with an understanding that the cross must be delivered into space, almost invariably missing the first defender and to the middle / back of the area between the 6 yard box and penalty area.

The key to Beckhams crossing ability is that he opens himself out when receiving the ball and controls the ball outside the line of his body. This does two things, he can get his head up to assess the positions of his forwards and the defenders and allows him to whip the ball, striking the outside of the ball, with a great deal of pace and swerve, concentrating on hitting pace, not players. By employing this technique, he knows that it is very unlikely he will hit the ball behind the goal as it will always be swerving back into play and into a space. The other key is that he will always try and miss the first defender and put the cross between defenders and the goalkeeper.

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W A S M

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<div class="box"><div class="content"><h1>Tactics</h1><p>Your team's tactics are very related to your team's formation. And again, it is determined by the primary purpose of the team: to attack, or to defend.

The following team styles represent some of the methods used to control the game and instigate attacks:

A soccer formation can be altered during a soccer match, (if your team wants to defend or attack more) but it will require fast adaptations from you and your teammates. Some formations lend themselves to dynamically change during a match. The ultra offensive 4-3-3 formation can be switched to a more defensive 4-5-1 during a game.</p><h2>Possession football</h2><p>For years, the golden rule for coaches everywhere was 'pass and move', and this tenet is still enshrined in possession football. Quite simply, teams attempt to hold onto the ball for as long as possible, at all times choosing the easiest possible pass (hence the many times you see defenders passing the ball along the defensive line).

There is logic behind this seemingly banal style though. By keeping hold of the ball, the opponent's frustration will hopefully draw out certain players from their starting positions, making spaces for killer through-balls which would otherwise be impossible. Moreover, by keeping possession, you encourage the opponent to chase all over the pitch, impacting their stamina and further allowing you to control the pace of the match.</p>
<h2>Counter-attacking football</h2><p>With 11 players to get past, scoring a goal is a tricky task at the best of times. However, the beauty of counter-attacking football is to use the other team's desperation to score to your own advantage.

By withdrawing into your own half, but keeping a man or two further up the pitch, the goal is to take the ball off the opponent while they have players committed to the attack and thus out of position. Once you have the ball in your own half, you have more space to deliver a through-ball for your strikers, who will be lurking around the halfway line and will have fewer players to negotiate.

This tactic, while extremely risky and reliant on solid defending, can render impressive results and is often utilised by teams who are defending a lead or field a 4-5-1 formation (meaning the lone striker can get isolated in front of 4 defenders if both sides are set up properly).</p>
<h2>Long-ball</h2><p>With 11 players to get past, scoring a goal is a tricky task at the best of times. However, the beauty of counter-attacking football is to use the other team's desperation to score to your own advantage.

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<h2>Wing-play</h2><p>Since the days of Stanley Matthews and Jimmy 'Jinky' Johnstone, the wings have always been a key part of attacking football. By spreading the ball wide, you allow a different angle of attack and offer a number of opportunities for the winger; take on the fullback and drag central defenders out of position, cut inside and drive forward at an angle, or whip in a cross from deep for the strikers to attack.

A further development in wing-play has been to alternate wingers on the left and right flanks. If a winger is losing the battle with his fullback, switching wings can provide a breakthrough for the team. This was effectively employed by Portugal on their way to the final of the 2004 European Championships, with Luis Figo and Cristiano Ronaldo frequently exchanging wing positions.</p>
<h2>Zonal defense</h2><p>Zonal defense is basically self-explanatory. To cover for a team's (or player's) lack of pace or technique, every defender and midfielder is given a particular

zone on the pitch to cover when the opposition has the ball. This is particularly important during set pieces, but does rely heavily on every player fulfilling their duties and keeping their concentration.

Ideally, the opposition will be facing two lines of four players covering the entirety of one half of the pitch. The defensive line is particularly important as, with proper communication and synchronised movement, it can exploit the offside rule and prevent all long-balls and through-balls succeeding. Generally speaking, zonal defense is fundamentally simple but allows sides to deal with all types of attackers on the opponent's team. However, it can be fraught with danger if any individual fails to cover his area of the pitch.</p>
<h2>Man-to-Man marking</h2><p>The term is often associated with continental (and particularly Italian) football and, once again, is extremely simple at its core. Whereas the defenders and midfielders are responsible for zones in zonal defense, man-to-man marking means certain individuals are responsible for guarding a particular opponent. Man-to-man marking is particularly effective alongside a sweeper who has a free role, enabling him/her to support anyone having problems with his opponent and reducing the potency of through-balls and balls played over the top of the defence for forward players to run onto.

However, man-to-man marking requires incredible discipline on the part of the marker, and good decision making on the part of the manager. If a slower defender is matched up with a pacey striker, the results could be grim to say the least!</p></div><div class="sidebar"><div class="subnav"><h3>Navigation</h3>SkillsSkillspassHeadingReceivingDribblingShootingStrategyPositionsFormationsTacticsConditioningFitnessNutritionInjuries</div><div class="clear"></div><div class="main-container"><div class="callout"><div class="callout-container"><div class="container_12"><div class="grid"><article class="footbox"><h2>F. Y. I.</h2>About
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into four categories: general conditioning (aerobic conditioning), specific conditioning (anaerobic conditioning), speed training, and strength and power training. Any good soccer training program will incorporate these four types of training.

General Endurance

General endurance is established through aerobic exercise. Aerobic conditioning is low intensity activity that raises the heart rate while still allowing the body to meet its oxygen needs.

Specific fitness is developed through training that imitates the combined aerobic and anaerobic physical demands of competition. During anaerobic exercise, the body is unable to take in enough oxygen to meet its energy requirements. Specific conditioning trains the athlete to perform in competition.

Speed

Speed can be defined several different ways. Several types of speed are demonstrated in the game of Soccer. There are three different types of Soccer speed: sprint speed, quickness and technical speed.

Technical speed is the combination of physical speed with Soccer skills. It is the speed with which a player is able to control the ball, make decisions and create offensive opportunities. Players with good technical speed are able to collect balls delivered at varying heights, angles and velocity.

Strength and Power

Strength and power often make the difference when it comes to winning tackles, balls in the air, or scoring goals. More importantly, balanced muscular strength optimizes performance and prevents injury. Strength and power can be developed through weight training, calisthenics, plyometric exercises and running.

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Nutrition

Athletes and their trainers often want to know exactly what constitutes a "balanced diet."

A balanced diet provides all the necessary nutrients and calories the body needs to function properly.

These nutrients are carbohydrates, fats, proteins, vitamins, minerals and water. Just as there are many training strategies that achieve victory, there are a number of dietary patterns that provide good nutrition.

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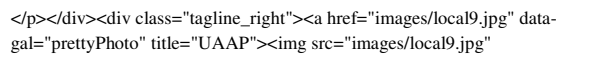
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is best suited for Filipinos</h2><div class="date"><span
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class="year">2010</span></div><p>Despite the global frenzy over the
ongoing Soccer World Cup in South Africa, some diehard sports followers
are puzzled why football, or soccer, lacks popular appeal in the Philippines
unlike basketball which commands tremendous following<br><br>As
former POC president and retired Col. Julian Malonso said:
<strong>"Football is a sport best suited for the Filipinos mainly because the
ball is on the ground unlike basketball where the ball is on the air, hence
giving the tall players undue advantage."</strong></p></div><div
class="tagline_right"><a href="images/local5.jpg" data-gal="prettyPhoto"
title="Filipino kids playing barefoot or wearing rubber flipflops."></a></div></div><div
class="dhtmlgoodies_answer"><div class="tagline_left"><p>Football is not
a tall man's game, explained Malonso, who was president of the Gymnastics
Association of the Philippines before assuming the presidency of the
Philippine Olympic Committee in 1980. In fact, two of the world's greatest
football players ever Pele of Brazil and Diego Maradona, the present coach
of Argentina are just about the same height as most
Filipinos.<br><br>Aside from being a sport where height is might,
basketball is in the 'wrong hands' mainly because the people running it do
not know much about the many aspects of the game. Their only clue about
basketball is that they're basketball league organizers, former broadcasters
and team owners.<br><br>Basketball in this country is buried 'six feet
under the ground,' the straightforward Malonso said. 'I just hope the public is
informed correctly. We are dreaming of winning the Asian Games gold and
qualifying for the 2012 London Olympics, but this dream is not within our
capacity. <br><br>For example, the present Smart Gilas-Pilipinas national
cage team could only finish a miserable seventh in last month's 21st FIBA
Asia Champions Cup held in Doha, Qatar. Before that, the team also had
unimpressive performances in Serbia, home turf of Smart Gilas-Pilipinas
imported Serbian coach Rajko Toroman; Dubai, Australia and the United
States.<br><br>But despite all this, Smart Gilas is not giving up. The team
is now honing for the Jones Cup in Taipei later next month, the Asian
Games in Guangzhou, China, in November and next year's FIBA Asia
qualifying tournament in Turkey for the 2012 London Olympic
Games.</p><br><h6 style="float:right;">By Manolo
Inigo</h6><br></div></div><div class="clear"></div></div><div
class="portfolio"><div class="dhtmlgoodies_question"><div
class="tagline_left"><h2>Why we're not soccer</h2><div
class="date"><span class="day">23</span><span class="month">J U
N</span><span class="year">2010</span></div><p>With the World Cup
2010 madness at its height, when European capitals stand still as their
national teams compete, you are likely to ask yourself: "Are we so different
that we don't play the game everyone's playing around the world?"<br><br>It's not a trivial question. Nearly one billion human
beings are said to be watching the World Cup 2010 games, and we're not.
We're very strangely not participants in what an American columnist termed
as the 'human family at play.' If football, as a historian pointed out, is the
new religion,' then we Filipinos are weirdly the fringe group atheists.

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And it's a game we Filipinos can dream of excelling in some day, unlike the tall man's game, basketball, in which we are genetically handicapped so that we'll never stand out.

Answering the question is even more interesting given the fact that there was a time when football competed with basketball in popularity before World War II. Indeed, our sole 'national stadium' was not a basketball stadium, but was officially named the Rizal Memorial Track and Football Stadium when it was inaugurated in 1934, in the old Manila area.

Many decades later, high school Ateneans of my generation routinely played both football and basketball, and many of the basketball stars of the late 1960s started off in football.

There are several reasons why we lost interest in the global game, some of which reveal our problems as a nation.

First, at least in explaining why we don't care about football, there is indeed something to the communists' big monster: US colonialism.

It was basketball (and baseball) but not football which was our colonizers' favorite game; and the little brown brothers certainly followed their colonizer's culture. Bird, Jabbar, Jordan, Kobe - any Pinoy you meet at the mall would know them. Pele, Maradona, Zidane, Ronaldo-who are they? (What do we do now after the US joined the global game, which is becoming more and more popular every year?)

We are indeed one of the most US-centered cultures in the world. The ancient civilizations of Europe and their modern structures are alien to us. Welfare state? Social democracy? Labor parties? These are as unfamiliar to us as the football stars, even for many educated Filipinos. The parliamentary system, essentially one in which the people's representatives, and not the people directly, choose the nation's leader, is really strange and suspicious to us, even as it has developed over many centuries in Europe to be indubitably the ideal democracy as it prevents ochlocracy, or rule by the angry mob. But our mind-set is still what's best for the USA (the masses directly voting for their leader, even in an era when media can easily manipulate people's sentiments) is still the best for us.

The popularity of basketball is a case study of how capitalism molds a cultural phenomenon and, in the Philippines, its unbridled power.

First, it was US-style, profit-driven television that boosted basketball and practically killed football in the country starting in the 1960s. The 48-minute game was divided into four quarters, with a 15-minute, half-time break and 12 one-minute time outs. It was almost designed for TV advertising-for inserting soap, beer and soft drink song-and-dance commercials. Football took so long, and running at least 90 minutes, with only one half-time break, and no time-out, TV advertising in that game was difficult. (FIFA, the world soccer federation, learned to commercially use television for the World Cup only in the 1990s.) Philippine capitalism strived for every second of basketball fans' attention to be on their product and so they organized professional basketball and named the teams after the corporate entity and their flagship products: Crispa, Toyota, San Miguel, Ginebra, Purefoods, Sta. Lucia Realtors, Talk 'N Text. (In the US, teams were organized by cities, creating some sense of community. But Beermen?)

Second, the Araneta Coliseum ("The Biggest Covered Coliseum in the World") was built in 1959, a deft business move by the Aranetas to move the center of commercial activity from downtown Manila to the family's estate in the then suburban Quezon City. Following the if-you-build-it-they-will-come logic, the Coliseum fast became the site of more and more professional basketball tournaments and, with television coverage, made it more popular than ever. (With the huge crowds at every basketball game, the Aranetas built the first mall in the country, Ali Mall, and its success undoubtedly inspired Henry Sy to change his business model from huge department stores to malls that have now created one of the most mall-dotted metropolises in the world. So thank basketball for our mall culture.)

By Rigoberto Tiglao

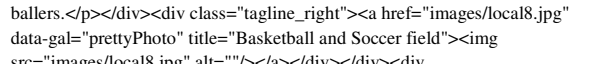
Basketball vs. Soccer

2010

Jaemark Tordecilla is a short geeky graduate of Philippine Science High School, while Rafe Bartholomew is a white 6'3" jock from New York. They met at the intersection of exuberant writing and a passion for Philippine basketball.

For months they

conducted a spirited exchange about all things basketball, often disagreeing about contentious issues, but always driven by a mutual love for the sport that found its most hospitable home in a land of height-challenged ballers.


Part 1: Congratulations!

Congratulations on having perhaps the only basketball book to have a successful launch in the middle of World Cup fever. Here in the Philippines, every time the World Cup rolls around, there's a familiar refrain from local soccer fans - usually bandwagon, and often the type who think that basketball, specifically Philippine basketball, is masa - that Filipinos are better off going into soccer instead of basketball.

But what these people leave out, or don't know, is that we don't really have much of a chance in soccer either. Every World Cup has been won by a country from either Europe or South America. The highest placing that an Asian team has ever had in the competition was the 2002 semifinals appearance by South Korea, which co-hosted the event with Japan, and even then, there were widespread allegations of game-fixing to benefit the home team. Before 2010, South Korea, Asia's traditional soccer powerhouse, had played in 24 World Cup games, winning only 4.

Sports are a domain of big men. Some small guys do excel. But in general, more men with large physical stature stand out, and not only in basketball-even if power, speed, strength and other physical qualities (that can be improved) can help overcome the size advantage.

Isn't it about time we stop trying to apologize for being short people who love a tall man's game? After all, there are so many other embarrassing things we ought to be apologizing for, such as undying love for cheesy late '80s/ early '90s power ballads by groups like Air Supply and Michael Learns to Rock.

Part 2: Fangirls

After reading my review of Pacific Rims, award-winning journalist Roel Landingin told me about a conversation he had with a local corporate bigwig about Philippine basketball fanaticism. The bigwig had been heavily involved in college basketball back in the '50s, and he told Roel that he and his buddies gravitated to basketball because it was the only sport that could draw the interest of collegial cheerleaders at the time. The young lasses weren't so keen about going out onto the soccer field to do a cheer routine, because of that endemic Filipino fear of getting a tan. The basketball game played indoors at the gymnasium, of course, served as protection from that fate.

Having read your book, where you struggled to find out why "the beautiful game" didn't take the Philippines by storm, this explanation made perfect sense to me. In fact, it still makes perfect sense today because, as you point out in the book, the biggest basketball games are social events as much as they are athletic competitions. This is true at every level, whether the teams are playing in the finals of the UAAP, or the Congressman Manhik Manaog inter-barangay invitational cup.

One thing you didn't have time to cover in the book is the impact of female fans on the popularity of basketball, and its stars. (You did have plenty to say about the screaming bading cheerleaders at courtside.) The biggest stars in Philippine basketball history - Freddie Webb, Robert Jaworski, Francis Arnaiz, Alvin Patrimonio, Vince Hizon, even guys like Atoy Co and Samboy Lim - were heartthrobs, something that remains true today with guys like James Yap and Chris Tiu. It gets over the top, with fans lobbying online for NBA general managers to draft the Smart Gilas captain.

While we're on that, do you think PBA players can play at that level? The obvious answer is no, of course, but when I watch someone like the Orlando Magic's JJ Redick thriving in the playoffs, I can't help but think that there's nothing Redick does that one of our talented swingmen like Yap or Dondon Hontiveros couldn't. Of course, there are many other factors why Yap wouldn't want to go stateside: the cultural adjustment, the grueling schedule, the language barrier, his cushy role as the face of the PBA, his stable home life. Ok, maybe not that last one.

Am I crazy? If not, what would it take for one of our guys to make the leap to The Association?

By Jaemark Tordecilla and Rafe Bartholomew

The time has come for soccer

2011

The long-time dream of soccer fans in

the Philippines that their favorite sport could at least be a poor second to basketball in national consciousness may have come. As I have written time and again in this newspaper, **it doesn't make sense for Filipinos to be so obsessed with basketball**. No matter how the genes of Filipinos are evolving as there are more intermarriages with Caucasians, it may take centuries before we can produce a generation of Michael Jordans and Pau Gasols. We will always be handicapped in basketball global competition by our having more "unos" (enanos in the original Spanish word) than giants.

In contrast, soccer or football does not require very tall players. The three players who were nominated in 2010 for the World Player of the Year - Lionel Messi, Andres Iniesta and Xavi Hernandez - are all under six-foot tall. Messi, who won the title for the second consecutive time, has the height of an average Filipino male today. As usual, the person who can make things happen comes from the private sector, the famous businessman-sportsman Manny Pangilinan (usually referred to as MVP). Just before Christmas last year, MVP expressed the hope that a big boost can be given to Philippine football by the surprisingly outstanding performance of the Filipino booters in the semifinals of the AFF Suzuki Cup. They won over the reigning champions, the Vietnamese. They also gave a good fight to the Indonesians who come from a country where there is a national passion for soccer. MVP reminded all and sundry that football is "the greatest spectator sport in the world and we have to be up there in the map of the world and we are not there at all, except this time with the team having done well in Vietnam and Indonesia."

As famous sports commentator Ronnie Nathanielsz wrote in this paper (December 23, 2010), MVP could not have picked a better time to rally for football's cause. The seemingly eternal intramurals among officials of the Philippine Football Association stopped when the International Football Federation (Fifa) ended the leadership dispute by recognizing Mariano Araneta as President in lieu of Jose Mari Martinez. In a recent meeting in Qatar, officials of Fifa expressed their strong support for Mr. Araneta and company. I have personal knowledge of the fact that Fifa would be willing to help the Philippines put up a stadium somewhere in Manila if we can sort out our football politics. As Mr. Nathanielsz reported, Araneta himself said "it's time to move forward and capitalize on the momentum brought by the Azkals." He said his first priority will be "to prepare the team for the Challenge Cup this February." Mr. Araneta also expressed his full support for team manager Dan Palami.

MVP has made it clear that he cannot do it alone: "I hope other corporations, other individuals will support football and I hope the country does as well along with our people." I am sure there are a good number of football enthusiasts in the business community who will respond to the call of MVP. I know a few of them: Fred Uytengsu Jr., President of Alaska Milk Corporation that has been sponsoring the Alaska Cup for the youth for several years now; Hyundai Corporation that also sponsors nationwide tournaments; Danny Moran, one of the founders of Red Ribbon and national team player in the past. I am sure there are others. What is important is that MVP and the other business executives interested in the long-term development of Philippine soccer should get together with the officials of the Philippine Football Federation to prepare a strategic plan for the next 10 years. There are no short cuts to developing a national sport.

In the short run, the national team may be bolstered by imports from abroad like the Youngusband brothers and the goalkeeper Neil Etheridge. There is no substitute, however, to a long-term talent development plan that can be patterned after the famous La Masia school that has brought FC Barcelona (Barca) to the top of world's football. I know I am partly dreaming because such a system requires a lot of financing. But we can start with what we have. First let me explain what La Masia is in Barcelona. It is a training camp put up by the Football Club of Barcelona that takes in boys as early as nine years old. In a business case developed by Professor Pablo Cardona of the IESE Business School, the school is described in great detail. The Financial Times carried an article by Professor Cardona last January 13, 2011. Let me quote from the FT article: "La Masia has been home to more than 500 players over three decades, as both a training academy and boarding house. The original aim of the school was to develop successful football players. It sought out players who were talented, but also had the drive to win and the ability to work as part of a team. Personal development

and athletic performance are made inseparable in the lives of young players... Young players are expected to adopt the team's fast-paced style of play early on. This means they will be able to integrate quickly when the big moment arrives and they join the starting team... La Masia's renown for instilling strong personal values in young players has played a vital role in the school's success. It has also helped convince many parents to let their children join the club, even though the chances of becoming a member of Barcelona's first team are slim."

FC Barcelona has helped put up similar schools in Mexico, Argentina and other Latin American countries. It is not overly ambitious to ask FC Barcelona to do the same thing in the Philippines, either directly or through the Spanish embassy that may have grants for soccer development. I know for a fact that Congressman Charlie Cojuangco has gotten help from another famous Spanish soccer club--the one in Sevilla-- to help train Filipino youth in soccer in Negros Oriental. The important thing is to start somewhere and somehow. My preference is to put up such a school in the city that is the soccer center of the Philippines--Iloilo City, where the costs of living are lower and where there are less distractions for the youth than Manila. One of the most famous players of FC Barcelona was Paulino Alcantara whose mother hailed from Iloilo. In fact, I already have in mind a small school which can be the seed of our version of La Masia. This is called Westbridge High School in Iloilo City. The school has a football team that has beaten all the high school teams in Iloilo City. This is quite a feat in a city where there is a passion for football.

Only through a systematic talent development program can we hope to ever send a Philippine team to the World Cup. I think some of our football officials got carried away by their enthusiasm after the Suzuki Cup victory. Some dared to mention that we may be able to qualify soon for the World Cup. This prompted a cynical remark from a long-time Spanish resident, who played for the famous Real Madrid in his younger days and who has been coaching soccer teams in Manila. I did agree with his cynicism: "Not in our lifetime." It may take decades before we will be ready for the big league. But, as I told him, the journey of a thousand miles starts with the first step. So let us start that version of La Masia somewhere in Iloilo and with Westbridge as a possible cooperating school.

By Bernardo Villegas

U.S. soccer culture must be overhauled

2011

Here is an article discussing how U.S. soccer culture should be developed further and that is by focusing on youth soccer. Their situation is very similar here in the Philippines since we probably had gotten our love for basketball, and not for soccer, from the Americans.

Like them, the right way to overwhelm our culture with soccer is through the youth. Moving on to the article:

The U.S. national team was routed in the CONCACAF Gold Cup final by a Mexican side featuring young attacking talent so good, it likely left even the most biased American fan wistful.

Soccer in US

The U.S. under-17 team was hammered 4-0 by Germany in the second round of the FIFA U-17 World Cup. If the game appeared to match pros against amateurs, it's because it essentially did. All 21 members of Germany's team already are in the systems at major professional clubs.

Top European teams are ignoring U.S. players during their summer spending sprees. Clint Dempsey, the most successful American currently working abroad, is set to begin his sixth season at Fulham, a club that never has qualified for the UEFA Champions League.

It has been a humbling summer for American soccer, but not an unfair or surprising one. The aforementioned adversity is the inevitable product of a youth soccer culture that's very different from much of the world.

Disparate (and often naive) coaching philosophies, along with the pursuit of college scholarships and trophies awarded at myriad youth tournaments, long have governed player development in the U.S. Why ask a competent striker to try a different position, and work on expanding his skill set and tactical understanding, if you've got a chance to win that upcoming Memorial Day showcase?

Meanwhile, foreign footballers are groomed by professional clubs with far more interest in the end product than in an under-15 state title.

The result? No American men play at any of the most prestigious clubs in Europe, and the

U.S. continues to compete at a second-tier level internationally. The U.S. Soccer Federation is well aware of the problem, but culture isn't easy to change. A significant part of the equation is being implemented by Major League Soccer, which has encouraged its 18 clubs to invest in player development by making it easier and cheaper to sign homegrown talent. Many of those MLS youth teams compete exclusively in the U.S. Soccer Development Academy, a four-year-old league for 15- to 18-year olds that stresses training and limited but high-level competition. A few talented Academy products already have made the jump to fully professional play. But what about younger players? What can be done to equip adolescents with the tools, mentality and motivation to commit to training in a professional environment as teenagers? Last year, U.S. Soccer turned to Claudio Reyna to find the answer. Reyna, 37, was born and raised in northern New Jersey, the son of a former pro from Argentina. He rose to become one of the most successful American players ever, captaining the U.S. national team at the 2002 and 2006 World Cup and starring for clubs in England, Germany and Scotland. Over the course of a year in his position as youth technical director, Reyna visited top clubs and training centers around the world to learn more about how they forge premier players. He consulted with coaches and teams throughout the U.S. In April, he unveiled the product of that work -- a coaching curriculum designed to unify the development of American players up to 13 years of age and give them the foundation needed to succeed in more demanding environments. "It's time to look at what we're doing as a coaching force in this country and understand the big picture," Reyna told Sporting News. "The competition isn't a team from Virginia trying to beat a team from D.C. It's the world. The world is our competition. That has to be the mindset of coaches around the country, that they're part of something bigger." The curriculum is comprehensive and outlines systems of play (Reyna prefers the versatile, attacking and ball possession oriented 4-3-3 that fueled decades of dominance at Ajax Amsterdam and FC Barcelona), age-appropriate practice plans, coaching points and philosophies and tactical principles. The idea is to create the same framework of understanding for players, coast to coast. "Imagine our school system if all the teachers just went in and said, 'I'm going to do whatever I want.' We'd be all over the place. We'd be a third-world country in terms of education," Reyna said. "The idea is, let's do the same in soccer. One year builds on the next. Build it up and have a collective vision that prepares kids for the real world." America's unique history presents unique challenges. While club and development systems arose organically in most countries, the sheer size, diverse cultures and primacy of other sports hindered that growth in the U.S. "That's the reason we haven't developed a playing style," he said. At the core is Reyna's insistence that technique comes before trophies. The urge to win at the youth level can lead misdirected coaches and parents to stress size and athleticism over skill and to limit the experimentation and subsequent mistakes a player needs to grow. Understand that, and the wins will come when it matters. "We need our coaches to become educators and teach the game and less managers and coaches trying to win games," Reyna said. "That means making the Monday through Friday the priority versus the Saturday or Sunday." The commonalities at the best places around the world are that young players are in environments where they can relax and develop.

By Bryan Straus

European youth football program

Aug 10 2011

Why the European system may be disastrous to adopt and why the Philippine Football Federation should follow instead the US Youth Soccer Program.

When Everton FC toured United States recently for international friendly matches during its English Premier League preseason, the English club brought along its youth academy team for its own tune-up games. What was revealed during a post-game interview, although expected, shocked many viewers and press. The revelation made the headlines of most sports news of various networks. After a friendly game between Everton FC and Philadelphia Union academy teams, the Everton youth players asked why the American players still go to high school.



