Fall 2016

Machine Intelligence
Term Project
Table Football (Foosball)

Objectives

By the end of this project, the student will be able to:

- Deal with the challenges of working in a company with respective to specific roles.
- Deal with the challenges of working in big teams.
- Enhance his/her communication skills.
- Apply "Machine Intelligence" techniques for real life applications.
- Build an intelligent game.
- Enhance his/her planning and time management skills.

Problem Description

It is required to design and implement an intelligent agent that will play a simple version of a table football (foosball) playing game that is described in the next section. The agent will play against other agents implemented by other project groups. Communication rules are to be set between groups' leaders and co-leaders in a signed-agreement that all teams have to follow.

Environment

In the simplified game version for this project, there are two teams Red and Blue. Each foosball team has only two rods (with six players). One rod is for the defense (with three players with one square apart). The other rod is for the offense, also with three players with one square apart placed as shown in Figure 1. Red team goal area and defense rod are on the left part of the playground, the offense rod is on the right part and vice versa for the blue team. For simplicity, the play ground is modeled by a 7 *11 squares board in addition to two rectangles of size 3 squares, each one outside each side of the playground representing the goal as shown in Figure 1.

Each agent is in a normal active state and can simultaneously move one or two of his rods and can choose independently one of three possible actions for each rod RIGHT, LEFT, KICK. RIGHT and LEFT actions move all the players on the same rod in the same direction one square to the right or to the left respectively (the direction is referenced normally w.r.t. the side who originated the move, so the red team

right move will be the opposite direction of the blue team right move). KICK action has a choice of moving the ball one to maximum five squares in three possible directions with respect to the player on the rod that had the ball in its reach straight to a square in the same direction or to the left or right diagonal. The reach of a player is one square straight infront or behind in addition to its own square. A NO-ACTION state is applied to any rod to keep players of a rod in the same square with normal active state. When a ball comes to a square that has a NO-ACTION state player it is simply assumed that the ball will rebound two squares straight in the opposite direction the ball was thrown. If the ball reaches any of the three squares in front of the goal and the square had no opponent agent the ball will continue its way onto the goal area and a goal is scored. If an opponent exists then he owns the ball and starts playing. The ball is not allowed to go out nor be dead at any time, this means that any position can be reached by at least one of the players in the two teams. If it is not reachable by "Red" team, it will be reachable by "Blue" team. If the ball reaches the border, it is assumed that it will just stop at the last square at the border.

The ball position at the start of the game is in the middle square as shown in Figure 1 with "Red" team starting and owning the ball. If the ball goes to the conflict middle line during the match, the "Red" agent always takes the ball. Timed communication messages exchanged between the agents should be logged in a file at both ends with the same format decided between the teams in a signed agreement. This will act as a state of proof if any of the teams claim that their agent sends messages that are not received by the other team.

A match will last for five live minutes. Both agent and opponent actions are to be rendered/shown on the GUI of both agents. A timer clock will be set live in the room during playing and at the buzz the winning team will be that with the larger number of goals. The competition has 5 teams, each team will play two matches with the rest of the teams so that in one match the agent is "Red" team and in the other "Blue". It is the responsibility of each team to record the results in a file indicating the score achieved in each match played. Use a table format as follows:

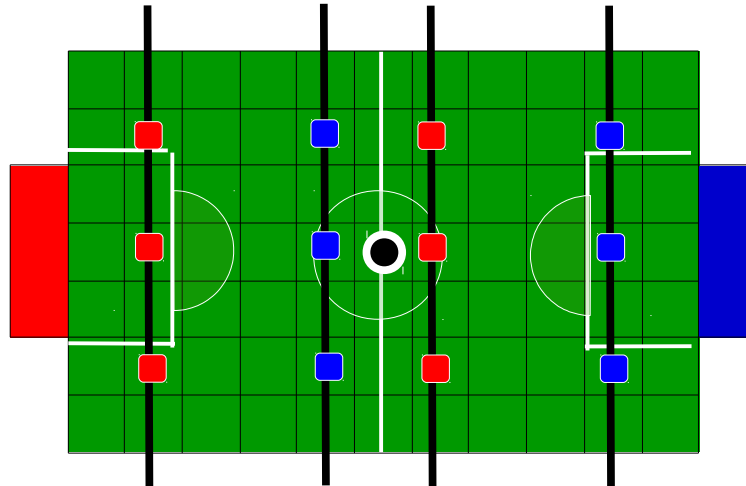| My Team#	Opp #	Opp#	Opp#	Opp#
Score as Red	Myscore/Oppscore	Myscore/Oppscore	Myscore/Oppscore	Myscore/Oppscore
Score as Blue	Myscore/Oppscore	Myscore/Oppscore	Myscore/Oppscore	Myscore/Oppscore

Figure 1: Foosball table model

Groups

You will be divided into teams (19/20 students each). Your group is supposed to form a company with the following structure:

1- Leader /Co-leader (2-students)

Responsible for:
- Planning and preparing a time plan with clear tasks as possible for every team member.
- Managing communications between all team members and making sure that each member finishes his work on time, and deliver it correctly to next phase.
- Managing communication needed with other groups (with both credit hours system or semester system groups) to agree upon the communication messages sent between agents. A meeting for all leaders and co-leaders of all groups should be held and a document holding an agreement for the way and protocol of communication and format of messages exchanged between the agents should be prepared and signed by all leaders of all groups.
- Collecting meeting minutes for all teams at every milestone.
- Giving an evaluation for all team members (a sheet for every member with objective evaluation for his/her responsibilities and tasks assigned).
- Choosing two persons that will conduct the competition game (we need two PCs to run parallel matches (the leader or co-leader may be one of them or not).
- Attendance of evaluation of all team members.

Co-leader has all leader responsibilities and acts as his back-up and helper. They are both evaluated on the successful completion of project and on the feedback of their team in addition to learning how to become a leader.

2- Research team (3 students)

Responsible for:
- Researching the problem and its variants.
- Delivering available similar projects, helpful tools and techniques.
- Preparing a good research document with all required information for design and implementation groups.
- Disseminating information to all team members in a concise and pleasant way.
- Recording meeting minutes for the team members and tasks assigned in each meeting.

3- Design team (4 students)

Responsible for
- Outlining the design adopted, and standard I/O formats between modules.
- Preparing a good design document with all required information for the other teams.
- Recording meeting minutes for the team members and tasks assigned in each meeting.

4- Implementation team (5-6 students)

Responsible for
- Reviewing and following the modular design adopted.
- Coding and integrating the modules passing modules for testing if needed within the implementation.
- Using one of the code control version tools or websites.
- Correcting the code based on testing reports or integration team.
- Recording meeting minutes for the team members and tasks assigned in each meeting.

5- Integration team and