Considering the intensity of the rivalries among football clubs in Europe and the demand for high caliber young players to join the team at an early age and the price tag set for them, expect that these young players will choose to miss high school. Many football superstars started at a young age and became professionals while they are in their teens. Cristiano Ronaldo, Wayne Rooney, Lionel Messi, and Cesc Fabregas played already in top leagues while they were still teenagers and earned millions of dollars that will make most executives of big companies envy. The recent acquisition of a seven-year-old Argentinean Leonel Angel Coira to the youth academy of super club Real Madrid grabbed the limelight of world sport news, and surely ignited some more the burning desires of hundreds of young footballers around the world to get into big football clubs.

The following are reasons why Philippine Football Federation (PFF) should be wary with the European system:

1. Out of many millions of youth Argentines pursuing a football career, how many will become Lionel Messi eventually? Very few. How many millions of youths will have a successful football careers at the end. The ratio will not be too high. However, for these countries that have hundreds of millions of passionate supporters, with multilevel professional leagues, and numerous clubs - this is alright as the young players face a lot more options and fallbacks. Meanwhile, the Philippines, that is just starting to gain upsurge of football popularity, does not have those options right now. The prospect of too many Filipino youths who cannot break in to professional leagues someday, with many of them do not possess competitive advantage in education, is too risky to take lightly.
2. Philippines' economy is unlike those European countries whose social and sports programs are better funded. The European system presents a difficult proposal to market to the grass-root level for three reasons. First, many parents still possess very little knowledge about football career possibilities and with no local testimonies they can associate. Second, many families dream that their kids will get them out of poverty someday, if they choose a sports path, they will be more likely to take basketball, boxing, or billiards. Third, it is too challenging for PFF or other government agencies to provide regular allowances for the kids, and without allowances, the program will fizzle out.
3. Neither PFF nor football clubs can afford to support a national-wide youth program financially. Launching a serious youth football program is financially challenging and one needs not be a financial expert to understand that. It requires huge investments on facilities, equipments, and training for both players and coaches. PFF cannot do it alone, and football clubs in the Philippines are not as profitable as the Europeans.

This writer suggests in lieu of the European method, PFF copies the US Youth Soccer Association (USYSA) programs. In comparison with the European practice, the US youth soccer program gives more importance to high school education. To illustrate, high school soccer season does not coincide with other youth development programs such as the USYSA's Olympic Development Program (ODP) and the US Development Academy (USDA). High school season happens in fall, while ODP and USDA are slated from spring to summer. A player is eligible for high school team plus either one of the other two programs. A player can choose only one between ODP and USDA, and not both, or a player may opt to select just one of the three. Whatever he/she decides, it will not jeopardize his/her dream to get into college varsity (various divisions), Major League Soccer (MLS), United Soccer League (USL), Women's professional League (WPS), or the national team as all youth programs have statewide, region-wide, and nation-wide championships. College and professional leagues scouts, do check players on these youth soccer leagues. Even with the American youth system, PFF still cannot do it by itself, it still needs help from another government department - the Department of Education, Culture, and Sports (DECS). This writer will explain why this tandem is very important to the growth of Philippine football in another blog.

By Norberto Obeso

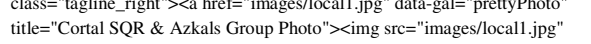
"Soccer is a sport we can be good in!"

Aug 10 2011

Its good to know that brands like Cortal SQR and the Philippine Azkals, our very own National Team, are up

for the challenge to promote soccer/football in the country. They both believe that Soccer can become a sport in which we Filipinos can excel, if given proper attention and support. Yours truly believes so as well.

I used to play Soccer for my small community back then in Germany, when I was about 6-10 years of age. I really love the sport and it's not that difficult to learn.



My favorite position back then (which it still is right now) was the left wing. It's mastering the sport, that can be a steep learning curve. Especially if you're trying to work it out with people aged 18 and above.

Philippine Azkals Winger Yannick Tuazon nailed it when he said that Soccer should be taught to children of young age. He doesn't mean to discourage people of all age to engage with the sport, no, but it makes more sense teaching the young to ensure that our National Team will have very competitive, experienced and skilled players when these mature.

Though neither Cortal SQR and Philippine Azkals seem to have drafted a solid plan to follow on how to promote the sport, it's very good see them trying to make some noise, make people aware that Soccer is here to stay.

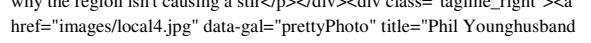
Soccer can be played by people of all ages, almost anywhere you'd like. Yannick was spot on when he said that you could just take a couple of stones and think that these are your goal posts. There's no excuse for someone not to be able to do the sport really!

For those who are not aware yet, Cortal SQR is a pain reliever, a combination of both Ibuprofen and Paracetamol. This medicine can be attained OTC (over the counter) and does not require a doctors' prescription. It is recommended though that you do not exceed recommended dosage.

Many people are yet unaware of this "in-15-minutes-effective" pain reliever, and yes, many people are yet unaware of the sport. It's a good blend of two start ups getting together and rally for the common cause. Promotion of football

Which will hopefully lead the Philippines to the... 2018 World Cup!

By Kevin Paquet



Second Chance

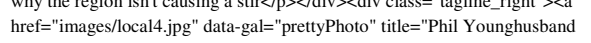
19

2011

A few weeks ago I ran into an Australian article, which analyzed the South East Asian region in terms of football prior to the clash between Australia and Thailand. It put forward the question "Why do South East Asia's national football teams fail consistently when the region loves the game so much?"

It brought forth the cold hard fact that the South East Asian nations, with a population of 600 million football crazy people, have only one World Cup Final appearance between them, which was in 1938 back when Indonesia were known as the Dutch East Indies.

According to the article, one of the main problems as to why the region isn't causing a stir



Phil Youngusband vs. Sri Lanka

on the world stage could be because of its infatuation with the Barclay's Premiere League rather than its domestic equivalents. Other problems mentioned are neglected grass roots development and youth football programs, as well as administrative shortcomings in the part of national football federations.

Coming from a Filipino perspective, this is ironic due to the fact that the other South East Asian nations are giants in our eyes. To the rest of the world, our region barely produces a whimper in the footballing world. With 600 million within the region, one would be forgiven for assuming that we should find enough talented individuals that could make a splash on the world stage.

A very reassuring fact is that the Philippines are being reborn as a footballing nation. We have to realize that we are but infants in football and we can avoid what has weakened our neighbors. Our domestic league is slowly starting to grow, youth teams are getting attention, and corporations and businessmen are pumping money into football. We have the advantage of developing our football culture from the ground up once again. Though action must be taken in order to avoid the situation that our neighbors are currently experiencing.

Though the football that will be shown in our domestic league would most certainly be less impressive compared to the

European leagues, the Filipino must support the teams and its players as fervently as they would in foreign leagues. It is imperative that our league flourishes, in order to ensure that the supply line of homegrown players does not diminish. This would help develop the quality of the football played in our country and in turn the development of the Filipino footballer.

Interest in the youth level must also be encouraged. Hopefully schools will find ways to incorporate football in their curriculum if it proves feasible. More playing surfaces must be developed to allow your everyday Filipino to be able to have a decent pick up game. Footballs and equipment must be made readily available for everybody who wants to play.

I could go on and on with what can be done, but words can only do so much. As a people, we need to support the movement that is football in our country and prove that it is no passing fad. We must fill the rafters and show support for our league domestically and encourage the young ones learning how to kick a ball to dream big. The future is in our hands. We could continue to develop the sport in our country and some day be mentioned in the same breath as England, Germany, and the like, or we could be content and let the sport wallow and stagnate once again.

As a footballing nation this is our second lease in life. Other nations don't have the luxury of starting again like we do.

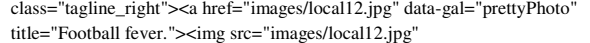
The ball is at your feet. Your move.

By Paolo del Rosario

Football fever

2012

Of course, I exaggerate about there being a football fever in the Philippines. As the superoptimist, though, I am also applying the concept of a "tipping point" as I did to the economy in general. In several speaking engagements and articles I have written on the Philippine economy, I have maintained that the Philippines has accumulated a series of economic, political, and social, and governance reforms over the last quarter of a century, that a critical mass of favorable conditions have led to the tipping point at which our GDP can start growing at 7% or more over the next ten to twenty years. In an analogous fashion, over the last two years during which the Azkals, the national football team, have captured the attention and imagination of the public,



Football fever

we are reaching a tipping point when football (soccer to the Americans) can begin to attract more Filipino children and youth to play the sport as an alternative to the wildly popular basketball.

In recent months, we have seen football going beyond its geographical epicenter, Barotac Nuevo in Iloilo. The City of Calamba in Laguna is giving Barotac Nuevo a run for its money. The vision of the leaders of Calamba is to make it the football center at least in Luzon. For several years now, some towns of Negros Occidental, thanks to the Cojuangcos, have been conducting football clinics coached by players from one of the top football clubs in Spain, FC Seville. Then the second best football club (disclosure: I am a Barca fan) in Spain, Real Madrid, is teaming up with the largest insurance company in Spain, Mapfre, to train children in Sta. Cruz, Davao del Sur, in the art of the beautiful game. More resources are being poured by the business sector in promoting the sport among a wider audience in the country. Some of these companies are Metro Pacific, Alaska Milk Corporation, Nestle, and Nike. There are others and more will follow. I have confidence that the present leadership of the Philippine Football Federation is sufficiently enlightened and united that a clearer direction has been set for the long-term development of football and the avoidance of the political bickerings of the past.

As a contribution to capturing the interest in the game of more Filipino children and youth, I would like to present to them a living hero and role model that they can emulate. I am referring to no one else but Lionel Messi, called by Time Magazine as the best football player in the world—possibly of all time. Starting with my own grand nephews, I do not hesitate to advise the children and the youth to literally idolize this player who has been nicknamed the Flea (because of his small size). Time writer Bobby Ghosh has summarized the reasons for my enthusiasm: "Every generation produces players who change the game with their talent or approach - Puskas, Di Stefano, Pele, Cruyff, Maradona, Zidane. Messi's third Ballon d'Or not only cemented his

place in the galaxy of greats. It also made him the centerpiece of a singular argument. 'Messi is amongst the best ever,' quoth Manchester United Alex Ferguson, perhaps the most successful manager of all time. Pep Guardiola, Messi's coach at Barcelona, declared that his team's superstar 'could be the best player of all time.' The influential British football writer Sid Lowe wrote in the Guardian: 'It is no longer about whether or not Messi is currently the best player in the world; it is about whether he might even be the best there has ever been.' "King Leo", as he is sometimes called, is only 24 years old. That is why children and the youth can look up to him as their idol for many more years to come. I am holding him up for emulation not primarily because he is an outstanding football player. He is a model for the young because of his qualities as a human being, especially his humility. As Ghosh remarked: "Messi hardly looks a monarch: he possesses no hauteur, not even the 'I'm the MAN!' swagger expected of a modern sporting superstar. For someone who has lived half his life in the spotlight, he is surprisingly shy, even painfully so. 'Year after year, I've grown, improved,' he told me after the award ceremony. 'I was lucky to start very young and always have very good colleagues around me as I was coming up, and this has helped me and how I play.'" Unlike other famous football players, he is no primadonna and always is a team player. Over the long run, I think our best football players will come from the lower income groups, not from the elite as they did during my generation in the 1950s and 1960s when the star football players came from such schools as Ateneo, La Salle, Letran, and San Beda. As Real Madrid and Mapfre are doing, the focus should be on children in the public schools such as those in Davao del Sur and other provinces outside the National Capital region. Messi is the perfect role model for these children and youth. He came from a working class family in Argentina. He left his mother country at 13 because his parents could not afford the \$1,000-a-month growth hormone treatment that he needed to remedy his very small size. His height was below the third percentile for his age. FC Barcelona agreed to recruit him and bear the expenses of the hormone treatment. He reached the height today of 169 cm. He grew up, as a man and a player, at the club's famous La Masia youth academy together with such other outstanding players as Xavi Hernandez and Andres Iniesta. It would be great if all the initiatives of business enterprises and football clubs in training Filipino children and youth could result in a Philippine version of the La Masia training camp in Barcelona. But even more important, every major town or city should put up a major football field. This may be something that President Benigno Aquino III could encourage through the Department of Local Government: "a football field in every town." Then, we can really say that the children and youth will be able to say, "It's more fun in the Philippines." Another human quality that aspiring Filipino football players can imitate in Messi is his never saying "enough." As Ghosh said, "...Messi may already have done enough to turn football's divine duopoly into a holy trinity: Pele, Maradona, Messi. But that's not enough for the man who sobs after a lost game, who is known to storm off the pitch if he loses a rondo, or training ground contest: he needs to keep playing, keep winning and (defenders of the world, beware!) keep getting better. 'There's still a lot of time to prepare and to improve,' he says. 'A day will come when those who are now investing in the training of the future football players of the Philippines will get together to bring to our country the great Leo Messi. That day may really bring this country to the tipping point where, at last, we can have our own "football fever" that occurs year in and year out in practically all countries of the world today, except the Philippines.

By Bernardo Villegas

game.html

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questions.html

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ease-out;-o-transition:all 1s ease-out;-ms-transition:all 1s ease-out;transition:all 1s ease-out}#container{width:800px;height:350px;position:relative;border-top:5px solid #999;border-bottom:5px solid #999;margin:0 auto}#slide1 span,#slide2 span,#slide3 span{background:url(..images/contentBg.png) repeat top left transparent;position:absolute;bottom:20px:right:20px;padding:10px}#slide1 .slideheading,#slide2 .slideheading,#slide3 .slideheading{font-family:"ChunkFive Regular", Georgia, serif;color:#FFF;font-size:35px;letter-spacing:2px;margin:0 0 10px}#slide1 p,#slide2 p,#slide3 p{font-family:Artifika, Georgia, serif;color:#FFF;margin:0}.jFlowSlideContainer a{color:#F90;text-decoration:none}.jFlowSlideContainer a: hover{text-decoration:none}.jFlowSlideContainer a:focus{position:relative;top:1px}.jFlowNext div{background:url(..images/arrows.png) no-repeat scroll 0 -35px transparent;height:130px;position:absolute;top:110px:right:-50px;width:50px;cursor:pointer}.jFlowPrev div{background:url(..images/arrows.png) no-repeat scroll -84px -35px transparent;height:130px;position:absolute;top:110px;left:-50px;width:50px;cursor:pointer}.jFlowNext div: hover{background-position:-84px -235px}.jFlowPrev div: hover{background-position:0 -235px}a.readmore{text-align:center;float:right;font-size:13px;color:#fff;text-decoration:none;margin-top:30px;background:#454545;-webkit-border-radius:10px;-moz-border-radius:10px;border-radius:10px;padding:10px}a.readmore: hover{background:#272727}ul.nav li: hover li ul,ul.nav li.sfHover li ul,ul.nav li li: hover li ul,ul.nav li li.sfHover li ul{top:-999em}ul.nav li li: hover ul,ul.nav li li.sfHover ul,ul.nav li li li: hover ul,ul.nav li li li.sfHover ul{left:10em;top:0}.nav li.active a,.nav li: hover,.nav li.sfHover,.nav a:focus,.nav a: hover,.nav a: active{background:#e0e0e0}.nav li li,.nav li li li{background:#eee url(..images/bg.png) repeat}ul.nav ul .sf-sub-indicator,.nav ul a:focus > .sf-sub-indicator,.nav ul a: hover > .sf-sub-indicator,.nav ul a: active > .sf-sub-indicator,.nav ul li: hover > a > .sf-sub-indicator{background-position:-10px 0}.sidebar .subnav ul,#home_featured2 ul,#gallery ul{list-style:none;margin:0;padding:0}#home_featured2 li.last,#gallery li.last{margin-right:0}#mySlides{font-family:Verdana, Arial, sans-serif;color:#FFF}.container1 .slideheading{letter-spacing:2px;text-shadow:0px 5px 5px #333}.sidebar .subnav ul li.current a,.sidebar .subnav ul li a.current{color:#A3443E;background-color:#F9F9F9}.questionbox{height:575px;background-color:#000;padding:0px;}.rulesbox{height:800px;background-color:#000;padding:0px;}.applecontainer{border-top:1px solid #666;padding:0px 0;}/-----| U|ToTop jQuery Plugin 1.1| http://www.mattvarone.com/web-design/uitotop-jquery-plugin/----- *#toTop{display:none;text-decoration:none;position:fixed;bottom:10px;right:10px;overflow:hidden;width:51px;height:51px;border:none;text-indent:-999px;background:url(..images/ui.totop.png) no-repeat left top}#toTopHover{background:url(..images/ui.totop.png) no-repeat left -51px;width:51px;height:51px;display:block;overflow:hidden;float:left;-ms-filter:"progid:DXImageTransform.Microsoft.Alpha(Opacity=0)";-ms-filter:alpha(opacity=0);opacity:0;filter:alpha(opacity=0)}#toTop:active,#toTop:focus{outline:none}/* prettyPhoto */div.pp_default .pp_top .pp_left,div.pp_default .pp_top .pp_right,div.pp_default .pp_bottom .pp_left,div.pp_default .pp_bottom .pp_right,div.pp_default .pp_top .pp_left,div.pp_default .pp_top .pp_right,div.pp_default .pp_bottom .pp_left,div.pp_default .pp_bottom .pp_right{height:13px}div.pp_default .pp_top .pp_left{background:url(..images/prettyPhoto/default/sprite.png) -78px -93px no-repeat}div.pp_default .pp_top .pp_right{background:url(..images/prettyPhoto/default/sprite.png) -112px -93px no-repeat}div.pp_default .pp_content .pp_content_container .pp_left{background:url(..images/prettyPhoto/default/sprite_y.png) -7px 0 repeat-y;padding-left:13px}div.pp_default .pp_content_container .pp_right{background:url(..images/prettyPhoto/default/sprite_y.png) top right repeat-y;padding-right:13px}div.pp_default .pp_next: hover{background:url(..images/prettyPhoto/default/sprite_next.png) center right no-repeat;cursor:pointer}div.pp_default .pp_previous: hover{background:url(..images/prettyPhoto/default/sprite_pre.png) center left no-repeat;cursor:pointer}div.pp_default .pp_expand{background:url(..images/prettyPhoto/default/sprite.png) 0 -29px no-repeat;cursor:pointer;width:28px;height:28px}div.pp_default .pp_expand: hover{background:url(..images/prettyPhoto/default/sprite.png) 0 -56px no-repeat;cursor:pointer}div.pp_default .pp_contract{background:url(..images/prettyPhoto/default/sprite.png) 0 -84px no-repeat;cursor:pointer;width:28px;height:28px}div.pp_default .pp_contract: hover{background:url(..images/prettyPhoto/default/sprite.png) 0 -113px no-repeat;cursor:pointer}div.pp_default .pp_close{width:30px;height:30px;background:url(..images/prettyPhoto/default/sprite.png) 2px 1px no-repeat;cursor:pointer}div.pp_default .pp_gallery ul li a{background:url(..images/prettyPhoto/default/default_thumb.png) center center #f8f8f8;border:1px solid #aaa}div.pp_default .pp_gallery a.pp_arrow_previous,div.pp_default .pp_gallery a.pp_arrow_next{position:static;left:auto}div.pp_default .pp_nav .pp_play,div.pp_default .pp_nav .pp_pause{background:url(..images/prettyPhoto/default/sprite.png) -51px 1px no-repeat;height:30px;width:30px}div.pp_default .pp_nav .pp_pause{background-position:-51px -29px}div.pp_default .pp_arrow_previous,div.pp_default .pp_arrow_next{background:url(..images/prettyPhoto/default/sprite.png) -31px -3px no-repeat;height:20px;width:20px;margin:4px 0}div.pp_default .pp_arrow_next{left:52px;background-position:-82px -3px}div.pp_default .pp_content_container .pp_details{margin-top:5px}div.pp_default .pp_nav{clear:none;height:30px;width:105px;position:relative}div.pp_default .pp_nav .currentTextHolder{font-family:Georgia;font-style:italic;font-color:#999;font-size:11px;left:75px;line-height:25px;position:absolute;top:2px;margin:0;padding:0 0 0 10px}div.pp_default .pp_close: hover,div.pp_default .pp_nav .pp_play: hover,div.pp_default .pp_nav .pp_pause: hover,div.pp_default .pp_arrow_next: hover,div.pp_default .pp_arrow_previous: hover{-ms-filter:"progid:DXImageTransform.Microsoft.Alpha(Opacity=70)";-ms-filter:"progid:DXImageTransform.Microsoft.Alpha(Opacity=70)";filter:alpha(opacity=70);opacity:0.7}div.pp_default .pp_description{font-size:11px;font-weight:700;line-height:14px;margin:5px 50px 5px 0}div.pp_default .pp_bottom .pp_left{background:url(..images/prettyPhoto/default/sprite.png) -78px -127px no-repeat}div.pp_default .pp_bottom .pp_middle{background:url(..images/prettyPhoto/default/sprite_x.png) bottom left repeat-x}div.pp_default .pp_bottom .pp_right{background:url(..images/prettyPhoto/default/sprite.png) -112px -127px no-repeat}div.pp_default .pp_loaderIcon{background:url(..images/prettyPhoto/default/loader.gif) center center no-repeat}div.light_rounded .pp_top .pp_left{background:url(..images/prettyPhoto/light_rounded/sprite.png) -88px -53px no-repeat}div.light_rounded .pp_top .pp_right{background:url(..images/prettyPhoto/light_rounded/sprite.png) -110px -53px no-repeat}div.light_rounded .pp_next: hover{background:url(..images/prettyPhoto/light_rounded/btnNext.png) center right no-repeat;cursor:pointer}div.light_rounded .pp_previous: hover{background:url(..images/prettyPhoto/light_rounded/btnPrevious.png) center left no-repeat;cursor:pointer}div.light_rounded .pp_expand{background:url(..images/prettyPhoto/light_rounded/sprite.png) -31px -26px no-repeat;cursor:pointer}div.light_rounded .pp_expand: hover{background:url(..images/prettyPhoto/light_rounded/sprite.png) -31px -47px no-repeat;cursor:pointer}div.light_rounded .pp_contract{background:url(..images/prettyPhoto/light_rounded/sprite.png) 0 -26px no-repeat;cursor:pointer}div.light_rounded .pp_contract: hover{background:url(..images/prettyPhoto/light_rounded/sprite.png) 0 -47px no-repeat;cursor:pointer}div.light_rounded .pp_close{width:75px;height:22px;background:url(..images/prettyPhoto/light_rounded/sprite.png) -1px -1px no-repeat;cursor:pointer}div.light_rounded .pp_nav .pp_play{background:url(..images/prettyPhoto/light_rounded/sprite.png) -1px -100px no-repeat;height:15px;width:14px}div.light_rounded .pp_nav .pp_pause{background:url(..images/prettyPhoto/light_rounded/sprite.png) -24px -100px no-repeat;height:15px;width:14px}div.light_rounded .pp_arrow_previous{background:url(..images/prettyPhoto/light_rounded/sprite.png) 0 -71px no-repeat}div.light_rounded

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.pp_arrow_next{background:url(..images/prettyPhoto/light_rounded/sprite.png) -22px -71px no-repeat}div.light_rounded .pp_bottom
.pp_left{background:url(..images/prettyPhoto/light_rounded/sprite.png) -88px -80px no-repeat}div.light_rounded .pp_bottom
.pp_right{background:url(..images/prettyPhoto/light_rounded/sprite.png) -110px -80px no-repeat}div.dark_rounded .pp_top
.pp_left{background:url(..images/prettyPhoto/dark_rounded/sprite.png) -88px -53px no-repeat}div.dark_rounded .pp_top
.pp_right{background:url(..images/prettyPhoto/dark_rounded/sprite.png) -110px -53px no-repeat}div.dark_rounded .pp_content_container
.pp_left{background:url(..images/prettyPhoto/dark_rounded/contentPattern.png) top left repeat-y}div.dark_rounded .pp_content_container
.pp_right{background:url(..images/prettyPhoto/dark_rounded/contentPattern.png) top right repeat-y}div.dark_rounded
.pp_next: hover{background:url(..images/prettyPhoto/dark_rounded/btnNext.png) center right no-repeat;cursor:pointer}div.dark_rounded
.pp_previous: hover{background:url(..images/prettyPhoto/dark_rounded/btnPrevious.png) center left no-repeat;cursor:pointer}div.dark_rounded
.pp_expand{background:url(..images/prettyPhoto/dark_rounded/sprite.png) -31px -26px no-repeat;cursor:pointer}div.dark_rounded
.pp_expand: hover{background:url(..images/prettyPhoto/dark_rounded/sprite.png) -31px -47px no-repeat;cursor:pointer}div.dark_rounded
.pp_contract{background:url(..images/prettyPhoto/dark_rounded/sprite.png) 0 -26px no-repeat;cursor:pointer}div.dark_rounded
.pp_contract: hover{background:url(..images/prettyPhoto/dark_rounded/sprite.png) 0 -47px no-repeat;cursor:pointer}div.dark_rounded
.pp_close{width:75px;height:22px;background:url(..images/prettyPhoto/dark_rounded/sprite.png) -1px -1px no-repeat;cursor:pointer}div.dark_rounded
.pp_description{margin-right:85px;color:#fff}div.dark_rounded .pp_nav
.pp_play{background:url(..images/prettyPhoto/dark_rounded/sprite.png) -1px -100px no-repeat;height:15px;width:14px}div.dark_rounded .pp_nav
.pp_pause{background:url(..images/prettyPhoto/dark_rounded/sprite.png) -24px -100px no-repeat;height:15px;width:14px}div.dark_rounded
.pp_arrow_previous{background:url(..images/prettyPhoto/dark_rounded/sprite.png) 0 -71px no-repeat}div.dark_rounded
.pp_arrow_next{background:url(..images/prettyPhoto/dark_rounded/sprite.png) -22px -71px no-repeat}div.dark_rounded .pp_bottom
.pp_left{background:url(..images/prettyPhoto/dark_rounded/sprite.png) -88px -80px no-repeat}div.dark_rounded .pp_bottom
.pp_right{background:url(..images/prettyPhoto/dark_rounded/sprite.png) -110px -80px no-repeat}div.dark_rounded
.pp_loaderIcon{background:url(..images/prettyPhoto/dark_rounded/loader.gif) center center no-repeat}div.dark_square .pp_left,div.dark_square .pp_middle,div.dark_square .pp_right,div.dark_square .pp_content{background:#000}div.dark_square
.pp_description{color:#fff;margin:0 85px 0 0}div.dark_square
.pp_loaderIcon{background:url(..images/prettyPhoto/dark_square/loader.gif) center center no-repeat}div.dark_square
.pp_expand{background:url(..images/prettyPhoto/dark_square/sprite.png) -31px -26px no-repeat;cursor:pointer}div.dark_square
.pp_expand: hover{background:url(..images/prettyPhoto/dark_square/sprite.png) -31px -47px no-repeat;cursor:pointer}div.dark_square
.pp_contract{background:url(..images/prettyPhoto/dark_square/sprite.png) 0 -26px no-repeat;cursor:pointer}div.dark_square
.pp_contract: hover{background:url(..images/prettyPhoto/dark_square/sprite.png) 0 -47px no-repeat;cursor:pointer}div.dark_square
.pp_close{width:75px;height:22px;background:url(..images/prettyPhoto/dark_square/sprite.png) -1px -1px no-repeat;cursor:pointer}div.dark_square
.pp_nav{clear:none}div.dark_square .pp_nav
.pp_play{background:url(..images/prettyPhoto/dark_square/sprite.png) -1px -100px no-repeat;height:15px;width:14px}div.dark_square .pp_nav
.pp_pause{background:url(..images/prettyPhoto/dark_square/sprite.png) -24px -100px no-repeat;height:15px;width:14px}div.dark_square
.pp_arrow_previous{background:url(..images/prettyPhoto/dark_square/sprite.png) 0 -71px no-repeat}div.dark_square
.pp_arrow_next{background:url(..images/prettyPhoto/dark_square/sprite.png) -22px -71px no-repeat}div.dark_square
.pp_next: hover{background:url(..images/prettyPhoto/dark_square/btnNext.png) center right no-repeat;cursor:pointer}div.dark_square
.pp_previous: hover{background:url(..images/prettyPhoto/dark_square/btnPrevious.png) center left no-repeat;cursor:pointer}div.light_square
.pp_expand{background:url(..images/prettyPhoto/light_square/sprite.png) -31px -26px no-repeat;cursor:pointer}div.light_square
.pp_expand: hover{background:url(..images/prettyPhoto/light_square/sprite.png) -31px -47px no-repeat;cursor:pointer}div.light_square
.pp_contract{background:url(..images/prettyPhoto/light_square/sprite.png) 0 -26px no-repeat;cursor:pointer}div.light_square
.pp_contract: hover{background:url(..images/prettyPhoto/light_square/sprite.png) 0 -47px no-repeat;cursor:pointer}div.light_square
.pp_close{width:75px;height:22px;background:url(..images/prettyPhoto/light_square/sprite.png) -1px -1px no-repeat;cursor:pointer}div.light_square

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ht_square/sprite.png) -1px -1px no-repeat;cursor:pointer}div.light_square
.pp_nav
.pp_play{background:url(..images/prettyPhoto/light_square/sprite.png) -1px -100px no-repeat;height:15px;width:14px}div.light_square .pp_nav
.pp_pause{background:url(..images/prettyPhoto/light_square/sprite.png) -24px -100px no-repeat;height:15px;width:14px}div.light_square
.pp_arrow_previous{background:url(..images/prettyPhoto/light_square/sprite.png) 0 -71px no-repeat}div.light_square
.pp_arrow_next{background:url(..images/prettyPhoto/light_square/sprite.png) -22px -71px no-repeat}div.light_square
.pp_next: hover{background:url(..images/prettyPhoto/light_square/btnNext.png) center right no-repeat;cursor:pointer}div.light_square
.pp_previous: hover{background:url(..images/prettyPhoto/light_square/btnPrevious.png) center left no-repeat;cursor:pointer}div.facebook .pp_top
.pp_left{background:url(..images/prettyPhoto/facebook/sprite.png) -88px -53px no-repeat}div.facebook .pp_top
.pp_middle{background:url(..images/prettyPhoto/facebook/contentPatternTop.png) top left repeat-x}div.facebook .pp_top
.pp_right{background:url(..images/prettyPhoto/facebook/sprite.png) -110px -53px no-repeat}div.facebook .pp_content_container
.pp_left{background:url(..images/prettyPhoto/facebook/contentPatternLeft.png) top left repeat-y}div.facebook .pp_content_container
.pp_right{background:url(..images/prettyPhoto/facebook/contentPatternRight.png) top right repeat-y}div.facebook
.pp_expand{background:url(..images/prettyPhoto/facebook/sprite.png) -31px -26px no-repeat;cursor:pointer}div.facebook
.pp_expand: hover{background:url(..images/prettyPhoto/facebook/sprite.png) -31px -47px no-repeat;cursor:pointer}div.facebook
.pp_contract{background:url(..images/prettyPhoto/facebook/sprite.png) 0 -26px no-repeat;cursor:pointer}div.facebook
.pp_contract: hover{background:url(..images/prettyPhoto/facebook/sprite.png) 0 -47px no-repeat;cursor:pointer}div.facebook
.pp_close{width:22px;height:22px;background:url(..images/prettyPhoto/facebook/sprite.png) -1px -1px no-repeat;cursor:pointer}div.facebook
.pp_description{margin:0 37px 0 0}div.facebook
.pp_loaderIcon{background:url(..images/prettyPhoto/facebook/loader.gif) center center no-repeat}div.facebook
.pp_arrow_previous{background:url(..images/prettyPhoto/facebook/sprite.png) 0 -71px no-repeat;height:22px;margin-top:0;width:22px}div.facebook
.pp_arrow_previous.disabled{background-position:0 -96px;cursor:default}div.facebook
.pp_arrow_next{background:url(..images/prettyPhoto/facebook/sprite.png) -32px -71px no-repeat;height:22px;margin-top:0;width:22px}div.facebook
.pp_arrow_next.disabled{background-position:-32px -96px;cursor:default}div.facebook .pp_nav{margin-top:0}div.facebook
.pp_nav p{font-size:15px;padding:0 3px 0 4px}div.facebook .pp_nav
.pp_play{background:url(..images/prettyPhoto/facebook/sprite.png) -1px -123px no-repeat;height:22px;width:22px}div.facebook .pp_nav
.pp_pause{background:url(..images/prettyPhoto/facebook/sprite.png) -32px -123px no-repeat;height:22px;width:22px}div.facebook
.pp_next: hover{background:url(..images/prettyPhoto/facebook/btnNext.png) center right no-repeat;cursor:pointer}div.facebook
.pp_previous: hover{background:url(..images/prettyPhoto/facebook/btnPrevious.png) center left no-repeat;cursor:pointer}div.facebook .pp_bottom
.pp_left{background:url(..images/prettyPhoto/facebook/sprite.png) -88px -80px no-repeat}div.facebook .pp_bottom
.pp_middle{background:url(..images/prettyPhoto/facebook/contentPatternBottom.png) top left repeat-x}div.facebook .pp_bottom
.pp_right{background:url(..images/prettyPhoto/facebook/sprite.png) -110px -80px no-repeat}div.pp_pic_holder
a:focus{outline:none}div.pp_overlay{background:#000;display:none;left:0;position:absolute;top:0;width:100%;z-index:9500}div.pp_pic_holder{display:none;position:absolute;width:100px;z-index:10000}.pp_content{height:40px;min-width:40px}*html
.pp_content{width:40px}.pp_content_container{position:relative;text-align:left;width:100%}.pp_content_container .pp_left{padding-left:20px}.pp_content_container .pp_right{padding-right:20px}.pp_content_container .pp_details{float:left;margin:10px 0 2px 0}.pp_description{display:none;margin:0}.pp_social{float:left;margin:7px 0 0 0}.pp_social .facebook{float:left;position:relative;top:-1px;margin-left:5px;width:55px;overflow:hidden}.pp_social .twitter{float:left}.pp_nav{clear:right;float:left;margin:3px 10px 0 0}.pp_nav p{float:left;margin:2px 4px}.pp_nav .pp_play, .pp_pause, .pp_arrow_previous, .pp_arrow_next{display:block;float:left;height:15px;margin-top:3px;overflow:hidden;text-indent:-10000px;width:14px}.pp_hoverContainer{position:absolute;top:0;width:100%;z-index:2000}.pp_gallery{display:none;left:50%;margin-top:-50px;position:absolute;z-index:10000}.pp_gallery div{float:left;overflow:hidden;position:relative}.pp_gallery

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ul{float:left;height:35px;position:relative;white-space:nowrap;margin:0 0
5px;padding:0}.pp_gallery ul a{border:1px rgba(0, 0, 0, 0.5)
solid;display:block;float:left;height:33px;overflow:hidden}.pp_gallery ul a
img{border:0}.pp_gallery li{display:block;float:left;margin:0 5px 0
0;padding:0}.pp_gallery li.default
a{background:url(/.images/prettyPhoto/facebook/default_thumbnail.gif) 0 0
no-repeat;display:block;height:33px;width:50px}.pp_gallery
.pp_arrow_previous,.pp_gallery .pp_arrow_next{margin-
top:7px}a.pp_next{background:url(/.images/prettyPhoto/light_rounded/btn
Next.png) 10000px 10000px no-
repeat;display:block;float:right;height:100%;text-indent:-
10000px;width:49%}a.pp_previous{background:url(/.images/prettyPhoto/li
ght_rounded/btnNext.png) 10000px 10000px no-
repeat;display:block;float:left;height:100%;text-indent:-
10000px;width:49%}a.pp_expand,a.pp_contract{cursor:pointer;display:none;
height:20px;position:absolute;right:30px;text-indent:-
10000px;top:10px;width:20px;z-
index:20000}a.pp_close{position:absolute;right:0;top:0;display:block;line-
height:22px;text-indent:-
10000px}.pp_loaderIcon{display:block;height:24px;left:50%;position:absol
ute;top:50%;width:24px;margin:-12px 0 0 -12px}#pp_full_res{line-
height:1}#pp_full_res .pp_inline{text-align:left}#pp_full_res .pp_inline
p{margin:0 0 15px}div.ppt{color:#fff;display:none;font-size:17px;z-
index:9999;margin:0 0 5px 15px}div.pp_default
.pp_content,div.light_rounded .pp_content{background-
color:#fff}div.pp_default #pp_full_res .pp_inline,div.light_rounded
.pp_content .ppt,div.light_rounded #pp_full_res .pp_inline,div.light_square
.pp_content .ppt,div.light_square #pp_full_res .pp_inline,div.facebook
.pp_content .ppt,div.facebook #pp_full_res
.pp_inline{color:#000}div.pp_default .pp_gallery ul li
a:hover,div.pp_default .pp_gallery ul li.selected a,.pp_gallery ul
a:hover,.pp_gallery li.selected a{border-color:#fff}div.pp_default
.pp_details,div.light_rounded .pp_details,div.dark_rounded
.pp_details,div.dark_square .pp_details,div.light_square
.pp_details,div.facebook .pp_details{position:relative}div.light_rounded
.pp_top .pp_middle,div.light_rounded .pp_content_container
.pp_left,div.light_rounded .pp_content_container
.pp_right,div.light_rounded .pp_bottom .pp_middle,div.light_square
.pp_left,div.light_square .pp_middle,div.light_square
.pp_right,div.light_square .pp_content,div.facebook
.pp_content{background:#fff}div.light_rounded
.pp_description,div.light_square .pp_description{margin-
right:85px}div.light_rounded .pp_gallery
a.pp_arrow_previous,div.light_rounded .pp_gallery
a.pp_arrow_next,div.light_rounded .pp_gallery
a.pp_arrow_previous,div.dark_rounded .pp_gallery
a.pp_arrow_next,div.dark_square .pp_gallery
a.pp_arrow_previous,div.dark_square .pp_gallery
a.pp_arrow_next,div.light_square .pp_gallery
a.pp_arrow_previous,div.light_square .pp_gallery a.pp_arrow_next{margin-
top:12px}div.light_rounded .pp_arrow_previous,div.light_rounded
.pp_arrow_previous,div.disabled,div.dark_square
.pp_arrow_previous,div.disabled,div.light_square
.pp_arrow_previous,div.disabled{background-position:0 0 -
87px;cursor:default}div.light_rounded
.pp_arrow_next,div.disabled,div.dark_rounded
.pp_arrow_next,div.disabled,div.light_square
.pp_arrow_next,div.disabled{background-position:-22px -
87px;cursor:default}div.light_rounded .pp_loaderIcon,div.light_square
.pp_loaderIcon{background:url(/.images/prettyPhoto/light_rounded/loader.
gif) center center no-repeat}div.light_rounded .pp_top
.pp_middle,div.light_rounded .pp_content,div.light_rounded .pp_bottom
.pp_middle{background:url(/.images/prettyPhoto/dark_rounded/contentPatt
ern.png) top left repeat}div.light_rounded
.currentTextHolder,div.light_square
.currentTextHolder{color:#c4c4c4}div.light_rounded #pp_full_res
.pp_inline,div.light_square #pp_full_res
.pp_inline{color:#fff}.pp_top,.pp_bottom{height:20px;position:relative}*
html .pp_top,* html .pp_bottom{padding:0 20px}.pp_top
.pp_left,.pp_bottom
.pp_left{height:20px;left:0;position:absolute;width:20px}.pp_top
.pp_middle,.pp_bottom
.pp_middle{height:20px;left:20px;position:absolute;right:20px}* html
.pp_top .pp_middle,* html .pp_bottom
.pp_middle{left:0;position:static}.pp_top .pp_right,.pp_bottom
.pp_right{height:20px;left:auto;position:absolute;right:0;top:0;width:20px}.
pp_fade,.pp_gallery li.default a img{display:none}

```

elegant-press.js

```

/*! * jQuery JavaScript Library v1.4.4 * http://jquery.com/ * Copyright
2010, John Resig * Dual licensed under the MIT or GPL Version 2 licenses.
* http://jquery.org/license * Includes Sizzle.js * http://sizzlejs.com/ *
Copyright 2010, The Dojo Foundation * Released under the MIT, BSD, and
GPL Licenses. * Date: Thu Nov 11 19:04:53 2010 -0500
*/(function(E,B){function
ka(a,b,d){if(d===B&&a.nodeType===1){d=a.getAttribute("data-
"+b);if(typeof
d==="string"){try{d=d==="true"?true:d==="false"?false:d==="null"?null:lc
.isNaN(d)?parseFloat(d):Ja.test(d)?c.parseJSON(d):d}catch(e){}c.data(a,b,d
)}else d=B}return d}function U(){return false}function ca(){return
true}function la(a,b,d){d[0].type=a;return
c.event.handle.apply(b,d)}function Ka(a){var
b,d,e,f,h,l,k,o,x,r,A,C=[];f=[];h=c.data(this,nodeType?"events":"__event
s_");if(typeof
h==="function")h=h.events;if(!a.liveFired===this||!h||h.liveella.button&&a.t
ype==="click"){if(a.namespace)A=RegExp("(^\\|"+a.namespace.split(",")
).join("\\.|?\\.?\\.?|"+a.namespace);a.liveFired=this;var
J=h.live.slice(0);for(k=0;k<J.length;k++){h=J[k];h.origType.replace(X,"")=
==a.type?f.push(h.selector):J.splice(k-
,1)}f=c(a.target).closest(f,a.currentTarget);o=0;for(x=f.length;o<x;o++){r=f[
o];for(k=0;k<J.length;k++){h=J[k];if(r.selector===h.selector&&(l||A).test(
h.namespace))){r.elem;e=null;if(h.preType==="mouseenter"||h.preType===
"mouseleave"){a.type=h.preType;e=c(a.relatedTarget).closest(h.selector)[0
]}if(!e||e===l)C.push({elem:l,handleObj:h,level:r.level})}}o=0;for(x=C.len
gth;o<x;o++){f=C[o];if(d&&f.level>d)break;a.currentTarget=f.elem;a.data=
f.handleObj.data;a.handleObj=f.handleObj;A=f.handleObj.origHandler.appl
y(f.elem,arguments);if(A===false||A.isPropagationStopped())(d=f.level;if(A
===false)b=false;if(a.isImmediatePropagationStopped())break}return
b}}function
Y(a,b){return(a&&a["=="+"a+."+""]+b.replace(La,"").replace(Ma,"&"))fu
nction ma(a,b,d){if(c.isFunction(b))return
c.grep(a,function(f,h){return!!b.call(f,h,f===d)});else if(b.nodeType)return
c.grep(a,function(f){return f===b===d});else if(typeof b==="string"){var
e=c.grep(a,function(f){return f.nodeType===1});if(Na.test(b))return
c.filter(b,e,!d);else b=c.filter(b,e)return c.grep(a,function(f){return
c.inArray(f,b)>=0===d})}function na(a,b){var
d=0;b.each(function(){if(this.nodeName===a[d]&&a[d].nodeName){var
e=c.data(a[d++]);f=c.data(this,e);if(e=e&&e.events){delete
f.handle;f.events={};for(var h in e)for(var l in
e[h])c.event.add(this,h,e[h][l],e[h][l].data)}})}function
Oa(a,b){b.src?c.ajax({url:b.src,async:false,dataType:"script"}):c.globalEval(
b.text||b.textContent||b.innerHTML||"");b.parentNode&&b.parentNode.remo
veChild(b)}function oa(a,b,d){var
e=b==="width"?a.offsetWidth:a.offsetHeight;if(d==="border")return
e;c.each(b==="width"?Pa:Qa,function(){dll(e-
=parseFloat(c.css(a,"padding"+this))||0;if(d==="margin")e+=parseFloat(c.c
ss(a,"margin"+this))||0;else e-
=parseFloat(c.css(a,"border"+this+"Width"))||0);return e})function
da(a,b,d,e){if(c.isArray(b)&&b.length)c.each(b,function(f,h){dllRa.test(a)?e(
a,h):da(a,"["+typeof h==="object"?l.c.isArray(h)?f:""]"+h,d,e)});else
if(!d&&b!==null&&typeof
b==="object")c.isEmptyObject(b)?e(a,""):c.each(b,function(f,h){da(a,"["+f
+""]"+h,d,e)});else e(a,b)}function S(a,b){var
d={};c.each(pa.concat.apply([],pa.slice(0,b)),function(){d[this]=a});return
d}function qa(a){if(!ea[a]){var
b=c("<"+"a">").appendTo("body");d=b.css("display");b.remove();if(d==="
none"||d==="")d="block";ea[a]=d}return ea[a]}function fa(a){return
c.isWindow(a)?a.a.nodeType===9?a.defaultView||a.parentWindow:false}var
r=E.document,c=function(){function
a(){if("b.isReady"){try{t.documentElement.doScroll("left")}catch(j){setTime
out(a,1);return}b.ready()}var b=function(j,s){return new
b.fn.init(j,s),d=E.jQuery,e=E.$,f,h=/(?![<]*[<\/\w]+>)[^>]*$#([<\/\w-
]+)$/!,i=/\$/k=/\$/o=/\$/x=/\$/w=/\$/d=/\$/A=/\$/<(w+)$*V?>(<\/>?$/&
C=/\$/;[?]{s}*/J=/\?:["\`bfnrt]lu0-9a-fA-
F}{4}*/g,w=["\`\\n\r"]*truefalseNull-?d+(?[\d*]?):[eE][+|-
]?d+)?/g,l=/(?:^|:|:|s;*)+/g,L=/\wkit[
V]([<\/\w+]/g,g=/\opera(?:\s*\version)?/|V|([<\/\w+]/g,i=/\msie)
([<\/\w+]/g),n=/\mozilla(?:\s*?
rv:([<\/\w+]/g),m=navigator.userAgent,p=false,q=[],u,y=Object.prototype,oS
tring,F=Object.prototype.hasOwnProperty,M=Array.prototype.push,N=Arra
y.prototype.slice,O=String.prototype.trim,D=Array.prototype.indexOf,R=
b.fn=b.prototype={init:function(j,s){var v,z,H;if(!j)return
this;if(j.nodeType){this.context=this[0]=j;this.length=1;return
this}if(j==="body"&&ls&&t.body){this.context=t;this[0]=t.body;this.select
or="body";this.length=1;return this}if(typeof
j==="string"if((v=h.exec(j))&&(v[1]||!s))if(v[1]){H=s?s.ownerDocuments:

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t;if(z=A.exec(j))if(b.isPlainObject(s)){j=[t.createElement(z[1])];b.fn.attr.call(j,s,true)}else
j=[H.createElement(z[1])];else{z=b.buildFragment([v[1]],[H]);j=(z.cacheable?z.fragment.cloneNode(true):z.fragment).childNodes}return
b.merge(this,j)}else{if((z=t.getElementByD(v[2]))&&z.parentNode){if(z.id!=""&&v[2])return
f.find(j);this.length=1;this[0]=z;this.context=t;this.selector=j;return this}else
if(!s&&lx.test(j)){this.selector=j;this.context=t;j=t.getElementsByTagName(j);return b.merge(this,j)}else return!s||s.jquery?(s||f).find(j):b(s).find(j);else
if(b.isFunction(j))return
f.ready(j);if(j.selector!=B){this.selector=j.selector;this.context=j.context}return
b.makeArray(j,this),selector:".jquery":1.4.4".length:0.size:function(){return
this.length}.toArray:function(){return N.call(this,0)}.get:function(j){return
j==null?this.toArray():j<0?this.slice(j)[0]:this[j]}.pushStack:function(j,s,v){
var
z=b(0);b.isArray(j)?M.apply(z,j):b.merge(z,j);z.prevObject=this;z.context=this
s.context;if(s=="find")z.selector=this.selector+(this.selector?" ":"")+v;else
if(s.z.selector=this.selector+" "+s+" "+" "+v+"")return
z}.each:function(j,s){return
b.each(this,j,s)}.ready(function(){b.bindReady();if(b.isReady)j.call(t,b);else
q&&q.push(j);return this}.eq:function(j){return j==
-1?this.slice(j):this.slice(j,+j+1)}.first:function(){return
this.eq(0)}.last:function(){return this.eq(-1)}.slice:function(){return
this.pushStack(N.apply(this,arguments),"slice".N.call(arguments,join(","))},
map:function(j){return this.pushStack(b.map(this,function(s,v){return
j.call(s,v,s)}))}.end:function(){return
this.prevObject||b(null)}.push:M.sort;}.sort:splice;}.splice;}.fn.init.prototype=
b.fn;b.extend=b.fn.extend=function(){var
j,s,v,z,H,G=arguments[0]||{};K=1,Q=arguments.length,ga=false;if(typeof
G=="boolean"){ga=G;G=arguments[1]||{};K=2}if(typeof
G!="object"&&!b.isFunction(G)G={};if(Q==K){G=this;--
K}for(;K<Q;K++)if(j=(j=arguments[K])!=null)for(s in
j){v=G[s];z=j[s];if(G!=z)if(ga&&z&&(b.isPlainObject(z)||H=b.isArray(z)
))if(!H){H=false;v=v&&b.isArray(v)?v:[]}else
v=v&&b.isPlainObject(v)?v:[];G[s]=b.extend(ga,v,z)}else
if(z!=B)G[s]=z}return
G};b.extend({noConflict:function(){E.$=e;if(j)E.jQuery=d;return
b}.isReady:false,readyWait:1,ready:function(){j==true&&b.readyWait--
;if(!b.readyWait||j==true&&!b.isReady){if(!t.body)return
setTimeout(b.ready,1);b.isReady=true;if(!j==true&&--
b.readyWait>0)if(q)var
s=0,v=q;for(q=null;j=v[s++];j.call(t,b);b.fn.trigger&&b(t).trigger("ready").
unbind("ready")}},bindReady:function(){if(!p){p=true;if(t.readyState=="
complete"}return
setTimeout(b.ready,1);if(t.addEventListener){t.addEventListener("DOMCon
tentLoaded",u,false);E.addEventListener("load",b.ready,false)}else
if(t.attachEvent){t.attachEvent("onreadystatechange",u);E.attachEvent("onlo
ad",b.ready);var
j=false;try{j=E.frameElement==null}catch(s){}t.documentElement.doScroll
&&j&&a()}.isFunction:function(j){return
b.type(j)=="function"}.isArray:Array.isArray||function(j){return
b.type(j)=="array"}.isWindow:function(j){return j&&typeof
j=="object"&&"setInterval"in j}.isNaN:function(j){return
j==null||r.test(j)||isNaN(j)}.type:function(j){return
j==null?String(j):R[y.call(j)]||"object"}.isPlainObject:function(j){if(!j||b.type
(j)!="object"||j.nodeType||b.isWindow(j))return
false;if(j.constructor&&!F.call(j,"constructor")&&!F.call(j.constructor.prototype,
"isPrototypeOf"))return false;for(var s in j)return
s==B||F.call(j,s).isPrototypeOf(j)}for(var s in j)return
false;return true}.error:function(j){throw
j}.parseJSON:function(j){if(typeof j!="string"||j)return
null;j=b.trim(j);if(C.test(j.replace(J,"@").replace(w,"").replace(I,""))return
E.JSON&&E.JSON.parse?E.JSON.parse:(new Function("return
"+j))());else b.error("Invalid JSON:
"+j)}.noop:function(){},globalEval:function(j){if(j&&I.test(j)){var
s=t.getElementsByTagName("head")[0]||t.documentElement,v=t.createElement("script");v.type="text/javascript";if(b.support.scriptEval)v.appendChild(t.createText
Node(j));else
v.text=j;s.insertBefore(v,s.firstChild);s.removeChild(v)}.nodeName:functio
n(j,s){return
j.nodeName&&j.nodeName.toUpperCase()===s.toUpperCase()}.each:functio
n(j,s,v){var z,H=0,G=j.length,K=G==B||b.isFunction(j);if(v)if(K)for(z in
j){if(s.apply(j[z],v)==false)break}else
for(;H<G;){if(s.apply(j[H++],v)==false)break}else if(K)for(z in
j){if(s.call(j[z],z,j[z])===false)break}else
for(v=j[0];H<G&&s.call(v,H,v)!=false;v=j[++H]);return
j}.trim:O?function(j){return j==null?"":O.call(j)}.function(j){return
j==null?"":j.toString().replace(k,"").replace(o,"").makeArray:function(j,s){
var v=s||[];if(j==null){var

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z=b.type(j);j.length==null||z=="string"||z=="function"||z=="regexp"||b.is
Window(j)?M.call(v,j):b.merge(v,j)}return
v}.inArray:function(j,s){if(s.indexOf)return s.indexOf(j);for(var
v=0,z=s.length;v<z;v++)if(s[v]==j)return v;return
-1}.merge:function(j,s){var v=j.length,z=0;if(typeof
s.length=="number")for(var H=s.length;z<H;z++)j[v++]=s[z];else
for(;s[z]!==B;j[v++]|=s[z++];j.length=v;return j}.grep:function(j,s,v){var
z=[],H=v!=!v;for(var
G=0,K=j.length;G<K;G++){H=!s(j[G],G);v!=H&&z.push(j[G])}return
z}.map:function(j,s,v){for(var
z=[],H,G=0,K=j.length;G<K;G++){H=s(j[G],G,v);if(H!=null)z[z.length]=H
}return
z.concat.apply([],z)}.guid:1.proxy:function(j,s,v){if(arguments.length===2)j
f(typeof s=="string"){v=j;v[s]=B}else
if(s&&!b.isFunction(s)){v=s;s=B}if(!s&&j)s=function(){return
j.apply(v||this,arguments)};if(j).guid=j.guid||s.guid||s.guid++;return
s}.access:function(j,s,v,z,H,G){var K=j.length;if(typeof
s=="object"){for(var Q in s)b.access(j,Q,s[j].z,H,v);return
j}if(v===B){z=!G&&z&&b.isFunction(v);for(Q=0;Q<K;Q++)H(j[Q],s,z)?v.
call(j[Q],Q,H(j[Q],s)):v.G;return j}return
K?H(j[0],s):B}.now:function(){return(new
Date).getTime()}.uaMatch:function(j){j=j.toLowerCase();j=L.exec(j)||g.exec
(j)||i.exec(j)||j.indexOf("compatible")<0&&n.exec(j)||j;return{browser:j[1]||
"",version:j[2]||"0"}.browser:{}.each("Boolean Number String
Function Array Date RegExp Object".split(" ").function(j,s){R["object
"+s+""]|=s.toLowerCase()};m=b.uaMatch(m);if(m.browser){b.browser[m.b
rowser]=true;b.browser.version=m.version;if(b.browser.webkit||b.browser.s
afari=true;if(D)b.inArray=function(j,s){return
D.call(s,j).if(!/s/.test("u00a0")){k=/[\xA0]+/;o=/[\xA0]+$/;f=b(t);if(t.
addEventListener)u=function(){t.removeEventListener("DOMContentLoade
d",u,false);b.ready()};else
if(t.attachEvent)u=function(){if(t.readyState=="complete"){t.detachEvent(
"onreadystatechange",u);b.ready()};return
E.jQuery=E.$=b}();(function(){c.support={};var
a=t.documentElement,b=t.createElement("script"),d=t.createElement("div");
e="script"+c.now();d.style.display="none";d.innerHTML="
<link/><table/><table><a href='/a'
style='color:red;float:left;opacity:.55;'>a</a><input type='checkbox'/'>";var
f=d.getElementsByTagName("a").h=d.getElementsByTagName("a")[0],l=t.
createElement("select"),k=l.appendChild(t.createElement("option"));if(!f||f.
length||l){c.support={leadingWhitespaces:d.firstChild.nodeType===3,tbo
dy:l.d.getElementsByTagName("tbody").length,htmlSerialize:!!d.getElement
sByTagName("link").length,style:/red/.test(h.getAttribute("style")),hrefNor
malized:h.getAttribute("href")==="/a",opacity:/^0.55$/;test(h.style.opacity),
cssFloat:!!h.style.cssFloat,checkOn:d.getElementsByTagName("input")[0].v
alue===on".optSelected:k.selected,deleteExpando:true,optDisabled:false,cl
oneClone:false,scriptEval:false,noCloneEvent:true,boxModel:null,inlineBloc
kNeedsLayout:false,shrinkWrapBlocks:false,reliableHiddenOffsets:true};l.d
isabled=true;c.support.optDisabled=!k.disabled;b.type="text/javascript";try{
b.appendChild(t.createTextNode("window."+"e+=1;"))}catch(o){}a.insertB
efore(b,a.firstChild);if(E[e]){c.support.scriptEval=true;delete
E[e]}try{delete
b.test}catch(x){c.support.deleteExpando=false}a.removeChild(b);if(d.attach
Event&d.fireEvent){d.attachEvent("onclick",function
r(){c.support.noCloneEvent=false;d.detachEvent("onclick",r)});d.cloneNode
(true).fireEvent("onclick")}d=t.createElement("div");d.innerHTML="<input
type='radio' name='radiotest'
checked='checked'/'>";a=t.createDocumentFragment();a.appendChild(d.first
Child);c.support.checkClone=a.cloneNode(true).cloneNode(true).lastChild.c
hecked;c(function(){var
r=t.createElement("div");r.style.width=r.style.paddingLeft="1px";t.body.app
endChild(r);c.boxModel=c.support.boxModel;r.offsetLeft===2;if("zoom"
in
r.style){r.style.display="inline";r.style.zoom=1;c.support.inlineBlockNeedsL
ayout=r.offsetLeft===2;r.style.display=""}.innerHTML="<div
style='width:4px;'></div>";c.support.shrinkWrapBlocks=r.offsetLeft===2}
r.innerHTML="<table><tr><td
style='padding:0;display:none;'><td><td></td></tr></table>";var
A=r.getElementsByTagName("td");c.support.reliableHiddenOffsets=A[0].of
setHeight===0;A[0].style.display="";A[1].style.display="none";c.support.r
eliableHiddenOffsets=c.support.reliableHiddenOffsets&&A[0].offsetHeight
===0;r.innerHTML="";t.body.removeChild(r).style.display="none"});a=fun
ction(r){var A=t.createElement("div");r="on"+r;var C=r in
A;if(!C){A.setAttribute(r,"return");C=typeof A[r]===function}return
C};c.support.submitBubbles=a("submit");c.support.changeBubbles=a("chan
ge");a=b=d=f=h=null}());var
ra=(!j).Ja/^(?:{.*}|\N.*)$/;c.extend({cache:{},uid:0,expando:"jQuery"+c.
now(),noData:{embed:true,object:"clsid:D27CDB6E-AE6D-11cf-96B8-
444553540000",applet:true,data:function(a,b,d){if(c.acceptData(a)){a=a==
E?ra:a;var

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e=a.nodeType,f=e?a[c.expando]:null,h=c.cache;if(!e&&f&&typeof
b=="string"&&d===B){if(e)ll[a.c.expando]=f++c.uid;else
h=a;if(typeof b=="object")if(e)h[f]=c.extend(h[f],b);else c.extend(h,b);else
if(e&&!h[f]h[f]={};a=e?h[f]:h;if(d===B)a[b]=d;return typeof
b=="string"?a[b]:a}}.removeData:function(a,b){if(c.acceptData(a)){a=a=
=E?ra:var
d=a.nodeType,e=d?a[c.expando]:a,f=c.cache,h=d?f[e]:e;if(b){if(h){delete
h[b];d&&c.isEmptyObject(h)&&c.removeData(a)}else
if(d&&c.support.deleteExpando)delete a[c.expando];else
if(a.removeAttribute)a.removeAttribute(c.expando);else if(d)delete f[e];else
for(var l in a)delete a[l]};acceptData:function(a){if(a.nodeName){var
b=c.noData[a.nodeName.toLowerCase()];if(b)return!(b===true||a.getAttribu
te("classid")!=b)}return true}};c.fn.extend({data:function(a,b){var
d=null;if(typeof a=="undefined"){if(this.length){var
e=this[0].attributes,f;d=c.data(this[0]);for(var
h=0,l=e.length;h<l;h++){f[e[h].name];if(f.indexOf("data-
")==0){f=f.substr(5);ka(this[0],f,d[f])}return d}else if(typeof
a=="object")return this.each(function(){c.data(this,a)});var
k=a.split(",");k[1]=k[1]?"."+k[1]:"";if(b===B){d=this.triggerHandler("getD
ata"+k[1]+"!";k[0]};if(d===B&&this.length){d=c.data(this[0],a);d=ka(this
[0],a,d)}return d===B&&k[1]?this.data(k[0]):d}else return
this.each(function(){var
o=c(this),x=k[0],b;o.triggerHandler("setData"+k[1]+"!";x);c.data(this,a,b);
o.triggerHandler("changeData"+k[1]+"!";x)}}).removeData:function(a){retu
rn
this.each(function(){c.removeData(this,a)});c.extend({queue:function(a,b
,d){if(a){b=(b||"fx")+"queue";var e=c.data(a,b);if(!d)return
e||;if(!e.c.isArray(d))e=c.data(a,b,c.makeArray(d));else e.push(d);return
e}};dequeue:function(a,b){b=b||"fx";var
d=c.queue(a,b),e=d.shift();if(e=="inprogress")e=d.shift();if(e){b=="fx"&
&d.unshift("inprogress");e.call(a,function(){c.dequeue(a,b)});}};c.fn.exten
d({queue:function(a,b){if(typeof a!="string"){b=a;a="fx"}if(b===B)return
c.queue(this[0],a);return this.each(function(){var
d=c.queue(this,a,b);a=="fx"&d[0]!="inprogress"&&c.dequeue(this,a)}
).dequeue(function(){return
this.each(function(){c.dequeue(this,a)});delay:function(a,b){a=c.fx?c.fx.sp
eeds[a]||a:a=b||"fx";return this.queue(b,function(){var
d=this;setTimeout(function(){c.dequeue(d,b)});}).clearQueue:function(a){
return this.queue(a||"fx",[])};var
sa=/\n\t/g,ha=/s+/,Sa=/r/g,Ta=/^(:hrefsrcstyle$)/,Ua=/^(?:buttoninput$
/i,Va=/^(?:buttoninputobjectselecttarea)$/i,Wa=/^a(?:rea)?$/i,ta=/^(?:ra
diocheckbox)$/i;c.props={"for":"htmlForm","class":"className","readonly":"r
eadOnly","maxLength":"maxLength","cellspacing":"cellSpacing","rowspan":"row
Span","colspan":"colSpan","tabindex":"tabIndex","usemap":"useMap","framebor
der":"frameBorder"};c.fn.extend({attr:function(a,b){return
c.access(this,a,b,true,c.attr)}.removeAttr:function(a){return
this.each(function(){c.attr(this,a,"");this.nodeType===1&&this.removeAttri
bute(a)}).addClass:function(a){if(c.isFunction(a))return
this.each(function(x){var
r=c(this);r.addClass(a.call(this,x,r.attr("class")))});if(a&&typeof
a=="string")for(var b=(a||"").split(ha),d=0,e=this.length;d<e;d++){var
f=this[d];if(f.nodeType===1)if(f.className){for(var h=" "+f.className+"
",l=f.className,k=0,o=b.length;k<o;k++){if(h.indexOf(" "+b[k]+" ")<0)l+=
"+b[k];f.className=c.trim(l)}else f.className=a}return
this}.removeClass:function(a){if(c.isFunction(a))return
this.each(function(o){var
x=c(this);x.removeClass(a.call(this,o,x.attr("class")))});if(a&&typeof
a=="string")l=a===B)for(var
b=(a||"").split(ha),d=0,e=this.length;d<e;d++){var
f=this[d];if(f.nodeType===1&&f.className)if(a){for(var h="
"+f.className+" ").replace(sa,""),l=0,k=b.length;l<k;l++)h=h.replace(
"+b[l]+" " " ");f.className=c.trim(h)}else f.className=""}return
this}.toggleClass:function(a,b){var d=typeof a,e=typeof
b=="boolean";if(c.isFunction(a))return this.each(function(f){var
h=c(this);h.toggleClass(a.call(this,f,h.attr("class"),b,b));}return
this.each(function(o){if(d=="string")for(var
f,h=0,l=c(this),k=b,o=a.split(ha);f=of[h++];){k=e?k:!!hasClass(f);[k?"addCl
ass":"removeClass"](f)}else
if(d=="undefined"||d=="boolean"){this.className&&c.data(this,"__class
Name__",this.className);this.className=this.className||a===false?"":c.d
ata(this,"__className__")||""}}).hasClass:function(a){a=" "+a+" ";for(var
b=0,d=this.length;b<d;b++){if((" "+this[b].className+" ").replace(sa,
").indexOf(a)>-1)return true;return
false}.val:function(a){if(!arguments.length){var
b=this[0];if(b){if(c.nodeName(b,"option")){var
d=b.attributes.value;return!d||d.specified?b.value:b.text}if(c.nodeName(b,"s
elect")){var e=b.selectedIndex;d=[];var f=b.options;b=b.type=="select-
one";if(e<0)return null;var h=b?e:0;for(e=b?e+1:f.length;h<e;h++){var
l=f[h];if(l.selected&&c.support.optDisabled?!l.disabled:l.getAttribute("disa
bled")===null)&&(!l.parentNode.disabled||l.nodeName(l.parentNode,"optg

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roup"))){a=c(l.val());if(b)return a;d.push(a)}return
d}if(ta.test(b.type)&&!c.support.checkOn)return
b.getAttribute("value")===null?"on":b.value;return(b.valuell").replace(Sa,"
")return B}var k=c.isFunction(a);return this.each(function(o){var
x=c(this),r=a;if(this.nodeType===1){if(k)r=a.call(this,o,x.val());if(r===null)r
=""};else if(typeof r=="number")r+="";else
if(c.isArray(r)r=c.map(r,function(C){return
C===null?"":C+""});if(c.isArray(r)&&ta.test(this.type))this.checked=c.inArra
y(x.val(),r)>=0;else if(c.nodeName(this,"select")){var
A=c.makeArray(r);("option",this).each(function(){this.selected=c.inArra
y(c(this).val(),A)>=0);if(!A.length)this.selectedIndex=-1} else
this.value=r}});c.extend({attrFn:{val:true,css:true,html:true,text:true,data
:true,width:true,height:true,offset:true},attr:function(a,b,d,e){if(!lla.nod
eType===3||a.nodeType===8)return B;if(e&&b in c.attrFn)return
c(a)[b](d);e=a.nodeType===1||c.isXMLDoc(a);var
f=d===B;b=e&&c.props[b]||b;var h=Ta.test(b);if(b in
lla[b]!==B)&&e&&h){if(f){b=="type"&&Ua.test(a.nodeName)&&a.par
entNode&&c.error("type property can't
be changed");if(d===null)a.nodeType===1&&a.removeAttribute(b);else
a[b]=d}if(c.nodeName(a,"form")&&a.getAttributeNode(b))return
a.getAttributeNode(b).nodeValue;if(b=="tabIndex")return(b=a.getAttribute
Node("tabIndex"))&&b.specified?b.value:Va.test(a.nodeName)||Wa.test(a.n
odeName)&&a.href?0:B;return
a[b]}if(!c.support.style&&e&&b=="style"){if(f)a.style.cssText=""+d;retu
n
a.style.cssText}f&&a.setAttribute(b,""+d);if(!a.attributes[b]&&a.hasAttribu
te(e)&&a.hasAttribute(b))return
B;a=!c.support.hrefNormalized&&e&&h?a.getAttribute(b,2):a.getAttribute(
b);return a===null?B:a};var
X=A.(/*$).ia=/^?:textareainputselect$/i,La=/g,Ma=/
/g,Xa=/^w\s.f/g,Ya=function(a){return
a.replace(Xa,"\\$&");ua={focus:0,focusout:0};c.event={add:function(a,b
,x=0,r;l=b[x++];){h=f?c.extend({},f):{handler:d,data:e};if(l.indexOf(",")>
-1){r=l.split(",");l=r.shift();h.namespace=r.slice(0).sort().join(",")}else{r=[];h
.namespace=""};h.type=l;if(h.guid)h.guid=d.guid;var
A=k[l],C=c.event.special[l]||{};if(!A){A=k[l]=[];if(C.setup||C.setup.call(a,e
,r,o)===false)if(a.addEventListener)a.addEventListener(l,o,false);else
a.attachEvent&&a.attachEvent("on"+l,o)}if(C.add.call(a,h);if(h.handler
guid)h.handler.guid=d.guid;A.push(h);c.event.global[l]=true;a=null}}
.global:{},remove:function(a,b,d,e){if(!a.nodeType===3||a.nodeType===8
){if(d===false)d=U;var
f,h,l=0,k=o,x,r,A,C,J=a.nodeType?"events":"__events__",w=c.data(a),l=w&
&w[J];if(w&&I){if(typeof
l=="function"){w=l;I=events}if(b&&b.type){d=b.handler;b=b.type}if(!b
l)typeof b=="string"&&b.charAt(0)===",")b=b||";for(f in
l).event.remove(a,f+b)}else{for(b=b.split(
")");b[b.length-1];){r=f;k=f.indexOf(",")<0;o=[];if(!k){o=f.split(",");f=o.shift();x=
RegExp("(^\\."+"c.map(o.slice(0).sort(),Ya).join("\\.(?:.*\\.)?")+"\\.$")}if(
A=I[f])if(d){r=c.event.special[f]||{};for(h=el0;h<A.length;h++){C=A[h];if(
d.guid===C.guid){if(k||x.test(C.namespace))e===null&&A.splice(h--
,1);r.remove&&r.remove.call(a,C)}if(e!=null)break}}if(A.length===0||e!=n
ull&&A.length===1){if(!r.teardown||r.teardown.call(a,o)===false)c.remove
Event(a,f,w.handler);delete l[f]}else
for(h=0;h<A.length;h++){C=A[h];if(k||x.test(C.namespace)){c.event.remove
e(a,r,C.handler,h);A.splice(h--
,1)}if(c.isEmptyObject(l)){if(b=w.handler)b.elem=null;delete
w.events;delete w.handler;if(typeof w=="function")c.removeData(a,J);else
c.isEmptyObject(w)&&c.removeData(a)}}}};trigger:function(a,b,d,e){var
f=a.type,lla;if(!e){a.type=f;f=f.slice(0,
-1);a.exclusive=true;if(d){a.stopPropagation();c.event.global[f]&&c.each(c.
cache,function(o){this.events&&this.events[f]&&c.event.trigger(a,b,this.hand
le.elem)});if(!d||d.nodeType===3||d.nodeType===8)return
B;a.result=B;a.target=d;b=c.makeArray(b);b.unshift(a);a.currentTarget=d;(e
=d.nodeType?c.data(d,"handle"):c.data(d,"__events__")||{}).handle&&e.a
pply(d,b);e=d.parentNode||ownerDocument;try{if(!d&&d.nodeName&&c
.noData[d.nodeName.toLowerCase()])if(d["on"+f]&&d["on"+f].apply(d,b)
===false){a.result=false;a.preventDefault()}catch(h){if(!a.isPropagationS
topped(h)&&c.event.trigger(a,b,e,true);else if(!a.isDefaultPrevented()){var
l=e.a.target;var

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k=f.replace(X,""),o=c.nodeName(e,"a")&&k==="click",x=c.event.special[k]
ll{};if(!x._defaultllx._default.call(d,a)===false)&&!o&&!e&&e.nodeName
&&c.noData(e.nodeName.toLowerCase())}try{if(e[k]){if(!e["on"+k]||e
on"+k]=null;c.event.triggered=true;e[k]{}catch(r){if(!e["on"+k]=c.eve
nt.triggered=false}}.handle:function(a){var b,d,e,f,d=ll;var
h=c.makeArray(arguments);a=h[0]=c.event.fix(allE.event);a.currentTarget=t
his;b=a.type.indexOf(" ");<0&&!a.exclusive;if(b){e=a.type.split(" ");a.type
=e.shift();d=e.slice(0).sort();e=RegExp("(^\\.|\\.|?)"+d.join("\\.|?")+"(\\.|$
)")a.namespace=a.namespaceId.join(" ");f=c.data(this,this.nodeType?"event
s":"__events__");if(typeof
f==="function")f=f.events;d=f[ll][a.type];if(f&&d){d=d.slice(0);f=0;for(v
ar ar=d.length;f<l;f++){var
k=d[f];if(!e.test(k.namespace)){a.handler=k.handler;a.data=k.data;a.handle
Obj=k;k=k.handler.apply(this,h);if(k===B){a.result=k;if(k===false){a.preve
ntDefault();a.stopPropagation()}}if(a.isImmediatePropagationStopped())bre
ak}}return a.result,props:"altKey attrChange attrName bubbles button
cancelable charCode clientX clientY ctrlKey currentTarget data detail
eventPhase fromElement handler keyCode layerX layerY metaKey
newValue offsetX offsetY pageX pageY prevValue relatedNode
relatedTarget screenX screenY shiftKey srcElement target toElement view
wheelDelta which".split(" ");fix:function(a){if(a.c.expando)return a;var
b=a;a=c.Event(b);for(var d=this.props.length,e;d){e=this.props[--
d];a[e]=b[e]if(!a.target)a.target=a.srcElement;ll;if(a.target.nodeType===3)
a.target=a.target.parentNode;if(!a.relatedTarget&&a.fromElement)a.relatedT
arget=a.fromElement===a.target?a.toElement:a.fromElement;if(a.pageX===n
ull&&a.clientX!==null){b=t.documentElement;d=t.body;a.pageX=a.clientX+
(b&&b.scrollLeft&&d.clientLeft);a.pageY=a.clientY+(b&&b.scrollTop
&&d.clientTop&&d.scrollTop)}(b&&b.clientLeft&&d.clientLeft)0);a.pageX=a.clientY+(b&&b.scrollTop
&&d.clientTop&&d.scrollTop)}(b&&b.clientTop&&d.clientTop)0)if(a.which===null&&(a.charCode!=nu
ll||a.keyCode!=null))a.which=a.charCode!=null?a.charCode:a.keyCode;if(!a
.metaKey&&a.ctrlKey)a.metaKey=a.ctrlKey;if(!a.which&&a.button===B)a
.which=a.button&1?1:a.button&2?3:a.button&4?2:0;return
a}.guid:1E8.proxy:c.proxy,special:{ready:{setup:c.bindReady,teardown:c.no
p}.live:{add:function(a){c.event.add(this,Y(a.origType,a.selector),c.exten
d({a,{handler:Ka.guid:a.handler.guid}})}},remove:function(a){c.event.rem
ove(this,Y(a.origType,a.selector),a)}},beforeunload:{setup:function(a,b,d){if
c.isWindow(this)this.onbeforeunload=d,teardown:function(a,b){if(this.onb
eforeunload===b)this.onbeforeunload=null}}},c.removeEvent=t.removeEve
ntListener?function(a,b,d){a.removeEventListener&&a.removeEventListener
(b,d,false):function(a,b,d){a.detachEvent&&a.detachEvent("on"+b,d)};c.
Event=function(a){if(!this.preventDefault)return new
c.Event(a);if(a&&a.type){this.originalEvent=a,this.type=a.type}else
this.type=a,this.timeStamp=c.now(),this.c.expando=true};c.Event.prototype
=({preventDefault:function(){this.isDefaultPrevented=c.a;var
a=this.originalEvent;if(a){a.preventDefault();a.preventDefault();else
a.returnValue=false}.stopPropagation:function(){this.isPropagationStopped
=c.a;var
a=this.originalEvent;if(a){a.stopPropagation&&a.stopPropagation();a.cancel
Bubble=true}}.stopImmediatePropagation:function(){this.isImmediatePropaga
tionStopped=c.a;this.stopPropagation()}.isDefaultPrevented:U.isPropagati
onStopped:U.isImmediatePropagationStopped:U};var va=function(a){var
b=a.relatedTarget;try{for(b&&b!==this;b=b.parentNode;if(b!==this){a.type
e=a.data;c.event.handle.apply(this,arguments)}catch(d){}}.wa=function(a)
{a.type=a.data;c.event.handle.apply(this,arguments)};c.each({mouseenter:"
mouseover",mouseleave:"mouseout"},function(a,b){c.event.special[a]={setu
p:function(d){c.event.add(this,b,d&&d.selector?va:va.a)},teardown:functio
n(d){c.event.remove(this,b,d&&d.selector?va:va.a)}});if(!c.support.submitB
ubbles)c.event.special.submit={setup:function(){if(this.nodeName.toLowerCase()
!=="form"){c.event.add(this,"click.specialSubmit",function(a){var
b=a.target,d=b.type;if(d==="submit"||d==="image")&&c(b).closest("form")
.length){a.liveFired=B;return
la("submit",this,arguments)}});c.event.add(this,"keypress.specialSubmit",fu
nction(a){var
b=a.target,d=b.type;if(d==="text"||d==="password")&&c(b).closest("form")
.length&&a.keyCode===13){a.liveFired=B;return
la("submit",this,arguments)}})}else return
false}.teardown:function(){c.event.remove(this,".specialSubmit")}}};if(!c.su
pport.changeBubbles){var V,xa=function(a){var
b=a.type,d=a.value;if(b==="radio"||b==="checkbox")d=a.checked}else
if(b==="select-multiple")d=a.selectedIndex>-
1?c.map(a.options,function(e){return e.selected}).join(" ");else
if(a.nodeName.toLowerCase()===select"||d=a.selectedIndex;return
d},Z=function(a,b){var
d=a.target,e,f;if(!e.test(d.nodeName)ll.d.readOnly)}{e=c.data(d,"_change_d
ata");f=xa(d);if(a.type!=="focusout"||d.type!=="radio")c.data(d,"_change_da
ta",f);if(!c.Bliff===e)if(e!=nullllf){a.type="change";a.liveFired=B;return
c.event.trigger(a,b,d)};c.event.special.change={filters:{focusout:Z.before
activate:Z.click:function(a){var
b=a.target,d=b.type;if(d==="radio"||d==="checkbox"||b.nodeName.toLowerCase

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Case()===select"return Z.call(this,a)}.keydown:function(a){var
b=a.target,d=b.type;if(a.keyCode===13&&b.nodeName.toLowerCase()===
textarea"||a.keyCode===32&&(d==="checkbox"||d==="radio"))d===select
-multiple"return
Z.call(this,a)}.beforeactivate:function(a){a=a.target;c.data(a,"_change_data
",xa(a))}.setup:function(){if(this.type===file"return false;for(var a in
V)c.event.add(this,a+".specialChange",V[a]).return
ia.test(this.nodeName)}.teardown:function(){c.event.remove(this,".specialC
hange");return
ia.test(this.nodeName)};V=c.event.special.change.filters;V.focus=V.before
activate}t.addEventListener&&c.each({focus:"focusin",blur:"focusout"},fun
ction(a,b){function d(e){e=c.event.fix(e);e.type=b;return
c.event.trigger(e,null,e.target)}c.event.special[b]={setup:function(){ua[b]++
===0&&t.addEventListener(a,d,true)}.teardown:function(){ua[b]--
===0&&t.removeEventListener(a,d,true)};c.each({"bind","one"},fu
nction(a,b){c.fn[b]=function(d,e,f){if(typeof d==="object"){for(var h in
d)this[b](h,e,d[f]);return this;if(c.isFunction(e))ll===false){f=e;e=B}var
l=b===one"?c.proxy(f,function(o){c(this).unbind(o,l);return
f.apply(this,arguments)}):f;if(d===unload"&&l===one)this.one(d,e,f);els
e{h=0;for(var k=this.length;h<k;h++)c.event.add(this[h],d,l,e)}return
this}};c.fn.extend({unbind:function(a,b){if(typeof
a==="object"&&!a.preventDefault)for(var d in
a)this.unbind(d,a[d]);else{d=0;for(var
e=this.length;d<e;d++)c.event.remove(this[d],a,b)}return
this}.delegate:function(a,b,d,e){return
this.live(b,d,e,a)}.undelegate:function(a,b,d){return
arguments.length===0?this.unbind("live"):this.die(b,null,d,a)}.trigger:functi
on(a,b){return
this.each(function(){c.event.trigger(a,b,this)}),triggerHandler:function(a,b)
{if(this[0]){var
d=c.Event(a);d.preventDefault();d.stopPropagation();c.event.trigger(d,b,this[
0]);return d.result}.toggle:function(a){for(var
b=arguments,d=1;d<b.length;c.proxy(a,b[d++]);return
this.click(c.proxy(a,function(e){var
f=c.data(this,"lastToggle"+a.guid)l0)%d;c.data(this,"lastToggle"+a.guid,f+
1).preventDefault();return
b[f].apply(this,arguments)||false}}).hover:function(a,b){return
this.mouseenter(a).mouseleave(b)});var
ya={focus:"focusin",blur:"focusout",mouseenter:"mouseover",mouseleave:"
mouseout"};c.each({"live","die"},function(a,b){c.fn[b]=function(d,e,f,h){var
l,k=0,o,x,r=hlthis.selector;h=h?this.c.context):if(typeof
d==="object"&&l.d.preventDefault)for(l in d)h[b](l,e,d[l],r);return
this;if(c.isFunction(e)){f=e;e=B}for(d=(dll).split(
");(l=d[k++])!=null){o=X.exec(l);x="";if(o){x=o[0];l=l.replace(X,"")}if(l=
===hover"j.d.push("mouseenter"+x,"mouseleave"+x);else{o=l;if(l===focus
"||l===blur){d.push(ya[l]+x);l+=x}else
l=(ya[l]||x)+x;if(b===live"){x=0;for(var
A=h.length;x<A;x++)c.event.add(h[x],live."+Y(l,r),{data:e.selector,r,handl
er:f,origType:l,origHandler:f.preType:o})}else
h.unbind("live."+Y(l,r,f))return this}};c.each({"blur focus focusin
focusout load resize scroll unload click dblclick mousedown mouseup
mousemove mouseover mouseout mouseenter mouseleave change select
submit keydown keypress keyup error".split(
")",function(a,b){c.fn[b]=function(d,e){if(e=null){e=d;d=null}return
arguments.length>0?this.bind(b,d,e).trigger(b)}:if(c.attrFn).attrFn[b]=tr
ue};E.attachEvent&&E.addEventListener&&E.bind("unload",function()
{for var a in
c.cache)if(c.cache[a].handle)try{c.event.remove(c.cache[a].handle.elem)}cat
ch(b)});function(a,g,i,n,m,p,q){p=0;for(var
u=m.length;p<q;p++){var y=m[p];if(y){var
F=false;for(y=y[g];y){if(y.sizcache===n){F=m[y.sizset];break}if(y.nodeType
pe===1&&!q){y.sizcache=n;y.sizset=p}if(y.nodeName.toLowerCase()===i
){F=y;break}y=y[g][m[p]=F]}function b(g,i,n,m,p,q){p=0;for(var
u=m.length;p<q;p++){var y=m[p];if(y){var
F=false;for(y=y[g];y){if(y.sizcache===n){F=m[y.sizset];break}if(y.nodeType
pe===1){if(!q){y.sizcache=n;y.sizset=p}if(typeof
i==="string"){if(y===i){F=true;break}}else
if(k.filter(i,y).length>0){F=y;break}}y=y[g][m[p]=F]}var
d=/((?:\((?:\(\^|O)+\)|\^|O)+)+)\[(?:\^|\^|%)|]|(?:\^|%)|]|(?:\^|%)|]|(?:\^|%)
>+,\(|\)|\+|>+)-)(s*|\s*)(?:\(|\)|\n)*\/g,e=O,Object.prototype.toString,
h=false,l=true;[0,0].sort(function(){l=false;return 0});var
k=function(g,i,n,m){n=nll};var
p=i=ll;if(i.nodeType===1&&i.nodeType!===9)return[];if(!lltypeo
f g!=="string"return n;var
q,u,y,F,M,N=true,O=k.isXML(i),D=[],R=g;do{d.exec(")}:if(q=d.exec(R)){R
=q[3];D.push(q[1]);if(q[2]){F=q[3];break}}while(q);if(D.length>1&&x.ex
ec(g)if(D.length===2&&o.relative[D[0]]u=L(D[0]+D[1],i);else
for(u=o.relative[D[0]][i];k(D.shift(),i);D.length){g=D.shift();if(o.relative[
g]g+=D.shift();u=L(g,u)}else{if(!m&&D.length>1&&i.nodeType===9&&
O&&o.match.ID.test(D[0])&&!o.match.ID.test(D[1].length-

```



```
1)]{q=k.find(D.shift(i,O);i=q.expr?k.filter(q.expr,q.set[0];q.set[0])if(i){q
=m?{expr:D.pop(),set:C(m)}:k.find(D.pop(),D.length===1&&D[0]===~1
ID[0]===~1)&&i.parentNode?.parentNode(i,O);u=q.expr?k.filter(q.expr,q
.set):q.set;if(D.length>0)y=C(u);else
N=false;for(;D.length>0){q=M=D.pop();if(o.relative[M])q=D.pop();else
M="";if(q===null)q=i.o.relative[M](y,q,O)}else
y=[];y||y(u);y||k.error(M);if(f.call(y)===~1)Object
Array"])}if(N)if(i&&i.nodeType===1)for(g=0;y[g]!=""&&y[g]!=""&&(y[
g]===truelly[g].nodeType===1&&k.contains(i,y[g]))n.push(u[g])}else
for(g=0;y[g]!=""&&y[g].nodeType===1&&n.push(u[g]);else
n.push.apply(n,y);else C(y,n);if(F){k(F.p,n,m);k.uniqueSort(n)}return
n};k.uniqueSort=function(g){if(w){h=u;g.sort(w);if(h)for(var
i=1;i<g.length;i++)g[i]===g[i-1]&&g.splice(i-1,1)}return
g};k.matches=function(g,i){return
k(g,null,null,i);k.matchesSelector=function(g,i){return
k(i,null,null,[g]).length>0};k.find=function(g,i,n){var
m;if(!g)return[];for(var p=0,q=0,order.length;p<q;p++){var
u,y,o.order[p];if(u=o.leftMatch[y].exec(g)){var
F=u[1];u.splice(1,1);if(F.substr(F.length-
1)!="\\")u[1]=u[1]||"".replace(/\\g/,"");m=o.find(y)(u,i,n);if(m!=""&&g
.g.replace(o.match[y],"").break}};if(m=i.getElementsByTagName(""));r
eturn{set:m,expr:g};k.filter=function(g,i,n,m){for(var
p,q,u=g,y=[],F=i,M=i&&i[0]&&k.isXML(i[0]);g&&i.length;){for(var N in
o.filter){p=o.leftMatch[N].exec(g);!=""&&p[2]}{var
O,D,R=o.filter[N];D=p[1];q=false;p.splice(1,1);if(D.substr(D.length-
1)!="\\")if(F===y)[]if(o.preFilter[N])if(p=o.preFilter[N](p,F,n,y,m,M)
){if(p===true)continue else q=O=true;if(p)for(var
j=0;(D=F[j])!=""&&j++)if(D){O=R(D,p,j,F);var
s=m^!O;if(n&&O===null)if(s)q=true;else F[j]=false;else
if(s){y.push(D);q=true}}if(O===B){n(F=y);g.g.replace(o.match[N],"");if(!
q)return[];break}}if(g===u)if(q===null)k.error(g);else break;u=g}return
F};k.error=function(g){throw"Syntax error, unrecognized expression:
"+g;};var
o=k.selectors={order:["ID","NAME","TAG"],match:{ID:/#(?:\w|u00c0-
uFFFF-\w|.)+/,CLASS:/^\.(\w|u00c0-\uFFFF-
\w|.)+/,NAME:/^\.(\w|u00c0-\uFFFF-
\w|.)+$/i,ATTR:/^[\s*]*(?:\w|u00c0-\uFFFF-
\w|.)+[\s*]*(?:\s*=\s*(["'](?:\w|u00c0-\uFFFF-
\w|.)+|(?!(\s|\\)|\s+))\s*)?$/i,TAG:/^([\w|u00c0-\uFFFF*
\w|.)+\.CHILD:/(onlyInthlastfirst-child(?:\s*(even|odd|dn+
-|*))?)?/POS:/(nth|eq|gt|lt|first|last|even|odd)(?:\s*(\d*))?(?:\s*[-
]|$)/PSEUDO:/(?:\w|u00c0-\uFFFF-
\w|.)+/(?:\s*(["'](?:\s*(\s|\\)|\s+))\s*)?/leftMatch:{},attrMap:{class
:"className","for":"htmlFor"},attrHandle:{href:function(g){return
g.getAttribute("href")},relative:{+":function(g,i){var n=typeof
i=="string",m=n&&!AW.test(i);n=n&&!m;if(m)i=i.toLowerCase();m=0;fo
r(var
p=g.length,q=m<p;m++)if(q=g[m]){for(;(q=q.previousSibling)&&q.nodeType
p!=1;);g[m]=n[q].q,nodeName.toLowerCase()===i?q||false;q===i)n&&
k.filter(i,g,true)},">":function(g,i){var n,m=typeof
i=="string",p=0,q=g.length;if(m&&!AW.test(i))for(i=i.toLowerCase());p<q
;p++)if(n=g[p]){n=n.parentNode;g[p]=n.nodeName.toLowerCase()===i?n:
false}}else{for(;p<q;p++)if(n=g[p])g[p]=m?n.parentNode:n.parentNode===
i&&k.filter(i,g,true)}},function(g,i,n){var m,p=e++,q=b;if(typeof
i=="string"&&!AW.test(i)){m=i.toLowerCase();q=a}q("parentNode",i,p
,g,m,n)},"~":function(g,i,n){var m,p=e++,q=b;if(typeof
i=="string"&&!AW.test(i)){m=i.toLowerCase();q=a}q("previousSibling
",i,p,g,m,n)}},find:{ID:function(g,i,n){if(typeof
i.getElementById=="undefined"&&!n)return(g=i.getElementById(g[1]))&&
g.parentNode?[g]:[]},NAME:function(g,i){if(typeof
i.getElementsByName=="undefined"){for(var
n=[],m=i.getElementsByName(g[1]),p=0,q=m.length;p<q;p++)m[p].getAttri
bute("name")===g[1]&&n.push(m[p]);return
n.length===0?null:n},TAG:function(g,i){return
i.getElementsByTagName(g[1])},preFilter:{CLASS:function(g,i,n,m,p,q){
g=" "+g[1].replace(/\\g/,"")+";if(q)return g;q=0;for(var
u;(u=i[q])!=""&&u)if(u.className&&(" "+u.className+"
").replace(/\\w|\\s/g,"").indexOf(g[1])>=0)nlm.push(u);else
if(n)[q]=false;return false},ID:function(g){return
g[1].replace(/\\g/,"")},TAG:function(g){return
g[1].toLowerCase()},CHILD:function(g){if(g[1]===~1)for(i=(
-)?(d*)n(?:\s+|-
)?(d*)/i.exec(g[2])===~1?"even"&&"2n"||g[2]===~1?"odd"&&"2n+1"||AD.test(g[2
])&&"0n"+g[2]||g[2];g[2]=i[1]+i[2]||1-0;g[3]=i[3]-0}g[0]=e++;return
g},ATTR:function(g,i,n,m,p,q){i=g[1].replace(/\\g/,"");if(!q&&o.attrMap[i]
g[1]=o.attrMap[i];if(g[2]===~1)g[4]=" "+g[4]+";return
g},PSEUDO:function(g,i,n,m,p){if(g[1]===~1)if(!d.exec(g[3])||"").length
>1||w.test(g[3])g[3]=k(g[3],null,null,i);else{g=k.filter(g[3],i,n,true"p);nl
m.push.apply(m,g);return false}else
if(o.match.POS.test(g[0])||o.match.CHILD.test(g[0]))return true;return
g},POS:function(g){g.unshift(true);return
```

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g});filters:{enabled:function(g){return
g.disabled===false&&g.type!=""&&"hidden"},disabled:function(g){return
g.disabled===true},checked:function(g){return
g.checked===true},selected:function(g){return
g.selected===true},parent:function(g){return!!g.firstChild},empty:function(
g){return!g.firstChild},has:function(g,i,n){return!!k(n[3],g.length)},header:f
unction(g){return!h/d/i.test(g.nodeName)},text:function(g){return"text"===
g.type},radio:function(g){return"radio"===g.type},checkbox:function(g){ret
urn"checkbox"===g.type},file:function(g){return"file"===g.type},password
:function(g){return"password"===g.type},submit:function(g){return"submit
"===g.type},image:function(g){return"image"===g.type},reset:function(g){
return"reset"===g.type},button:function(g){return"button"===g.type},node
Name.toLowerCase()===~1},input:function(g){return
area/button/i.test(g.nodeName)}},setFilters:{first:function(g,i){return
i===0},last:function(g,i,n,m){return i===m.length-
1},even:function(g,i){return i%2===0},odd:function(g,i){return
i%2===1},lt:function(g,i,n){return i<n[3]-0},gt:function(g,i,n){return
i>n[3]-0},nth:function(g,i,n){return n[3]-0===i},eq:function(g,i,n){return
n[3]-0===i},filter:{PSEUDO:function(g,i,n,m){var
p=i[1],q=o.filters[p];if(q)return q(g,n,i,m);else
if(p===~1)q=o.contains?return(g.textContent).indexOf(g[1])>=0:else
if(p===~2){i=i[3];n=0;for(m=i.length;n<m;n++){if(i[n]===g)return
false;return true}else k.error("Syntax error, unrecognized expression:
"+p)},CHILD:function(g,i){var n=i[1],m=g.switch(n){case"only":case
"first":for(m=m.previousSibling);if(m.nodeType===1)return
false;if(n===~1)return true;m=g.case
"last":for(m=m.nextSibling);if(m.nodeType===1)return false;return
true;case"nth":n=i[2];var p=i[3];if(n===1&&p===0)return true;var
q=i[0],u=g.parentNode;if(u&&(u.sizcache===~1||!q.nodeTypeIndex)){var
y=0;for(m=u.firstChild;m=m.nextSibling)if(m.nodeType===1)m.nodeTypeInd
ex+=y;u.sizcache=q}m=g.nodeTypeIndex-p;return
n===0?m===0:m%u===0&&m%u>=0},ID:function(g,i){return
g.nodeType===1&&g.getAttribute("id")===i},TAG:function(g,i){return
i===g.nodeType===1&&g.nodeName.toLowerCase()===i},CLASS:fu
nction(g,i){return" "+(g.className).getAttributes("class")+
").indexOf(i)>=0},ATTR:function(g,i){var
n=i[1],n=o.attrHandle[n]?o.attrHandle[n](g):g[n]!=""&&g.getAttribute(
n);var m=n+"",p=i[2],q=i[4];return
n===null?p===~1:"p===~2"?m===q:p===~3?"m.indexOf(q)>=0:p===~4
?"m"+"m+"
").indexOf(q)>=0:!q?m&&n!=""&&false:p===~5?"m===q:p===~6?"m.index
Of(q)===0:p===~7?"m.substr(m.length-
q.length)===q:p===~8?"m===q||m.substr(0,q.length+1)===q+"-
":false},POS:function(g,i,n,m){var p=o.setFilters[i[2]];if(p)return
p(g,n,i,m)}},x=o.match.POS,r=function(g,i){return"\\w+(i-0+1)},A;for(A in
o.match){o.match[A]=RegExp(o.match[A].source+(?!["\*\?"])(?!["\*\?"])/s
ource).leftMatch[A]=RegExp(/(?:\s*\r\n)?/i).source+o.match[A].source.r
eplace(/\\(\\d+|g)/g,r)}var
C=function(g,i){g=Array.prototype.slice.call(g,O);if(i){i.push.apply(i,g);retu
r i}return
g};try{Array.prototype.slice.call(t.documentElement.childNodes,O)}catch(J)
{C=function(g,i){var n=0,m=i||[];if(f.call(g)===~1)Object
Array"]Array.prototype.push.apply(m,g);else if(typeof
g.length===~1)for(var p=g.length;n<p;p++)m.push(g[p]);else
for(;g[n];n++)m.push(g[n]);return m}}var
w=i.(t=documentElement.compareDocumentPosition)w=function(g,i){if(g=
=i){h=true;return
0}if(!g.compareDocumentPosition||!i.compareDocumentPosition)return
g.compareDocumentPosition?-1:1;return
g.compareDocumentPosition(i)&&4?-1:1;else{w=function(g,i){var
n,m,p=[],q=[];n=g.parentNode;m=i.parentNode;var
u=n;if(g===i){h=true;return 0}else if(n===m)return 1(g,i);else
if(n){if(!m)return 1}else return-
1;for(;u;){p.unshift(u);u=u.parentNode}for(u=m;u;){q.unshift(u);u=u.parent
Node}n=p.length;m=q.length;for(u=0;u<n&&u<m;u++){if(p[u]===q[u])retu
r n-l:(p[u],i,1):l=function(g,i,n){if(g===i)return
n;for(g=g.nextSibling);if(g===i)return-1;g=g.nextSibling}return
1}k.getText=function(g){for(var
i="",n,m=0;g[m];m++){n=g[m];if(n.nodeType===3||n.nodeType===4)i+=n.
nodeValue;else if(n.nodeType===8)i+=k.getText(n.childNodes)}return
i};function(){var g=t.createElement("div"),i="script"+(new
Date).getTime(),n=t.documentElement.g.innerHTML="<a
name="+i+""/>";n.insertBefore(g,n.firstChild);if(t.getElementById(i))o.fi
nd.ID=function(m,p,q){if(typeof
p.getElementById=="undefined"&&!q)return(p=p.getElementById(m[1]))?
p.id===m[1]?l:typeof
p.getAttributeNode=="undefined"&&p.getAttributeNode("id").nodeValue=
===m[1]?p:B:[]};o.filter.ID=function(m,p){var q=typeof
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m.getAttributeNode!=="undefined"&&m.getAttributeNode("id");return
m.nodeType===1&&q&&q.nodeValue===p}}n.removeChild(g);n=g=null}
)();function(){var
g=t.createElement("div");g.appendChild(t.createComment(""));if(g.getElem
entsByTagName("*").length>0).find.TAG=function(i,n){var
m=n.getElementsByTagName(i[1]);if(i[1]==="*")for(var
p=[],q=0;m[q].q+=m[q].nodeType===1&&p.push(m[q]);m=p}return
m);g.innerHTML="<a href=#></a>";if(g.firstChild&&typeof
g.firstChild.getAttribute!=="undefined"&&g.firstChild.getAttribute("href")!
=="#")o.attrHandle.href=function(i){return
i.getAttribute("href",2);g=null}();t.querySelectorAll&&function(){var
g=k,i=t.createElement("div");i.innerHTML="<p
class=TEST></p>";if(!i.querySelectorAll&&i.querySelectorAll("TEST").
length===0){k=function(m,p,q,u){p=pllt;m=m.replace(/\s*([^\s]*)\s*/g,
"$1");if(!u&&!k.isXML(p))if(p.nodeType===9)try{return
C(p.querySelectorAll(m),q)catch(y){}else
if(p.nodeType===1&&p.nodeName.toLowerCase()!="object"){var
F=p.getAttribute("id"),M=F||__sizzle__;Flp.setAttribute("id",M);try{return
n(C(p.querySelectorAll("#"+M+"
"+m),q)catch(N){}finally{Flp.removeAttribute("id")}}return
g(m,p,q,u)}for(var n in g[k][n]=g[n];i=null}());(function(){var
g=t.documentElement,i=g.matchesSelector||g.mozMatchesSelector||g.webkit
MatchesSelector||g.msMatchesSelector,n=false;try{i.call(t.documentElement
,"[test=]:sizzle")catch(m){n=true}if(i).k.matchesSelector=function(p,q){q
=q.replace(/\s*([^\s]*)\s*/g,"$1");if(!k.isXML(p))try{if(!n||o.match.
PSEUDO.test(q)&&!/=/-test(q)/return i.call(p,q)catch(u){}return
k(q,null,null,p)}.length>0)}();(function(){var
g=t.createElement("div");g.innerHTML="<div class=test e></div><div
class=test></div>";if(!g.getElementsByClassName||g.getElementsByClassName("
e").length===0){g.lastChild.className="e";if(g.getElementsByClassName(Cl
assName("e")).length!=="1")o.order.splice(1,0,"CLASS");o.find.CLASS=fun
ction(i,n,m){if(typeof
n.getElementsByClassName!=="undefined"&&!m)return
n.getElementsByClassName(i[1]);g=null}});k.contains=t.documentElem
ent.contains?function(g,i){return
g===i&&(g.contains?g.contains(i):true)}:t.documentElement.compareDocu
mentPosition?function(g,i){return!(g.compareDocumentPosition(i)&16)}:f
unction(){return
false};k.isXML=function(g){return(g=g.ownerDocument||g).document
Element?g.nodeName!="HTML":false};var L=function(g,i){for(var
n,m=[],p="",q=i.nodeType?i:i.n=0;match.PSEUDO.exec(g);){p+=n[0];g=g
.replace(o.match.PSEUDO,"")}g=o.relative[g]?g+"*":g;n=0;for(var
u=q.length;n<u;n++)k(g,q[n],m);return
k.filter(p,m);c.find=k;c.expr=k.selectors;c.expr["."]=c.expr.filters;c.unique
=k.uniqueSort;c.text=k.getText;c.isXMLDoc=k.isXML;c.contains=k.contains
s)}();var
Za=/Until$/,Sa=/^(?:parents|prevUntil|prevAll)/,ab=/,Na=/^\.#\/\.*$/,bb
=Array.prototype.slice,cb=c.expr.match.POS;c.fn.extend({find:function(a){f
or(var
b=this.pushStack("","find",a),d=0,e=0,f=this.length;e<f;e++){(d=b.length;c.f
ind(a,this[e],b);if(e>0)for(var h=d;h<cb.length;h++)for(var
l=0;l<d;l++){if(b[l]===b[h]){b.splice(h--,1);break}}return
b},has:function(a){var b=c(a);return this.filter(function(){for(var
d=0,e=b.length;d<e;d++)if(c.contains(this,b[d]))return
true}}),not:function(a){return
this.pushStack(ma(this,a,false),"not",a)},filter:function(a){return
this.pushStack(ma(this,a,true),"filter",a)},is:function(a){return!a&&c.filter(
a,this).length>0},closest:function(a,b){var
d=[],e,f,h=this[0];if(c.isArray(a)){var
l,k={};o=1;if(h&&a.length){e=0;for(f=a.length;e<f;e++){l=a[e];k[l]||k[l]=c
.expr.match.POS.test(l)?c(1,blthis.context:l)}for(h&&h.ownerDocument&
&h!=="#");for(l in k){e=k[l];if(e.jquery?e.index(h)>-
1:c(h).is(e).d.push({selector:l,elem:h,level:o})}h=h.parentNode;o++}return
d]}=cb.test(a)?c(a,blthis.context):null;e=0;for(f=this.length;e<f;e++)for(h=t
his[e];h;if(!L.index(h)>-
1:c.find.matchesSelector(h,a)){d.push(h);break}else{h=h.parentNode;if(!h||
h.ownerDocument!=="#")break}d=d.length>1?c.unique(d):return
this.pushStack(d,"closest",a)},index:function(a){if(!alltypeof
a=="string")return c.inArray(this[0],a)?c(a):this.parent().children();return
c.inArray(a.jquery?a[0]:a,this),add:function(a,b){var d=typeof
a=="string"?c(a,blthis.context):c.makeArray(a),e=c.merge(this.get(),d);ret
urn
this.pushStack([d[0]||d[0].parentNode||d[0].parentNode.nodeType===11||e
[0]||e[0].parentNode||e[0].parentNode.nodeType===11?c.unique(e)),and
Self:function(){return
this.add(this.prevObject)});c.each({parent:function(a){return(a=a.parentNode)
&&a.nodeType===11?a:null},parents:function(a){return
c.dir(a,"parentNode")},parentsUntil:function(a,b,d){return
c.dir(a,"parentNode",d)},next:function(a){return
c.nth(a,2,"nextSibling")},prev:function(a){return

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c.nth(a,2,"previousSibling")},nextAll:function(a){return
c.dir(a,"nextSibling")},prevAll:function(a){return
c.dir(a,"previousSibling")},nextUntil:function(a,b,d){return
c.dir(a,"nextSibling",d),prevUntil:function(a,b,d){return
c.dir(a,"previousSibling",d)},siblings:function(a){return
c.sibling(a.parentNode.firstChild,a)},children:function(a){return
c.sibling(a.firstChild)},contents:function(a){return
c.nodeName(a,"iframe"?a.contentDocument||a.contentWindow.document:c.
makeArray(a.childNodes)},function(a,b){c.fn[a]=function(d,e){var
f=c.map(this,b,d);Za.test(a)||e=d;if(e&&typeof
e=="string")f=c.filter(e,f);f=this.length>1?c.unique(f):f;if((this.length>1||ab
.test(e))&&Sa.test(a))f=f.reverse();return
this.pushStack(f,a,bb.call(arguments).join(", "));c.extend({filter:function(
a,b,d){if(d)a="not("+a+")";return
b.length===1?c.find.matchesSelector(b[0],a)?b[0]:[]:c.find.matches(a,b),
dir:function(a,b,d){var
e=[];for(a=a[b];a&&a.nodeType!==9&&(d===b||a.nodeType===11||c(a).is(d
)));{a.nodeType===1&&e.push(a);a=a[b]}return
e},nth:function(a,b,d){b=bl1;for(var
e=0;a=a[a[d]]if(a.nodeType===1&&+e===b)break;return
a},sibling:function(a,b){for(var
d=[];a=a.nextSibling)a.nodeType===1&&a!=="#&&d.push(a);return
d}});var za=
jQuery/d+="/(?:d+null)/g,$=/\s+/g,Aa=/^(?!arealbr|collembd|hr|img|input|l
ink|meta|param)(([w:]+)[^>]*)/g,Ba=/^(?:[w:]+),db=/<tbody/i,eb=/<#
?w+:/,Ca=/^(?:script|object|embed|option|style)/i,Da=/checked\s*(?:[^=]\s
*checked/i,fb=/^(?:>|>+|>+>)/g,P=option[1].<select
multiple="multiple">,"<select>"],legend:[1,"<fieldset>","</fieldset>"],thead
:[1,"<table>","</table>"],tr:[2,"<table><tbody>","</tbody></table>"],td:[3,
"<table><tbody><tr>","</tr></tbody></table>"],col:[2,"<table><tbody></tbody><colgroup>","</colgroup></table>"],area:[1,"<map>","</map>"],_defa
ult:[0,"",""];P.optgroup=P.option;P.tbody=P.tfoot=P.colgroup=P.caption=P
.thead;P.th=P.td;if(!c.support.htmlSerialize)P._default=[1,"div<div>","</div
>"];c.fn.extend({text:function(a){if(c.isFunction(a))return
this.each(function(b){var d=c(this);d.text(a.call(this,b,d.text()));if(typeof
a!="object"&&a!=="B")return
this.empty().append((this[0]&&this[0].ownerDocument||t).createTextNode(a
));return c.text(this)},wrapAll:function(a){if(c.isFunction(a))return
this.each(function(d){c(this).wrapAll(a.call(this,d))});if(this[0]){var
b=c(a,this[0].ownerDocument).eq(0).clone(true);this[0].parentNode&&b.ins
ertBefore(this[0]);b.map(function(){for(var
d=this.d.firstChild&&d.firstChild.nodeType===1;d=d.firstChild;return
d}).append(this)}return this},wrapInner:function(a){if(c.isFunction(a))return
this.each(function(b){c(this).wrapInner(a.call(this,b))});return
this.each(function(){var
b=c(this),d=b.contents();d.length?d.wrapAll(a):b.append(a)}),wrap:functio
n(a){return
this.each(function(){c(this).wrapAll(a)}),unwrap:function(){return
this.parent().each(function(){c.nodeName(this,"body")||c(this).replaceWith(
t.his.childNodes)}),end()}.append:function(){return
this.domManip(arguments,true,function(a){this.nodeType===1&&this.appen
dChild(a)}),prepend:function(){return
this.domManip(arguments,true,function(a){this.nodeType===1&&this.inser
tBefore(a,this.firstChild)}),before:function(){if(this[0]&&this[0].parentNo
de)return
this.domManip(arguments,false,function(b){this.parentNode.insertBefore(b,
this)});else if(arguments.length){var
a=c(arguments[0]);a.push.apply(a,this.toArray());return
this.pushStack(a,"before",arguments)},after:function(){if(this[0]&&this[0].
parentNode)return
this.domManip(arguments,false,function(b){this.parentNode.insertBefore(b,
this.nextSibling)});else if(arguments.length){var
a=this.pushStack(this,"after",arguments);a.push.apply(a,c(arguments[0]).toA
rray());return a},remove:function(a,b){for(var
d=0,e=(e=this[d])?null:d++);if(!l||c.filter(a,[e]).length){if(b&&e.nodeType
===1){c.cleanData(e.getElementsByTagName("*"));c.cleanData([e])}e.pare
ntNode&&e.parentNode.removeChild(e)}return
this},empty:function(){for(var
a=0,b=(b=this[a])?null:a++);for(b.nodeType===1&&c.cleanData(b.getElements
ByTagName("*"));b.firstChild);b.removeChild(b.firstChild);return
this},clone:function(a){var
b=this.map(function(){if(!c.support.noCloneEvent&&!c.isXMLDoc(this))v
ar
d=this.outerHTML,e=this.ownerDocument;if(!d){d=e.createElement("div");
d.appendChild(this.cloneNode(true));d=d.innerHTML}return
c.clean([d.replace(z,"").replace(fb,"$1">").replace("$",""),e])[0]}else return
this.cloneNode(true)};if(a===true){na(this,b);na(this.find("*"),b.find("*"))
return b},html:function(a){if(a===B)return
this[0]&&this[0].nodeType===1?this[0].innerHTML.replace(z,""):null;else
if(typeof

```

```
a===string"&&!Ca.test(a)&&(c.support.leadingWhitespacell$.test(a))&&!
P[(Ba.exec(a)ll["", ""], [1].toLowerCase())]a=a.replace(Aa, "<S1</S2>");try
{for var
b=0,d=this.length;b<d;b++)if(this[b].nodeType===1){c.cleanData(this[b].ge
tElementsByTagName(""));this[b].innerHTML=a} catch(e){this.empty().a
ppend(a)} else c.isFunction(a)?this.each(function(f){var
h=c(this);h.html(a.call(this,f,h.html()));this.empty().append(a);return
this}.replaceWith:function(a){if(this[0]&&this[0].parentNode){if(c.isFuncni
on(a))return this.each(function(b){var
d=c(this),e=d.html();d.replaceWith(a.call(this,b,e));});if(typeof
a!=="string")a=c(a).detach();return this.each(function(){var
b=this.nextSibling,d=this.parentNode;c(this).remove();b?c(b).before(a):c(d).
append(a)}) else return
this.pushStack(c(c.isFunction(a)?a():a,"replaceWith",a).detach:function(a)
{return this.remove(a,true)}.domManip:function(a,b,d){var
e,f,h,l=a[0],k=[];if(!c.support.checkClone&&arguments.length===3&&type
of l==="string"&&Da.test(l))return
this.each(function(){c(this).domManip(a,b,d,true)});if(c.isFunction(l))return
this.each(function(x){var
r=c(this);a[0]=l.call(this,x,b,r.html():B);r.domManip(a,b,d);});if(this[0]){e=l
&&l.parentNode;e=c.support.parentNode&&e&&e.nodeType===1&&e.ch
ildNodes.length===this.length?{fragment:e}:c.buildFragment(a,this,k);h=c.f
ragment;if(h=h.childNodes.length===1?h.h.firstChild:h.firstChild){b=b&&
c.nodeName(f,"tr");f=0;for(var
o=this.length;f<o;f++)d.call(b?c.nodeName(this[f],"table"):this[f].getEleme
ntsByTagName("tbody")[0])llthis[f].appendChild(this[f].ownerDocument.cre
ateElement("tbody"));this[f].f>0lle.cacheablellthis.length>1?h.cloneN
ode(true):h)}k.length&&c.each(k,Oa)return
this};c.buildFragment=function(a,b,d){var
e,f,h;b=b&&b[0]?b[0].ownerDocumentllb[0]?1;if(a.length===1&&typeof
a[0]===string"&&a[0].length<512&&b===t&&!Ca.test(a[0])&&(c.support
t.checkClone!llDa.test(a[0]))){f=true;if(h=c.fragments[a[0]])if(h!=""e=h}if(
!e){e=b.createDocumentFragment();c.clean(a,b,e,d)}if(f.c.fragments[a[0]]
=h?e:l;return {fragment:e,cacheable:f};};c.fragments={};c.each({appendTo:"a
ppend","prependTo":"prepend",insertBefore:"before",insertAfter:"after",replac
eAll:"replaceWith"},function(a,b){c.fn[a]=function(d){var e=[];d=c(d);var
f=this.length===1&&this[0].parentNode;if(f&&f.nodeType===1&&f.chil
dNodes.length===1&&d.length===1){d(b)(this[0]);return
this} else {f=0;for(var h=d.length;f<h;f++){var
l=(f>0?this.clone(true):this).get();c(d[f])l(l);e=e.concat(l)} return
this.pushStack(e,a,d.selector)});};c.extend({clean:function(a,b,d,e){b=lll;if
(typeof
b.createElement===undefined)b=b.ownerDocumentllb[0]&&b[0].ownerD
ocumentlll;for(var f=[],h=0,l=(a[h])!=""llnull;h++){if(typeof
l==="number")l+=""if(l)if(typeof
l==="string"&&leb.test(l))l=b.createTextNode(l);else if(typeof
l==="string")l=l.replace(Aa,"<S1></S2>");var
k=(Ba.exec(l)ll["", ""], [1].toLowerCase(),o=P[k]llP._default,x=o[0],r=b.creat
eElement("div");for(r.innerHTML=o[1]+l+o[2];x--
);r=r.lastChild;if(!c.support.tbody){x=db.test(l);k=k===table"&&l?r.first
Child&&r.firstChild.childNodes:o[1]===table"&&l?r.firstChild.childNodes:[];fo
r(o=k.length-1;o>=0;--
o).nodeName(k[o],"tbody")&&l[k[o].childNodes.length&&k[o].parentNode
.removeChild(k[o])};c.support.leadingWhitespacell$.test(l)&&r.insertBef
ore(b.createTextNode($.exec(l)[0]),r.firstChild);l=r.childNodes}if(l.nodeType
p)f.push(l);else
f=c.merge(f,l)} if(d)for(h=0;f[h];h++)if(e&&c.nodeName(f[h],"script")&&(
!f[h].type||f[h].type.toLowerCase()===text/javascript"))e.push(f[h].parentN
ode?f[h].parentNode.removeChild(f[h]):f[h]);else {f[h].nodeType===1&&f.s
plice.apply(f,[h+1,0].concat(c.makeArray(f[h].getElementsByTagName("scri
pt"))));d.appendChild(f[h])}return f},cleanData:function(a){for var
b,d,e=c.cache,f=c.event.special,h=c.support.deleteExpando,l=0,k;(k=a[l])!=""n
ull;l++)if(!k.nodeName&&c.noData[k.nodeName.toLowerCase()])if(d=k[c
.expando]){if((b=e[d])&&b.events)for var o in
b.events)f[o]?c.event.remove(k,o):c.removeEvent(k,o,b.handle);if(h)delete
k[c.expando];else
k.removeAttribute&&k.removeAttribute(c.expando);delete e[d]});var
Ea=/alpha(?:*)/i,gb=/opacity(?:*)/i,hb=-/[a-z]/i,ib=-/[A-
Z]/g,Fa=-/^\d+(?:px)?$/i,jb=-/
^\d/,kb={position:"absolute",visibility:"hidden",display:"block"},Pa=["Left
","Right"],Qa=["Top","Bottom"],W,Ga,aa,lb=function(a,b){return
b.toUpperCase()};c.fn.css=function(a,b){if(arguments.length===2&&b===
B)return this;return c.access(this,a,b,true,function(d,e,f){return
f!=""?c.style(d,e,f):c.css(d,e)});c.extend({cssHooks:{opacity:{get:function
(a,b){if(b){var d=W(a,"opacity"),opacity="";return d===""?1:"d"}else return
a.style.opacity}}},cssNumber:{zIndex:true,fontWeight:true,opacity:true,zoo
m:true,lineHeight:true},cssProps:{"float":c.support.cssFloat?"cssFloat":"styl
eFloat"},style:function(a,b,d,e){if(!(!alla.nodeType===3lla.nodeType===8ll
a.style){var
f,h=c.camelCase(b),l=a.style,k=c.cssHooks[h];b=c.cssProps[h]llh;if(d!=""B}
```

```
if(!typeof d===number"&&isNaN(d)lld===null){if(typeof
d===number"&&lc.cssNumber[h]d+=""px";if(!kll("set" in
k)(d=k.set(a,d))!=""B)try{l[b]=d} catch(o){}} else {if(k&&"get" in
k&&(f=k.get(a,false,e))!=""B)return f;return l[b]}}.css:function(a,b,d){var
e,f=c.camelCase(b),h=c.cssHooks[f];b=c.cssProps[f]llf;if(h&&"get" in
h&&(e=h.get(a,true,d))!=""B)return e;else if(W)return
W(a,b,f),swap:function(a,b,d){var e={};f:for(f in
b){e[f]=a.style[f];a.style[f]=b[f]}d.call(a);for(f in
b)a.style[f]=e[f]}.camelCase:function(a){return
a.replace(hb,lb)};}.curCSS=c.css.c.each(["height","width"],function(a,b){
c.cssHooks[b]={get:function(d,e,f){var
h;if(e){if(d.offsetLeft!=""0)h=oa(d,b,f);else
c.swap(d,kb,function(){h=oa(d,b,f)});if(h<=0){h=W(d,b,b);if(h===0px"&
&aa)h=aa(d,b,b);if(h!=""null)return
h===llh===auto?"0px":h}if(h<0llh===null){h=d.style[b];return
h===llh===auto?"0px":h}return typeof
h===string?"h:h+""px"};set:function(d,e){if(Fa.test(e)){e=parseFloat(e);if
e>=0)return e+""px"} else return
e}};if(c.support.opacity)c.cssHooks.opacity={get:function(a,b){return
gb.test(b&&a.currentStyle?a.currentStyle.filter:a.style.filter)ll""}parseFloat
(RegExp.$1/100+""b?"1": "");},set:function(a,b){var d=a.style;d.zoom=1;var
e=c.isNaN(b)?""alpha(opacity="+b*100+)"":f.d.filterll";d.filter=Ea.test(f)
?f.replace(Ea,e):d.filter+
"+e");if(!c.defaultView&&t.defaultView.getComputedStyle)Ga=function(a,b
,d){var e;d=d.replace(ib,"-
S1").toLowerCase();if(!b.ownerDocument.defaultView)return
B;if(b=b.getComputedStyle(a,null))e=b.getPropertyValue(d);if(e===&&
!c.contains(a.ownerDocument.documentElement,a))e=c.style(a,d)}return
e};if(!t.documentElement.currentStyle)aa=function(a,b){var
d,e,f=a.currentStyle&&a.currentStyle[lb],h=a.style;if(!Fa.test(f)&&jb.test(f)
){d=h.left;e=a.runtimeStyle.left;a.runtimeStyle.left=a.currentStyle.left;h.left=
b===fontSize?"1em":fl0;f=h.pixelLeft+""px";h.left=d;a.runtimeStyle.left=
e}return
f===""?auto":f};W=Galla;if(c.expr&&c.expr.filters){c.expr.filters.hidden=
function(a){var b=a.offsetHeight;return
a.offsetWidth===0&&b===0llc.support.reliableHiddenOffsets&&(a.style.d
isplay||c.css(a,"display"))===none"};c.expr.filters.visible=function(a){retur
n!c.expr.filters.hidden(a)};var
mb=c.now(),nb=<script>[<^&*</script></^&*</script>/gi,ob=/^(?:
select|textarea)/i,pb=/^(?:color|date|datetime|email|hidden|month|number|pas
sword|range|search|tel|text|time|url|week)/i,qb=/^(?:GET|HEAD)/$,Ra=/[
$]/,T=A=/(?&S)/ja=/?/rb=/(?:&)_=[^&]*,sb=-/^(w+)?VV(?:^#)+/,tb=
/%20/g,ub=#.*$/Ha=c.fn.load;c.fn.extend({load:function(a,b,d){if(typeof
a!=""string"&&Ha)return Ha.apply(this,arguments);else
if(this.length)return this;var e=a.indexOf( " ");if(e>=0){var
f=a.slice(e,a.length);a=a.slice(0,e)}e="GET";if(b)if(c.isFunction(b)){d=b;b=
null} else if(typeof
b==="object"){b=c.param(b,c.ajaxSettings.traditional);e="POST"} var
h=this;c.ajax({url:a,type:e,dataType:"html",data:b,complete:function(l,k){if(
k==="success"llk===notmodified")h.html(f?c("<div>").append(l.responseText
).replace(nb,"")).find(f).l.responseText;d&&h.each(d,[l.responseText,k,l
])});return this},serialize:function(){return
c.param(this.serializeArray())},serializeArray:function(){return
this.map(function(){return
this.elements?c.makeArray(this.elements):this}).filter(function(){return
this.name&&!this.disabled&&(this.checked||b.test(this.nodeName))llp.test(
this.type)}).map(function(a,b){var d=c(this).val();return
d===null?null:c.isArray(d)?c.map(d,function(e){return{name:b.name,value:e
}});{name:b.name,value:d}}).get()});c.each("ajaxStart ajaxStop
ajaxComplete ajaxError ajaxSuccess ajaxSend".split(
"),function(a,b){c.fn[b]=function(d){return
this.bind(b,d)};};c.extend({get:function(a,b,d,e){if(c.isFunction(b)){e=elld;d=
b;b=null}return
c.ajax({type:"GET",url:a,data:b,success:d,dataType:e}),getScript:function(
a,b){return c.get(a,null,b,"script")}.getJSON(function(a,b,d){return
c.get(a,b,d,"json")}.post:function(a,b,d,e){if(c.isFunction(b)){e=elld;d=b;b=
}})return
c.ajax({type:"POST",url:a,data:b,success:d,dataType:e}),ajaxSetup:functio
n(a){c.extend(c.ajaxSettings,a)},ajaxSettings:{url:location.href,global:true,ty
pe:"GET",contentType:"application/x-www-form-
urlencoded",processData:true,async:true,xhr:function(){return new
E.XMLHttpRequest},accepts:{xml:"application/xml,
text/xml",html:"text/html",script:"text/javascript,
application/javascript",json:"application/json,
text/javascript",text:"text/plain",_default:"*/"},ajax:function(a){var
b=c.extend(true, {},c.ajaxSettings,a),d,e,f,h=b.type.toUpperCase(),l=qb.test(
h)?b.url=b.url.replace(ub,"");b.context=a&&a.context=null?a.context:b;if(b.
data&&b.processData&&typeof
b.data!=""string")b.data=c.param(b.data,b.traditional);if(b.dataType===jso
np")if(h===GET")T.test(b.url)ll(b.url+=""(ja.test(b.url))&":"?")+b.jsonpll"
```

```

callback")+=""?);else
if(!b.data||T.test(b.data))b.data=(b.data?b.data+"&":"")+b.jsonp||"callback"
)+=""?";b.dataType="json"}if(b.dataType==="json"&&(b.data&&T.test(b.da
ta)||T.test(b.url))){d=b.jsonpCallback||"jsonp"+mb++;if(b.data)b.data=(b.dat
a+"").replace(T,"="+d+"$1");b.url=b.url.replace(T,"="+d+"$1");b.dataType
="script";var
k=E[d];E[d]=function(m){if(c.isFunction(k))k(m);else{E[d]=B;try{delete
E[d]}catch(p){}}f=m;c.handleSuccess(b,w,e,f);c.handleComplete(b,w,e,f);r
&&r.removeChild(A)}if(b.dataType==="script"&&b.cache===null)b.cach
e=false;if(b.cache===false&&I){var
o=c.now(),x=b.url.replace(rb,"$1_="+o);b.url=x+(x===b.url?(ja.test(b.url)?
&":"?")+_="+o:");if(b.data&&I)b.url+=x+(ja.test(b.url)?&":"?")+b.data;b.g
lobal&&c.active+===0&&c.event.trigger("ajaxStart");o=(o-sb.exec(b.url)
)&&(o[1]&&o[1]).toLowerCase()!==location.protocol[2].toLowerCase()!:=
location.host;if(b.dataType==="script"&&h==="GET"&&o){var
r=t.getElementsByTagName("head")[0]||t.documentElement,A=t.createElement("script");if(b.scriptCharset)A.charset=b.scriptCharset;A.src=b.url;if(!d){
var
C=false;A.onload=A.onreadystatechange=function(){if(!C&&(this.readyState
atellthis.readyState==="loaded"||this.readyState==="complete")){C=true;c.h
andleSuccess(b,w,e,f);c.handleComplete(b,w,e,f);A.onload=A.onreadystatechange
change=null;r&&A.parentNode&&r.removeChild(A)}}r.insertBefore(A,r.fir
stChild);return B}var
J=false,w=b.xhr();if(w){b.username?w.open(h,b.url,b.async,b.username,b.pa
ssword):w.open(h,b.url,b.async);try{if(b.data!=null&&I||a&&a.contentType
)w.setRequestHeader("Content-
Type","b.contentType");if(b.ifModified){c.lastModified[b.url]&&w.setReques
tHeader("If-Modified-
Since",c.lastModified[b.url]);c.etag[b.url]&&w.setRequestHeader("If-None-
Match",c.etag[b.url]);o||w.setRequestHeader("X-Requested-
With","XMLHttpRequest");w.setRequestHeader("Accept",b.dataType&&b.
accepts[b.dataType]?b.accepts[b.dataType]+",
/*:q=0.01".b.accepts._default)}catch(i){if(b.beforeSend&&b.beforeSend.
call(b.context,w,b)===false){b.global&&c.active--
===1&&c.event.trigger("ajaxStop");w.abort();return
false}b.global&&c.triggerGlobal(b,"ajaxSend",[w,b]);var
L=w.onreadystatechange=function(m){if(!w||w.readyState===0||m==="abor
t"){llc.handleComplete(b,w,e,f);J=true;if(w.w.onreadystatechange=c.noop)
else
if(!J&&w&&(w.readyState===4||m==="timeout")){J=true;w.onreadystatechange
change=c.noop;e=m==="timeout"?m:"timeout";l.c.httpSuccess(w)?"error":b.ifM
odified&&c.httpNotModified(w,b.url)?"notmodified":"success";var
p;if(e==="success")try{f=c.httpData(w,b.dataType,b)}catch(q){e="parsererr
or";p=q}if(e==="success"||e==="notmodified")dlc.handleSuccess(b,w,e,f);e
lse
c.handleError(b,w,e,p);dlc.handleComplete(b,w,e,f);m==="timeout"&&w.a
bort();if(b.async)w=null};try{var
g=w.abort;w.abort=function(){w&&Function.prototype.call.call(g,w);L("ab
ort")}catch(i){}b.async&&b.timeout>0&&setTimeout(function(){w&&L("ab
ort")},b.timeout);try{w.send(l||b.data===null?null:b.data)}catch(n)
){c.handleError(b,w,null,n);c.handleComplete(b,w,e,f);b.async||L();return
w};param:function(a,b){var
d=[],e=function(h,1){=c.isFunction(l)?l:(l;d.length)=encodeURICompon
ent(h)+"="+encodeURIComponent(l);if(b===B)=c.ajaxSettings.traditional;
if(c.isArray(a))l.jQuery)c.each(a,function(){e(this.name,this.value)});else
for(var f in a)da(f,a[f],b,e);return
d,join("&").replace(/b, "+" )};c.extend({active:0,lastModified:{},etag:
{}},h.a.ndleError:function(a,b,d,e){a.error&&a.error.call(a.context,b,d,e);a.global&
&c.triggerGlobal(a,"ajaxError",[b,a,e]);},handleSuccess:function(a,b,d,e){a.s
uccess&&a.success.call(a.context,e,d,b);a.global&&c.triggerGlobal(a,"ajaxS
uccess",[b,a]);},handleComplete:function(a,b,d){a.complete&&a.complete.ca
ll(a.context,b,d);a.global&&c.triggerGlobal(a,"ajaxComplete",[b,a]);a.global
&&c.active--
===1&&c.event.trigger("ajaxStop");},triggerGlobal:function(a,b,d){(a.conte
xt&&a.context.url===null?c(a.context):c.event).trigger(b,d),httpSuccess:fun
ction(a){try{return!a.status&&location.protocol==="file:"||a.status>=200&
&a.status<300||a.status===304||a.status===1223}catch(b){}return
false},httpNotModified:function(a,b){var d=a.getResponseHeader("Last-
Modified"),e=a.getResponseHeader("Etag");if(d&&c.lastModified[b]=d;if(e)c.
etag[b]=e;return a.status===304},httpData:function(a,b,d){var
e=a.getResponseHeader("content-
type")||"",f=b==="xml"||b&&c.indexOf("xml")>=0;a=f?a.responseXML:a.r
esponseText;f&&a.documentElement.nodeName==="parsererror"&&c.error
("parsererror");if(d&&d.dataFilter=a.d.dataFilter(a,b);if(typeof
a==="string")if(b==="json"||b&&c.indexOf("json")>=0)a=c.parseJSON(a);
else
if(b==="script"||b&&c.indexOf("javascript")>=0)c.globalEval(a);return
a});if(E.ActiveXObject)c.ajaxSettings.xhr=function(){if(E.location.protocol
!=="file:")try{return new E.XMLHttpRequest}catch(a){}try{return new
E.ActiveXObject("Microsoft.XMLHTTP")}catch(b){};c.support.ajax=!c.a

```

```

jaxSettings.xhr();var ea={},vb=/(?::toggle|show|hide)/$,wb=/(^|+
-)=?(\d+|-
+)?(.*$)/,ba,pa=[["height","marginTop","marginBottom","paddingTop","pad
dingBottom"],["width","marginLeft","marginRight","paddingLeft","padding
Right"],["opacity"]];c.fn.extend({show:function(a,b,d){if(alla===0)return
this.animate("show",3),a,b,d);else{d=0;for(var
e=this.length;d<e;d++){a=this[d];b=a.style.display;if(!c.data(a,"olddisplay")
&&b===none)b=a.style.display="";b===&&c.css(a,"display")===non
e"&&c.data(a,"olddisplay",qa(a.nodeName))for(d=0;d<e;d++){a=this[d];b
=a.style.display;if(b===&&lb===none)a.style.display=c.data(a,"olddisplay")
||""return this};hide:function(a,b,d){if(alla===0)return
this.animate("hide",3),a,b,d);else{a=0;for(b=this.length;a<b;a++){d=c.css(
this[a],"display");d!=""&&c.data(this[a],"olddisplay",d)}for(a=0;a<b;
a++){this[a].style.display="none";return
this};_toggle:c.fn.toggle,toggle:function(a,b,d){var e=typeof
a==="boolean";if(c.isFunction(a)&&c.isFunction(b))this._toggle.apply(this,
arguments);else a=null||e?this.each(function(){var
f=e?a:c(this).is("hidden");c(this)[f?"show":"hide"]());this.animate("toggl
e",3),a,b,d);return this},fadeTo:function(a,b,d,e){return
this.filter("hidden").css("opacity",0).show().end().animate({opacity:b},a,d,e
)},animate:function(a,b,d,e){var
f=c.speed(b,d,e);if(c.isEmptyObject(a))return this.each(f.complete);return
this[f.queue===false?"each":"queue"](function(){var
h=c.extend({},f),l,k=this.nodeType===1,o=k&&c(this).is("hidden"),x=this;
for(l in a){var r=c.camelCase(l);if(l!==r){a[r]=a[l];delete
a[l];l=r}if(a[l]===hide"&&olla[l]===show"&&lo)return
h.complete.call(this);if(k&&(l===height"&&width"))h.overflow=[this.
style.overflow,this.style.overflowX,this.style.overflowY];if(c.css(this,"displ
ay")===inline"&&c.css(this,"float")===none)if(c.support.inlineBlockNe
edsLayout)if(qa(this.nodeName)===inline)this.style.display="inline-
block";else{this.style.display="inline";this.style.zoom=1}else
this.style.display="inline-
block"}if(c.isArray(a[l])){h.specialEasing=h.specialEasing||{};l=a[l][0];a[l]
=a[l][0]}if(h.overflow!=null)this.style.overflow="hidden";h.curAnim=c.e
xtend({},a);c.each(a,function(A,C){var J=new
C(x,h,A);if(vb.test(C))J.C===toggle"?o?show":"hide":C(a);else{var
w=wb.exec(C),I=J.cur||0;if(w){var
L=parseFloat(w[2]),g=w[3]||px";if(g!=""px"){c.style(x,A,(L||1)+g);I=(L||1)
/J.cur()*I;c.style(x,A,I+g)}if(w[1])L=(w[1]===-?
1:1)*L+I;J.custom(I,L,g)}else J.custom(I,C,")});return
true});stop:function(a,b){var
d=c.timers;a&&this.queue().each(function(){for(var e=d.length-
1;e>=0;e--
)if(d[e].elem===this){b&&d[e](true);d.splice(e,1)});b||this.dequeue();return
this};c.each({slideDown:S("show",1),slideUp:S("hide",1),slideToggle:S("t
oggle",1),fadeIn:{opacity:"show"},fadeOut:{opacity:"hide"},fadeToggle:{o
pacity:"toggle"}},function(a,b){c.fn[a]=function(d,e,f){return
this.animate(b,d,e,f)};c.extend({speed:function(a,b,d){var e=a&&typeof
a==="object"?c.extend({},a):{complete:d||d&&b||c.isFunction(e).old
d&&e.old.call(this)};return e},easing:{linear:function(a,b,d,e){return-
Math.cos(a*Math.PI/2+0.5)*e+d};timers:[]},fx:function(a,b,d){this.options
=b;this.elem=a;this.prop=d;if(!b.orig)b.orig={}});c.fn.prototype={update:f
unction(){this.options.step&&this.options.step.call(this.elem,this.now,this);(
c.fx.step[this.prop]||c.fx.step._default)(this);cur:function(){if(this.elem[this.
prop]===null&&(!this.elem.style||this.elem.style[this.prop]===null)}return
this.elem[this.prop];var a=parseFloat(c.css(this.elem,this.prop));return
a&&a>=1E4?a:0},custom:function(a,b,d){function e(l){return f.step(l)}var
f=this,h=c.fx;this.startTime=c.now();this.start=a;this.end=b;this.unit=d||this.
unit||px";this.now=this.start;this.pos=this.state=0;e.elem=this.elem;if(e()&
&c.timers.push(e)&&!ba)ba=setInterval(h.tick,h.interval);},show:function(){
this.options.orig[this.prop]=c.style(this.elem,this.prop);this.options.show=tr
ue;this.custom(this.prop===width"||this.prop===height"?1:0,this.cur());(t
his.elem).show();},hide:function(){this.options.orig[this.prop]=c.style(this.el
em,this.prop);this.options.hide=true;this.custom(this.cur(),0);step:functio
n(a){var
b=c.now(),d=true;if(allb>=this.options.duration+this.startTime){this.now=th
is.end;this.pos=this.state=1;this.update();this.options.curAnim[this.prop]=tru
e;for(var e in
this.options.curAnim)if(this.options.curAnim[e]!==true)d=false;if(d){if(this.
options.overflow!=null&&lc.support.shrinkWrapBlocks){var
f=this.elem,h=this.options;h.each(["X","Y"],function(k,o){f.style["overflow
"+o]=h.overflow[k]})}this.options.hide&&c(this.elem).hide();if(this.optio
ns.hide||this.options.show)for(var l in
this.options.curAnim)c.style(this.elem,l,this.options.orig[l]);this.options.cu

```

```
plete.call(this.elem) return false } else { a=b-
this.startTime;this.state=a/this.options.duration;b=this.options.easing||c.easing.swing?"swing":"linear";this.pos=c.easing[this.options.specialEasing&&t
his.options.specialEasing[this.prop]](this.state,a,0,1,this.options.duration);
this.now=this.start+(this.end-this.start)*this.pos;this.update() return
true } ;c.extend(c.fx,{tick:function() { for var
a=c.timers,b=0;b<a.length;b++a[b](0)ll.splice(b--
,1);a.lengthll.fx.stop();interval:13,stop:function() { clearInterval(ba);ba=null
},speeds:{slow:600,fast:200,_default:400},step:{opacity:function(a) { c.style
a.elem,"opacity",a.now) },_default:function(a) { if(a.elem.style&&a.elem.styl
e[a.prop]!=null)a.elem.style[a.prop]=(a.prop=="width"||a.prop=="height"
?Math.max(0,a.now):a.now)+a.unit;else
a.elem[a.prop]=a.now } } };if(c.expr&&c.expr.filters)c.expr.filters.animated=
function(a) { return c.grep(c.timers,function(b) { return
a===b.elem }).length };var
xb="/^(?:ableldlh)/i,la="/^(?:bodylhtml)/i;c.fn.offset="getBoundingClientR
ect" in t.documentElement?function(a) { var b=this[0],d;if(a)return
this.each(function(l){c.offset.setOffset(this,a,l)});if(!b.ownerDocument)r
eturn null;if(b===b.ownerDocument.body) return
c.offset.bodyOffset(b);try { d=b.getBoundingClientRect() } catch(e) { } var
f=b.ownerDocument,h=f.documentElement;if(!d||c.contains(h,b))return
dll({top:0,left:0});b=f.body;f=fa(f);return {top:d.top+(f.pageXOffsetll.support
.boxModel&&h.scrollTopll.scrollTop)-
(h.clientTopll.clientTopll),left:d.left+(f.pageXOffsetll.support.boxModel
&&h.scrollLeftll.scrollLeft)-(h.clientLeftll.clientLeftll)} };function(a) { var
b=this[0];if(a)return
this.each(function(x) { c.offset.setOffset(this,a,x) });if(!b.ownerDocument)
return null;if(b===b.ownerDocument.body) return
c.offset.bodyOffset(b);c.offset.initialize();var
d=e.b.offsetParent,f=b.ownerDocument,h=f.documentElement,l=f.body;d=(f
=f.defaultView)?f.getComputedStyle(b,null):b.currentStyle;for(var
k=b.offsetTop,o=b.offsetLeft,(b=b.parentNode)&&b!==-l&&b!==-h);{ if(c.off
set.supportsFixedPosition&&d.position==="fixed")break;d=f.getCompute
dStyle(b,null):b.currentStyle;k-=b.scrollTop;o-
=b.scrollLeft;if(b===e){k+=b.offsetTop;o+=b.offsetLeft;if(c.offset.doesNot
AddBorder&&!c.offset.doesAddBorderForTableAndCells&&xb.test(b.nod
eName)) { k+=parseFloat(d.borderTopWidth)ll;o+=parseFloat(d.borderLeft
Width)ll } e=b.offsetParent;if(c.offset.subtractsBorderForOverflowNotVisib
le&&d.overflow!=="visible") { k+=parseFloat(d.borderTopWidth)ll;o+=pars
eFloat(d.borderLeftWidth)ll } d=d;if(d.position==="relative"||d.position==="
static") { k+=l.offsetTop;o+=l.offsetLeft } if(c.offset.supportsFixedPosition
&&d.position==="fixed") { k+=Math.max(h.scrollTop,l.scrollTop);o+=Math.m
ax(h.scrollLeft,l.scrollLeft) } return {top:k,left:o} };c.offset={ initialize:functio
n() { var
a=t,body,b=t.createElement("div"),d,e,f,h=parseFloat(c.css(a,"marginTop"))l
ll;o:c.extend(b.style,{ position:"absolute",top:0,left:0;margin:0;border:0,width:
"1px",height:"1px",visibility:"hidden"});b.innerHTML="<div
style=position:absolute;top:0;left:0;margin:0;border:5px solid
#000;padding:0;width:1px;height:1px;></div></div></div><table
style=position:absolute;top:0;left:0;margin:0;border:5px solid
#000;padding:0;width:1px;height:1px; cellpadding=0'
cellspacing=0'><tr><td></td></tr></table>";a.insertBefore(b,a.firstChild);d
=b.firstChild;e=d.firstChild;f=d.nextSibling.firstChild.firstChild;this.doesNo
tAddBorder=e.offsetTop===5;this.doesAddBorderForTableAndCells=f.offse
tTop===5;e.style.position="fixed";e.style.top="20px";this.supportsFixedPos
ition=e.offsetTop===20ll.offsetTop===15;e.style.position=e.style.top==="d
.style.overflow="hidden";d.style.position="relative";this.subtractsBorderFor
OverflowNotVisible=e.offsetTop===
5;this.doesNotIncludeMarginInBodyOffset=a.offsetTop!==(h=a.removeChild
(b));c.offset.initialize=c.noop}.bodyOffset:function(a) { var
b=a.offsetTop,d=a.offsetLeft;c.offset.initialize();if(c.offset.doesNotInclude
MarginInBodyOffset) { b+=parseFloat(c.css(a,"marginTop"))ll;d+=parseFloatFlo
at(c.css(a,"marginLeft"))ll } return {top:b,left:d} }.setOffset:function(a,b,d) { v
ar e=c.css(a,"position");if(e==="static")a.style.position="relative";var
f=c(a),h=f.offset(),l=c.css(a,"top"),k=c.css(a,"left"),o=e==="absolute"&&c.i
nArray("auto",[l,k])>-1:e={ };var
x={ };if(o)x=f.position();l=0?x.top:parseFloat(l,10)ll;o=0?x.left:parseFloat(k,10)
ll;if(c.isFunction(b))b=b.call(a,d,h);if(b.top!=null)e.top=b.top-
h.top+1;if(b.left!=null)e.left=b.left-h.left+k;"using" in
b?b.using.call(a,e):f.css(e) };c.fn.offset=function() { if (this[0])retu
rn null;var
a=this[0],b=this.offsetParent(),d=this.offset(),e=la.test(b[0].nodeName)?{to
p:0,left:0}:b.offset();d.top=parseFloat(c.css(a,"marginTop"))ll;d.left=
parseFloat(c.css(a,"marginLeft"))ll;e.top+=parseFloat(c.css(b[0],"borderT
opWidth"))ll;e.left+=parseFloat(c.css(b[0],"borderLeftWidth"))ll;return {to
p:d.top-e.top,left:d.left-e.left } }.offsetParent:function() { return
this.map(function() { for var
a=this.offsetParentll.body;a&&!la.test(a.nodeName)&&c.css(a,"position")=
==="static";a=a.offsetParent;return
a } ) };c.each(["Left","Top"],function(a,b) var
```

```
d="scroll"+b;c.fn[d]=function(e) { var f=this[0],h;if(!f)return
null;if(e===B)return
this.each(function() { if(h=fa(this))h.scrollTo(!a?e:c(h).scrollLeft(),a?e:c(h).s
crollTop());else this[d]=e } );else return(h=fa(f))?"pageXOffset" in
h?h[a?"pageYOffset":"pageXOffset"]:c.support.boxModel&&h.document.d
ocumentElement[d]llh.document.body[d]:f[d] } );c.each(["Height","Width"],
function(a,b) { var d=b.toLowerCase();c.fn["inner"+b]=function() { return
this[0]?parseFloat(c.css(this[0],d,"padding")):null } ;c.fn["outer"+b]=function
(e) { return
this[0]?parseFloat(c.css(this[0],d,e?"margin":"border")):null } ;c.fn[d]=functi
on(e) { var f=this[0];if(!f)return e===null?null:this;if(c.isFunction(e))return
this.each(function(l) { var
k=c(this);k[d](e.call(this,l,k(d))) } );if(c.isWindow(f))return
f.document.compatMode==="CSS1Compat" && f.document.documentElemen
t["client"+b]llf.document.body["client"+b];else if(f.nodeType===9)return
Math.max(f.documentElement["client"+b],f.body["scroll"+b],f.documentEle
ment["scroll"+b],f.body["offset"+b],f.documentElement["offset"+b]);else
if(e===B) { f=c.css(f,d);var h=parseFloat(f);return c.isNaN(h)?f:h } else return
this.css(d,typeof e==="string"?e+"px") } ) } (window);/* -----
-----Class: prettyPhotoUse: Lightbox
clone for jQueryAuthor: Stephane Caron (http://www.no-margin-for
errors.com)Version: 3.1.2-----
*/(function($){$.prettyPhoto={ version:'3.1.2'};$.fn.prettyPhoto=function(pp
_settings) { pp_settings=jQuery.extend({ animation_speed:'fast',slideshow:50
0,autoplay_slideshow:false,opacity:0.80,show_title:true,allow_resize:true,d
efault_width:500,default_height:344,counter_separator_label:'/',theme:'dark_
rounded',horizontal_padding:20,hideflash:false,wmode:'opaque',autoplay:tru
e,modal:false,deeplinking:true,overlay_gallery:true,keyboard_shortcuts:true,
changepicturecallback:function() { },callback:function() { },ie6_fallback:true,
markup:'<div class="pp_pic_holder"><div class="ppt"></div><div
class="pp_top"><div class="pp_left"></div><div
class="pp_middle"></div><div class="pp_right"></div></div><div
class="pp_content_container"><div class="pp_left"><div
class="pp_right"><div class="pp_content"><div
class="pp_loaderIcon"></div><div class="pp_fade"><a href="#"
class="pp_expand" title="Expand the image">Expand</a><div
class="pp_hoverContainer"><a class="pp_next" href="#">next</a><a
class="pp_previous" href="#">previous</a></div><div
id="pp_full_res"></div><div class="pp_details"><div class="pp_nav"><a
href="#" class="pp_arrow_previous">Previous</a><p
class="currentTextHolder">0/0</p><a href="#"
class="pp_arrow_next">Next</a></div><p
class="pp_description"></p> [pp_social] <a class="pp_close"
href="#">Close</a></div></div></div></div><div
class="pp_bottom"><div class="pp_left"></div><div
class="pp_middle"></div><div class="pp_right"></div></div></div><div
class="pp_overlay"></div>,gallery_markup:'<div class="pp_gallery"><a
href="#"
class="pp_arrow_previous">Previous</a><div><ul> [gallery] </ul></div><
a href="#" class="pp_arrow_next">Next</a></div>,image_markup:'',flash_markup:'<object
classid="clsid:D27CDB6E-AE6D-11cf-96B8-444553400000"
width="{ width }" height="{ height }"><param name="wmode"
value="{ wmode }"/><param name="allowfullscreen" value="true"/><param
name="allowscriptaccess" value="always"/><param name="movie"
value="{ path }"/><embed src="{ path }" type="application/x-shockwave-
flash" allowfullscreen="true" allowscriptaccess="always" width="{ width }"
height="{ height }"
wmode="{ wmode }"></embed></object>',quicktime_markup:'<object
classid="clsid:02BF25D5-8C17-4B23-BC80-D3488ABDDC6B"
codebase="http://www.apple.com/qtactivex/qtplugin.cab" height="{ height }"
width="{ width }"><param name="src" value="{ path }"><param
name="autoplay" value="{ autoplay }"><param name="type"
value="video/quicktime"><embed src="{ path }" height="{ height }"
width="{ width }" autoplay="{ autoplay }" type="video/quicktime"
pluginspage="http://www.apple.com/quicktime/download/"></embed></obj
ect>,iframe_markup:'<iframe src="{ path }" width="{ width }"
height="{ height }" frameborder="no"></iframe>,inline_markup:'<div
class="pp_inline"><content></div>,custom_markup:'<div
class="pp_social"><div class="twitter"><a href="http://twitter.com/share"
type="twitter-share-button" data-count="none">Tweet</a><script
type="text/javascript"
src="http://platform.twitter.com/widgets.js"></script></div><div
class="facebook"><iframe
src="http://www.facebook.com/plugins/like.php?locale=en_US&href='+loca
tion.href+'&layout=button_count&show_faces=true&width=500&action=lik
e&font&colorscheme=light&height=23" scrolling="no" frameborder="0"
style="border:none;overflow:hidden;width:500px;height:23px;"
allowTransparency="true"></iframe></div></div>'},pp_settings);var
```

```

matchedObjects=this.percentBased=false,pp_dimensions,pp_open,pp_contentHeight,pp_contentWidth,pp_containerHeight,pp_containerWidth>windowHeight=$(window).height(),windowWidth=$(window).width(),pp_slideshow,doresize=true,scroll_pos=get_scroll();$(window).unbind('resize.prettyphoto').bind('resize.prettyphoto',function(){_resize_overlay();});if(pp_settings.keyboard_shortcuts){$(document).unbind('keydown.prettyphoto').bind('keydown.prettyphoto',function(e){if(typeof $pp_pic_holder!='undefined'){if($pp_pic_holder.is(':visible')){switch(e.keyCode){case 37:$.prettyPhoto.changePage('previous');e.preventDefault();break;case 39:$.prettyPhoto.changePage('next');e.preventDefault();break;case 27:if(!settings.modal){$.prettyPhoto.close();e.preventDefault();break;};};});$.prettyPhoto.initialize=function(){settings=pp_settings;if(settings.theme!='dark_rounded')settings.horizontal_padding=16;if(settings.ie6_fallback&&$$.browser.msie&&parseFloat($.browser.version)==6)settings.theme="dark_rounded";theRel=$(this).attr('data-gal');galleryRegExp=/\((?:\s*\))/;isSet=(galleryRegExp.exec(theRel))>true;false:pp_images=(isSet)?jQuery.map(matchedObjects,function(n,i){if($n.attr('data-gal').indexOf(theRel)!=-1)return $n.attr('href');}):$.makeArray($(this).attr('href'));pp_titles=(isSet)?jQuery.map(matchedObjects,function(n,i){if($n.attr('data-gal').indexOf(theRel)!=-1)return $n.find('img').attr('alt')?$.fn.find('img').attr('alt'):"":}):$.makeArray($(this).find('img').attr('alt'));pp_descriptions=(isSet)?jQuery.map(matchedObjects,function(n,i){if($n.attr('data-gal').indexOf(theRel)!=-1)return $n.attr('title')?$.fn.attr('title'):"":}):$.makeArray($(this).attr('title'));set_position=jQuery.inArray($(this).attr('href'),pp_images);rel_index=(isSet)?set_position:0;_build_overlay=$(this).attr('rel')?$.fn.attr('rel'):"";_build_overlay=$(this);if(settings.allow_resize$(window).bind('scroll.prettyphoto',function(){_center_overlay();});$.prettyPhoto.open();return false;};$.prettyPhoto.open=function(event){if(typeof settings=="undefined"){settings=pp_settings;if($.browser.msie&&$.browser.version==6)settings.theme="dark_rounded";pp_images=$.makeArray(arguments[0]);pp_titles=(arguments[1])?$.makeArray(arguments[1]):$.makeArray("");pp_descriptions=(arguments[2])?$.makeArray(arguments[2]):$.makeArray("");isSet=(pp_images.length>1)?true:false;set_position=0;_build_overlay(event.target);if($.browser.msie&&$.browser.version==6)$('select').css('visibility','hidden');if(settings.hideflash$('object,embed,iframe[src*=youtube],iframe[src*=vimeo]').css('visibility','hidden');_checkPosition($pp_images).size(0);$('pp_loaderIcon').show();if($pp.is(':hidden'))$ppt.css('opacity',0).show();$pp_overlay.show().fadeTo(settings.animation_speed,settings.opacity);$pp_pic_holder.find('currentTextHolder').text(set_position+1)-settings.counter_separator_label+$pp_images.size(0);if(pp_descriptions[set_position]!=''){pp_pic_holder.find('pp_description').show().html(unescape(pp_descriptions[set_position]));}else{$pp_pic_holder.find('pp_description').hide();}movie_width=(parseFloat(getParam('width',pp_images[set_position]))?getParam('width',pp_images[set_position]):settings.default_width.toString());movie_height=(parseFloat(getParam('height',pp_images[set_position]))?getParam('height',pp_images[set_position]):settings.default_height.toString());percentBased=false;if(movie_height.indexOf('%')!=1){movie_height=parseFloat(($(window).height()*parseFloat(movie_height)/100)-150);percentBased=true;}if(movie_width.indexOf('%')!=1){movie_width=parseFloat(($(window).width()*parseFloat(movie_width)/100)-150);percentBased=true;}$pp_pic_holder.fadeIn(function(){(settings.show_title&&pp_titles[set_position]!=''&&typeof pp_titles[set_position]!='undefined')?$.ppt.html(unescape(pp_titles[set_position])):$.ppt.html("");imgPreloader="";skipInjection=false;switch(_getFileTypes(pp_images[set_position])){case 'image':imgPreloader=new Image();nextImage=new Image();if(isSet&&set_position<$pp_images.size()-1)nextImage.src=pp_images[set_position+1];prevImage=new Image();if(isSet&&pp_images[set_position-1])prevImage.src=pp_images[set_position-1];$pp_pic_holder.find("#pp_full_res")[0].innerHTML=settings.image_markup.replace(/\{path\}/g,pp_images[set_position]);imgPreloader.onload=function(){pp_dimensions=_fitToViewport(imgPreloader.width,imgPreloader.height);_showContent();};imgPreloader.onerror=function(){alert('Image cannot be loaded. Make sure the path is correct and image exist.');
```

```

play=1;vimeo_width=pp_dimensions['width']+embed/'moog_width'+pp_dimensions['width'];toInject=settings.iframe_markup.replace(/\{width\}/g,vimeo_width).replace(/\{height\}/g,pp_dimensions['height']).replace(/\{path\}/g,movie);break;case'quicktime':pp_dimensions=_fitToViewport(movie_width,movie_height);pp_dimensions['height']+=15;pp_dimensions['contentHeight']+=15;pp_dimensions['containerHeight']+=15;toInject=settings.quicktime_markup.replace(/\{width\}/g,pp_dimensions['width']).replace(/\{height\}/g,pp_dimensions['height']).replace(/\{wmode\}/g,settings.wmode).replace(/\{path\}/g,pp_images[set_position]).replace(/\{autoplay\}/g,settings.autoplay);break;case'flash':pp_dimensions=_fitToViewport(movie_width,movie_height);flash_vars=pp_images[set_position];flash_vars=flash_vars.substring(pp_images[set_position].indexOf('flashvars')+10,pp_images[set_position].length);filename=pp_images[set_position];filename=filename.substring(0,filename.indexOf('?'));toInject=settings.flash_markup.replace(/\{width\}/g,pp_dimensions['width']).replace(/\{height\}/g,pp_dimensions['height']).replace(/\{wmode\}/g,settings.wmode).replace(/\{path\}/g,filename+'?'+flash_vars);break;case'iframe':pp_dimensions=_fitToViewport(movie_width,movie_height);frame_url=pp_images[set_position];frame_url=frame_url.substr(0,frame_url.indexOf('iframe')-1);toInject=settings.iframe_markup.replace(/\{width\}/g,pp_dimensions['width']).replace(/\{height\}/g,pp_dimensions['height']).replace(/\{path\}/g,frame_url);break;case'ajax':doresize=false;pp_dimensions=_fitToViewport(movie_width,movie_height);doresize=true;skipInjection=true;$.get(pp_images[set_position],function(responseHTML){toInject=settings.inline_markup.replace(/\{content\}/g,responseHTML);$pp_pic_holder.find("#pp_full_res")[0].innerHTML=toInject._showContent();});break;case'custom':pp_dimensions=_fitToViewport(movie_width,movie_height);toInject=settings.custom_markup;break;case'inline':myClone=$pp_images[set_position].clone().append('<br clear="all"/>').css({'width':settings.default_width}).wrapInner('<div id="pp_full_res"><div class="pp_inline"></div></div>').appendTo($('body')).show();doresize=false;pp_dimensions=_fitToViewport(myClone.width(),myClone.height());doresize=true;myClone.remove();toInject=settings.inline_markup.replace(/\{content\}/g,$pp_images[set_position].html());break;};if(!imgPreloader&&skipInjection){pp_pic_holder.find("#pp_full_res")[0].innerHTML=toInject._showContent();};return false;};$.prettyPhoto.changePage=function(direction){currentGalleryPage=0;if(direction=='previous'){set_position--;if(set_position<0)set_position=$pp_images.size()-1;};else if(direction=='next'){set_position++;if(set_position>$pp_images.size()-1)set_position=0;};else{set_position=direction;};rel_index=set_position;if(!doresize)doresize=true;$.pp_contract.removeClass('pp_contract').addClass('pp_expand').hideContent(function(){$.prettyPhoto.open();});$.prettyPhoto.changeGalleryPage=function(direction){if(direction=='next'){currentGalleryPage++;if(currentGalleryPage>totalPage)currentGalleryPage=0;};else if(direction=='previous'){currentGalleryPage--;if(currentGalleryPage<0)currentGalleryPage=totalPage;};else{currentGalleryPage=direction;};slide_speed=(direction=='next'?direction=='previous')?settings.animation_speed:0;slide_to=currentGalleryPage*(itemsPerPage*itemWidth);$pp_gallery.find('ul').animate({left:slide_to,slide_speed});$.prettyPhoto.startSlideshow=function(){if(typeof pp_slideshow=='undefined'){pp_pic_holder.find('pp_play').unbind('click').removeClass('pp_play').addClass('pp_pause').click(function(){$.prettyPhoto.stopSlideshow();return false;});pp_slideshow=setInterval($.prettyPhoto.startSlideshow,settings.slideshow);};else{$.prettyPhoto.changePage('next');};$.prettyPhoto.stopSlideshow=function(){pp_pic_holder.find('pp_pause').unbind('click').removeClass('pp_pause').addClass('pp_play').click(function(){$.prettyPhoto.startSlideshow();return false;};clearInterval(pp_slideshow);pp_slideshow=undefined;};$.prettyPhoto.close=function(){if($pp_overlay.is(":animated"))return;$.prettyPhoto.stopSlideshow();$pp_pic_holder.stop().find('object,embed').css('visibility','hidden');$('div_pp_pic_holder,div_ppt,pp_fade').fadeOut(settings.animation_speed,function(){$(this).remove();});$pp_overlay.fadeOut(settings.animation_speed,function(){if($.browser.msie&&$.browser.version==6)$('select').css('visibility','visible');if(settings.hideflash$('object,embed,iframe[src*=youtube],iframe[src*=vimeo]').css('visibility','visible');$(this).remove();$(window).unbind('scroll.prettyphoto');settings.callback();doresize=true;pp_open=false;delete settings;});function _showContent(){$('pp_loaderIcon').hide();projectedTop=scroll_pos/scrollTP+((windowHeight/2)-(pp_dimensions['containerHeight']/2));if(projectedTop<0)projectedTop=0;$ppt.fadeTo(settings.animation_speed,1);$pp_pic_holder.find('pp_content').animate({height:pp_dimensions['contentHeight'],width:pp_dimensions['contentWidth']},settings.animation_speed);$pp_pic_holder.animate({top:'projectedTop,left':(windowWidth/2)-(pp_dimensions['containerWidth']/2),width:pp_dimensions['containerWidth']},settings.animation_speed,function(){pp_pic_holder.find('pp_hoverContainer,fullResImage').height(pp_dimensions['height']).width(pp_dimensions['width']);pp_pic_holder.find('pp_fade').fadeIn(settings.animation_speed);if(isSet&&_getFileTypes(pp_images[set_position])=="image"){pp_pic_holder

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.find('pp_hoverContainer').show();else{$pp_pic_holder.find('pp_hoverCo
ntainer').hide();if(pp_dimensions['resized']){$(a.pp_expand,a.pp_contract)
.show();}else{$(a.pp_expand).hide();}if(settings.autoplay_slideshow&&!p
p_slideshow&&pp_open$.prettyPhoto.startSlideshow();if(settings.deeplin
king)setHashtag();settings.changePicturecallback();pp_open=true;};_insert_
gallery();};function
_hideContent(callback){$pp_pic_holder.find('#pp_full_res
object,#pp_full_res
embed').css('visibility','hidden');$pp_pic_holder.find('pp_fade').fadeOut(sett
ings.animation_speed,function(){pp_loaderIcon().show();callback();});;f
unction
_checkPosition(setCount){(setCount>1)?$('pp_nav').show():$('pp_nav').hid
e();};function
_fitToViewport(width,height){resized=false;_getDimensions(width,height);i
mageWidth=width,imageHeight=height;if((pp_containerWidth>windowWid
th)||pp_containerHeight>windowHeight)&&doresize&&settings.allow_re
size&&!percentBased){resized=true,fitting=false;while(!fitting){if((pp_cont
ainerWidth>windowWidth)||pp_containerHeight>windowHeight){_getDimensio
ns(imageWidth,imageHeight);if(pp_containerWidth>windowWidth)||pp_co
ntainerHeight>windowHeight){_fitToViewport(pp_containerWidth,pp_co
ntainerHeight);};return{width:Math.floor(imageWidth),height:Math.floor(i
mageHeight),containerHeight:Math.floor(pp_containerHeight),containerWid
th:Math.floor(pp_containerWidth)+(settings.horizontal_padding*2),content
Height:Math.floor(pp_contentHeight),contentWidth:Math.floor(pp_content
Width),resized:resized};};function
_getDimensions(width,height){width=parseFloat(width);height=parseFloat(
height);$pp_details=$pp_pic_holder.find('pp_details');$pp_details.width(wi
dth);detailsHeight=parseFloat($pp_details.css('marginTop'))+parseFloat($pp
_details.css('marginBottom'));$pp_details=$pp_details.clone().addClass(sett
ings.theme).width(width).appendTo($('body')).css({'position':'absolute','top':-
10000});detailsHeight+=$pp_details.height();detailsHeight=(detailsHeight<
=34)?36:detailsHeight;if($.browser.msie&&$$.browser.version==7){detailsHe
ight+=8;$pp_details.remove();$pp_title=$pp_pic_holder.find('ppt');$pp_titl
e.width(width);titleHeight=parseFloat($pp_title.css('marginTop'))+parseFloa
t($pp_title.css('marginBottom'));$pp_title=$pp_title.clone().appendTo($('bo
dy')).css({'position':'absolute','top':-
10000});titleHeight+=$pp_title.height();$pp_title.remove();pp_contentHeig
ht=height+detailsHeight;pp_contentWidth=width;pp_containerHeight=pp_c
ontentHeight+titleHeight+$pp_pic_holder.find('pp_top').height()+$pp_pic_
holder.find('pp_bottom').height();pp_containerWidth=width;function
_getFileType(itemSrc){if(itemSrc.match(/youtube\.com\/watch\/i){return'yo
utube';}else if(itemSrc.match(/vimeo\.com\/i){return'vimeo';}else
if(itemSrc.match(/b.mov\/b/i){return'quicktime';}else
if(itemSrc.match(/b.swf\/b/i){return'flash';}else
if(itemSrc.match(/biframe=true\/b/i){return'iframe';}else
if(itemSrc.match(/bajax=true\/b/i){return'ajax';}else
if(itemSrc.match(/bcustom=true\/b/i){return'custom';}else
if(itemSrc.substr(0,1)=="#"){return'inline';}else{return'image'}};};function
_center_overlay(){if(doresize&&typeof
$pp_pic_holder!="undefined"){scroll_pos=_get_scroll();contentHeight=$pp_
pic_holder.height(),contentwidth=$pp_pic_holder.width();projectedTop=(wi
ndowHeight/2)+scroll_pos[scrollTop]-
(contentHeight/2);if(projectedTop<0)projectedTop=0;if(contentHeight>win
dowHeight)return;$pp_pic_holder.css({'top':projectedTop,'left':(windowWid
th/2)+scroll_pos[scrollLeft]-(contentwidth/2)});};function
_get_scroll(){if(self.pageYOffset){return{scrollTop:self.pageYOffset,scroll
Left:self.pageXOffset};}else
if(document.documentElement&&document.documentElement.scrollTop){r
eturn{scrollTop:document.documentElement.scrollTop,scrollLeft:document.
documentElement.scrollLeft};}else
if(document.body){return{scrollTop:document.body.scrollTop,scrollLeft:do
cument.body.scrollLeft};};};function
_resize_overlay(){windowHeight=$(window).height(),windowWidth=$(win
dow).width();if(typeof
$pp_overlay!="undefined")$pp_overlay.height($(document).height()).width(
windowWidth);};function
_insert_gallery(){if(isSet&&settings.overlay_gallery&&_getFileType(pp_i
mages[set_position])=="image"&&(settings.ie6_fallback&&!$.browser.msi
e&&parseInt($.browser.version)==6))){itemWidth=52+5;navWidth=(setting
s.theme=="facebook"?settings.theme=="dark_rounded"?50:30;itemsPerPag
e=Math.floor(pp_dimensions['containerWidth']-100-
navWidth)/itemWidth);itemsPerPage=(itemsPerPage<pp_images.length)?ite
msPerPage:pp_images.length;totalPage=Math.ceil(pp_images.length/itemsP
erPage)-
1;if(totalPage==0){navWidth=0;$pp_gallery.find('pp_arrow_next,pp_arrow
w_previous').hide();}else{$pp_gallery.find('pp_arrow_next,pp_arrow_prev

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```

ious').show();};galleryWidth=itemsPerPage*itemWidth;fullGalleryWidth=
p_images.length*itemWidth;$pp_gallery.css('margin-left',-
((galleryWidth/2)+(navWidth/2))).find('div:first').width(galleryWidth+5).fin
d('ul').width(fullGalleryWidth).find('li.selected').removeClass('selected');goT
oPage=(Math.floor(set_position/itemsPerPage)<totalPage)?Math.floor(set_p
osition/itemsPerPage):totalPage;$prettyPhoto.changeGalleryPage(goToPag
e);$pp_gallery_li.filter(':eq('+set_position+')').addClass('selected');}else{$pp
_pic_holder.find('pp_content').unbind('mouseenter mouseleave');};function
_overlay(caller){settings.markup=settings.markup.replace({'pp_social
'},(settings.social_tools)?settings.social_tools:"");$('body').append(settings.m
arkup);$pp_pic_holder=$('pp_pic_holder'),$ppt=$('ppt'),$pp_overlay=$(di
v.pp_overlay);if(isSet&&settings.overlay_gallery){currentGalleryPage=0;to
Inject="";for(var
i=0;i<pp_images.length;i++){if(!pp_images[i].match(/b(jpg|jpeg|png|gif)/b/
gi/))){classname='default';img_src="";}else{classname="img_src=pp_images[
i];}toInject+="<li class='"+classname+"'><a href='#"><img
src='"+img_src+"' width='50'
alt='"/><a/></li>";};toInject=settings.gallery_markup.replace(/gallery/g,to
Inject);$pp_pic_holder.find('#pp_full_res').after(toInject);$pp_gallery=$('pp
_pic_holder
_pp_gallery'),$pp_gallery_li=$pp_gallery.find('li');$pp_gallery.find('pp_aro
w_next').click(function(){$.prettyPhoto.changeGalleryPage('next');$.prettyP
hoto.stopSlideshow();return
false;});$pp_gallery.find('pp_arrow_previous').click(function(){$.prettyPho
to.changeGalleryPage('previous');$.prettyPhoto.stopSlideshow();return
false;});$pp_pic_holder.find('pp_content').hover(function(){$pp_pic_holder
.find('pp_gallery:not(.disabled)').fadeIn();},function(){$pp_pic_holder.find(
'pp_gallery:not(.disabled)').fadeOut();});itemWidth=52+5;$pp_gallery_li.ea
ch(function(i){$(this).find('a').click(function(){$.prettyPhoto.changePage(i);
$.prettyPhoto.stopSlideshow();return
false;});});if(settings.slideshow){$pp_pic_holder.find('pp_nav').prepend(
<a href="#" class="pp_play">Play</a>);$pp_pic_holder.find('pp_nav
_pp_play').click(function(){$.prettyPhoto.startSlideshow();return
false;});$pp_pic_holder.attr('class','pp_pic_holder
'+settings.theme);$pp_overlay.css({'opacity':0,height:$(document).height(),
width:$(window).width()}).bind('click',function(){if(!settings.modal)$prett
yPhoto.close();});$('a.pp_close').bind('click',function(){$.prettyPhoto.close()
;return
false;});$('a.pp_expand').bind('click',function(e){if($(this).hasClass('pp_exp
and')){$(this).removeClass('pp_expand').addClass('pp_contract');doresize=fal
se;};else{$(this).removeClass('pp_contract').addClass('pp_expand');doresize
=true;};_hideContent(function(){$.prettyPhoto.open();});return
false;});$pp_pic_holder.find('pp_previous,pp_nav
_pp_arrow_previous').bind('click',function(){$.prettyPhoto.changePage('prev
ious');$.prettyPhoto.stopSlideshow();return
false;});$pp_pic_holder.find('pp_next,pp_nav
_pp_arrow_next').bind('click',function(){$.prettyPhoto.changePage('next');$.
prettyPhoto.stopSlideshow();return
false;});_center_overlay();};if(!pp_alreadyInitialized&&getHashtag()){pp_a
lreadyInitialized=true;hashIndex=getHashtag();hashRel=hashIndex;hashInde
x=hashIndex.substring(hashIndex.indexOf('/')+1,hashIndex.length-
1);hashRel=hashRel.substring(0,hashRel.indexOf('/'));setTimeout(function()
{$(a[rel^="+hashRel+"]):eq("+hashIndex+")}.trigger('click');},50);return
this.unbind('click,prettyphoto').bind('click,prettyphoto',$.prettyPhoto.initial
ize);};function getHashtag(){url=location.href;hashtag=(url.indexOf('#!')==
1)?decodeURI(url.substring(url.indexOf('#!')+2,url.length)):false;return
hashtag;};function setHashtag(){if(typeof
theRel=="undefined")return;location.hash="!"+theRel+"/"+rel_index+"/";};funt
ion
getParam(name,url){name=name.replace(/[/\|,|"\\|"])/.replace(/[/\|,|"\\|"])/;var
regexS="(?:[?&]" + name + "=([^\&#]*)");var regex=new RegExp(regexS);var
results=regex.exec(url);return(results==null)?{}:results[1];}(jQuery);var
pp_alreadyInitialized=false;*/ Copyright (c) 2010 WordImpressed.com
jFlow Plus derived from Kean Loong Tan's original jFlow
http://www.wordimpressed.com * Licensed under the MIT
(http://www.opensource.org/licenses/mit-license.php) * jFlow 1.2 (Plus) *
Version: jFlow Plus * Requires: jQuery 1.2+
*/(function($){$.fn.jFlow=function(options){var
opts=$.extend({},$.fn.jFlow.defaults,options);var
randNum=Math.floor(Math.random()*11);var jFC=opts.controller;var
jFS=opts.slideWrapper;var jSel=opts.selectedWrapper;var cur=0;var
timer;var maxi=$(jFC).length;var
slide=function(dur,i){$(opts.slides).children().css({'overflow':"hidden"});$(o
pts.slides+
iframe").hide().addClass("temp_hide");$(opts.slides).animate({marginLeft:"-
"+(i*$opts.slides).find(":first-
child").width()+px"},opts.duration*(dur),opts.easing,function(){$(opts.slid
es).children().css({'overflow':"hidden"});$("temp_hide").show();});$(this).f
ind(jFC).each(function(i){$(this).click(function(){dotimer();if($opts.slides.
is(":not(:animated)")){jFC.removeClass(jSel);$(this).addClass(jSel);var

```

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dur=Math.abs(cur-i);slide(dur,i);cur=i;});$(opts.slides).before('<div
id="" +jFS.substring(1,jFS.length)+"></div>').appendTo(jFS);$(opts.slides).f
ind("div").each(function(){$(this).before('<div
class="jFlowSlideContainer"></div>').appendTo($(this).prev());});$(jFC).e
q(cur).addClass(jSel);var
resize=function(x){$(jFS).css({position:"relative",width:opts.width,height:op
ts.height,overflow:"hidden"});$(opts.slides).css({position:"relative",width:
$(jFS).width()*$(jFC).length+"px",height:$(jFS).height()+"px",overflow:"hi
dden"});$(opts.slides).children().css({position:"relative",width:$(jFS).width(
)+"px",height:$(jFS).height()+"px",float:"left",overflow:"hidden"});$(opts
.slides).css({marginLeft:"-
"+cur*$(opts.slides).find("eq(0)").width()+"px"});});resize();$(window).res
ize(function(){resize();});$(opts.prev).click(function(){dotimer();doprev();});
$(opts.next).click(function(){dotimer();donext();});var
doprev=function(x){if($(opts.slides).is(":"not(:animated)")){var
dur=1;if(cur>0)cur--;else{cur=maxi-
1;dur=cur;}}$(jFC).removeClass(jSel);slide(dur,cur);$(jFC).eq(cur).addClass
(jSel);}}var donext=function(x){if($(opts.slides).is(":"not(:animated)")){var
dur=1;if(cur<maxi-1)cur++;else{cur=0;dur=maxi-
1;}}$(jFC).removeClass(jSel);slide(dur,cur);$(jFC).eq(cur).addClass(jSel);}}
var
dotimer=function(x){if((opts.auto)==true){if(timer!=null)clearInterval(timer
);timer=setInterval(function(){$(opts.next).click();},10000);}}dotimer();$(op
ts.slides).hover(function(){clearInterval(timer);},function(){dotimer();});};
$.fn.jFlow.defaults={controller:"#myController",slideWrapper:"#mySlides",
selectedWrapper:".jFlowSelected",auto:true,easing:"swing",duration:400,wid
th:"100%",prev:".jFlowPrev",next:".jFlowNext"};})(jQuery);/* jQuery
EasIng v1.1.2 - http://gsgd.co.uk/sandbox/jquery.easing.php * Uses the built
in easing capabilities added In jQuery 1.1 * to offer multiple easing options
* Copyright (c) 2007 George Smith * Licensed under the MIT License: *
http://www.opensource.org/licenses/mit-license.php */// t: current time, b:
beginning value, c: change In value, d:
durationjQuery.extend(jQuery.easing,{easeInQuad:function(x,t,b,c,d){return
c*(t/d)^2+b},easeOutQuad:function(x,t,b,c,d){return-c*(t/d)^2*(t-
2)+b},easeInOutQuad:function(x,t,b,c,d){if((t/d<1)return
c/2*t^2+b;return-c/2*(t-2)-
1)+b},easeInCubic:function(x,t,b,c,d){return
c*(t/d)^3+b},easeOutCubic:function(x,t,b,c,d){return-c*((t/d-
1)^3+1)+b},easeInOutCubic:function(x,t,b,c,d){if((t/d<1)return
c/2*t^3+b;return-c/2*((t-
2)^3+1)+b},easeInQuart:function(x,t,b,c,d){return
c*(t/d)^4+b},easeOutQuart:function(x,t,b,c,d){return-c*((t/d-
1)^4+1)+b},easeInOutQuart:function(x,t,b,c,d){if((t/d<1)return
c/2*t^4+b;return-c/2*((t-
2)^4+1)+b},easeInQuint:function(x,t,b,c,d){return
c*(t/d)^5+b},easeOutQuint:function(x,t,b,c,d){return-c*((t/d-
1)^5+1)+b},easeInOutQuint:function(x,t,b,c,d){if((t/d<1)return
c/2*t^5+b;return-c/2*((t-
2)^5+1)+b},easeInSine:function(x,t,b,c,d){return-
c*Math.cos(t/d*(Math.PI/2))+c+b},easeOutSine:function(x,t,b,c,d){return
c*Math.sin(t/d*(Math.PI/2))+b},easeInOutSine:function(x,t,b,c,d){return-
c/2*(Math.cos(Math.PI*t/d)-
1)+b},easeInExpo:function(x,t,b,c,d){return((t==0)?b:c*Math.pow(2,10*(t/d-
1))+b)},easeOutExpo:function(x,t,b,c,d){return(t==d)?b+c:c*(-Math.pow(2,-
10*(t/d)+1)+b)},easeInOutExpo:function(x,t,b,c,d){if(t==0)return
b;if(t==d)return b+c;if((t/d<1)return c/2*Math.pow(2,10*(t-1))+b;return
c/2*(-Math.pow(2,-10*(t-1)+2)+b)},easeInCirc:function(x,t,b,c,d){return-
c*(Math.sqrt(1-(t/d)^2)+1)+b},easeOutCirc:function(x,t,b,c,d){return
c*Math.sqrt(1-(t/d-
1)^2)+b},easeInOutCirc:function(x,t,b,c,d){if((t/d<1)return-
c/2*(Math.sqrt(1-t^2)-1)+b;return c/2*(Math.sqrt(1-(t-
2)^2)+1)+b},easeInElastic:function(x,t,b,c,d){var s=1.70158;var p=0;var
a=c;if(t==0)return b;if(t/d==1)return
b+c;if(!p)p=d*.3;if(a<Math.abs(c)){a=c;var s=p/4}else var
s=p/(2*Math.PI)*Math.asin(c/a);return-a*Math.pow(2,10*(t-
1))*Math.sin((t*d-
s)/(2*Math.PI/p))+b},easeOutElastic:function(x,t,b,c,d){var s=1.70158;var
p=0;var a=c;if(t==0)return b;if(t/d==1)return
b+c;if(!p)p=d*.3;if(a<Math.abs(c)){a=c;var s=p/4}else var
s=p/(2*Math.PI)*Math.asin(c/a);return a*Math.pow(2,-10*(t-1))*Math.sin((t*d-
s)/(2*Math.PI/p))+c+b},easeInOutElastic:function(x,t,b,c,d){var
s=1.70158;var p=0;var a=c;if(t==0)return b;if(t/d==2)return
b+c;if(!p)p=d*(.3*1.5);if(a<Math.abs(c)){a=c;var s=p/4}else var
s=p/(2*Math.PI)*Math.asin(c/a);if(t<1)return-.5*(a*Math.pow(2,10*(t-
1))*Math.sin((t*d-s)/(2*Math.PI/p))+b;return a*Math.pow(2,-10*(t-
1))*Math.sin((t*d-
s)/(2*Math.PI/p))*5+c+b},easeInBack:function(x,t,b,c,d,s){if(s==undefine
d)s=1.70158;return c*(t/d)^s*(s+1)-
s)+b},easeOutBack:function(x,t,b,c,d,s){if(s==undefined)s=1.70158;return
c*((t/d-

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1)^s*((s+1)*t+s)+1)+b},easeInOutBack:function(x,t,b,c,d,s){if(s==undefine
d)s=1.70158;if((t/d<1)return c/2*(t^s*((s+1.525)+1)*t-s)+b;return
c/2*((t-
2)^s*((s+1.525)+1)*t+s)+2)+b},easeInBounce:function(x,t,b,c,d){return
c-jQuery.easing.easeOutBounce(x,d-
t,0,c,d)+b},easeOutBounce:function(x,t,b,c,d){if((t/d<1/(2.75))){return
c*(7.5625*t^2)+b}else if(t<(2/2.75))){return c*(7.5625*(t-
=(1.5/2.75)*t+.75)+b}else if(t<(2.5/2.75))){return c*(7.5625*(t-
=(2.25/2.75)*t+.9375)+b}else {return c*(7.5625*(t-
=(2.625/2.75)*t+.984375)+b)},easeInOutBounce:function(x,t,b,c,d){if(t<d/
2)return jQuery.easing.easeInBounce(x,t*2,0,c,d)*5+b;return
jQuery.easing.easeOutBounce(x,t*2-d,0,c,d)*5+c+(5+b)};}/-----
-----I UItoTop jQuery Plugin 1.11
http://www.mattvarone.com/web-design/uitotop-jquery-plugin/-----
*/(function($){$.fn.UItoTop=function(options){var defaults={text:'To
Top',min:200,inDelay:600,outDelay:400,containerID:'toTop',containerHover
ID:'toTopHover',scrollSpeed:1200,easingType:'linear'};var
settings=$.extend(defaults,options);var
containerIDhash='#'+settings.containerID;var
containerHoverIDhash='#'+settings.containerHoverID;$(body').append('<a
href="#"
id="" +settings.containerID+">'+settings.text+'</a>');$(containerIDhash).hid
e().click(function(){$(html,
body').animate({scrollTop:0},settings.scrollSpeed,settings.easingType);$('#
+settings.containerHoverID,this).stop().animate({'opacity':0},settings.inDela
y,settings.easingType);return false});prepend('<span
id="" +settings.containerHoverID+"></span>').hover(function(){$(container
HoverIDhash,this).stop().animate({'opacity':1,600,'linear'}),function(){$(c
ontainerHoverIDhash,this).stop().animate({'opacity':0},700,'linear')});$(win
dow).scroll(function(){var sd=$(window).scrollTop();if(typeof
document.body.style.maxHeight===undefined){$(containerIDhash).css({'
position':'absolute','top':$(window).scrollTop()+$(window).height()-
50})if(sd>settings.min)$(containerIDhash).fadeIn(settings.inDelay);else
$(containerIDhash).fadeOut(settings.outDelay)}})})(jQuery);/* Superfish
v1.4.8 - jQuery menu widget * Copyright (c) 2008 Joel Birch * Dual
licensed under the MIT and GPL licenses: *
http://www.opensource.org/licenses/mit-license.php *
http://www.gnu.org/licenses/gpl.html * CHANGELOG:
http://users.tpg.com.au/j_birch/plugins/superfish/changelog.txt
*/(function($){$.fn.superfish=function(op){var
sf=$.fn.superfish,c=sf.c,$arrow=$(['<span class=""',c.arrowClass,">
»</span>'].join(")),over=function(){var
$$=$(this),menu=getMenu($$);clearTimeout(menu.sfTimer);$.showSuperf
ishUI().siblings().hideSuperfishUI(),out=function(){var
$$=$(this),menu=getMenu($$),o=sf.op;clearTimeout(menu.sfTimer);menu.s
fTimer=setTimeout(function(){o.retainPath=$(o.inArray($$[0],o.$path)-
1);$.hideSuperfishUI();if(o.$path.length&&$$.parents(['li',o.hoverClass],jo
in(")).length<1){over.call(o.$path)},o.delay)}),getMenu=function($menu){
var
menu=$menu.parents(['ul',c.menuClass,'first'].join("))[0];sf.op=sf.o[menu.s
erial];return
menu).addArrow=function($a){$.addClass(c.anchorClass).append($arrow.
clone());return this.each(function(){var s=this.serial=sf.o.length;var
o=$.extend({},sf.defaults,op);o.$path=$(li'+o.pathClass,this).slice(0,o.pat
hLevels).each(function(){$(this).addClass([o.hoverClass,c.bcClass].join(
')).filter('li:has(ul)').removeClass(o.pathClass);sf.o[s]=o;$(li:has(ul)
,this)[(o.$fn.hoverIntent&&!o.disableHI)?'hoverIntent':'hover'](over,out).each
(function(){if(o.autoArrows)addArrow('>a:fi
r-child',this)}),not(''+c.bcClass).hideSuperfishUI();var
$a=$(a',this);$.each(function(i){var
$li=$a.eq(i).parents('li');$.eq(i).focus(function){over.call($li)}.blur(functi
on(){out.call($li)}});o.onInit.call(this)}),each(function(){var
menuClasses=[c.menuClass];if(sf.op.dropShadows&&!($.browser.msie&&$.
browser.version<7))menuClasses.push(c.shadowClass);$(this).addClass(me
nuClasses.join("));var
sf=$.fn.superfish;sf.o=[sf.op={};sf.IE7fix=function(){var
o=sf.op;if($.browser.msie&&$.browser.version>6&&&o.dropShadows&&o.a
nimation.opacity!=undefined)this.toggleClass(sf.c.shadowClass+'
off');sf.c=[bcClass:'sf-breadcrumb',menuClass:'sf-js-
enabled',anchorClass:'sf-with-ul',arrowClass:'sf-sub-
indicator',shadowClass:'sf-
shadow'];sf.defaults={hoverClass:'sfHover',pathClass:'overrideThisToUse',p
athLevels:1,delay:800,animation:{opacity:'show'},speed:'normal',autoArrow
s:true,dropShadows:true,disableHI:false,onInit:function(){},onBeforeShow:f
unction(){},onShow:function(){},onHide:function(){}}};$.fn.extend({hideSu
perfishUI:function(){var
o=sf.op,not=(o.retainPath===true)?o.$path:";o.retainPath=false;var
$ul=$(li'+o.hoverClass].join("),this.add(this).not(not).removeClass(o.hove
rClass).find('>ul').hide().css('visibility','hidden');o.onHide.call($ul);return

```



```
this},showSuperfishUI:function(){var o=sf.op,sh=sf.c.shadowClass+'-off',$ul=this.addClass(o.hoverClass).find('>ul:hidden').css('visibility','visible');sf.IE7fix.call($ul);o.onBeforeShow.call($ul);$ul.animate(o.animation,o.speed,function(){sf.IE7fix.call($ul);o.onShow.call($ul)});return this}})(jQuery);$(document).ready(function(){$("#myController").jFlow({controller:"jFlowControl",slideWrapper:"#jFlowSlider",slides:"mySlides",selectedWrapper:"jFlowSelected",width:"960px",height:"350px",duration:400,prev:"jFlowPrev",next:"jFlowNext",auto:true});$.UIToTop({easingType:'easeOutQuart'});jQuery("a[data-gal^=prettyPhoto]").prettyPhoto({social_tools:false});jQuery(function(){jQuery('ul.nav').superfish();});var open=false;$('#blah').click(function(){if(open){$(this).animate({height:'20px'});}else{$(this).animate({height:'100%'});}open=!open;});
```

11 ACKNOWLEDGEMENT

The development of this Special Problem (SP) has been one of the most compelling academic challenges I have ever had to face. Without the support, patience and counsel of the following people, this project would not have been completed. It is to them that I owe my deepest gratitude.

Foremost, my adviser, Dr. Peter Magboo, who guided me through the whole process of developing this SP, from finding a good topic to the word-by-word proofreading of the final manuscript. He had been critical during my proposal and oral defense. Despite the several times that I had problems with motivation, he still never knew when to stop giving me second chances. He was the primary reason for making my graduation attainable.

My favorite professor, Prof. Geoffrey Solano, who always encouraged me to be assiduous in my studies and to maintain my honor standing. He was very constructive during my oral defense and was eager to help me on how to improve this paper further.

My other professors and lecturers in UP Manila, who equipped me the necessary knowledge to complete this project. I will never forget their innumerable lessons, especially those from my favorite subject, CMSC 142: Design and Analysis of Algorithms.

Ate Eden of Information and Technology Unit in DPSM, who assisted me in completing the final requirements for this SP and in my late application for graduation. She also permitted me to stay in her office for hours ~~sleeping~~ reading the SPs of past students.

The staffs from OCS (particularly those in window-3), OSA and Office of the Chancellor, who repeatedly accepted each of my letters for late enrollments and the most important of all, my unforgivably late application for graduation.

My altruistic friend, Alpine, and the rest of the ~~kuys~~ DoTABoys who consistently urged me every single day ~~to destroy the Frozen Throne~~ to finish my SP as soon as possible.

All my other blockmates, ComSci Dose '08, who have been my second family in the university. If it were not for them I would not be writing a single word or code of this SP. Their lecture notes, assignments and solo acts on group projects were the reason behind my survival in UP.

My parents, Mama and Papa, who never failed to give me their ~~financial~~ support.

My younger brother, Venz, for creating the soccer questions used in this SP.

I dedicate this work to my grandmother, who had a stroke attack on the day of my oral defense and passed away two days after. I will always miss you, Nanay...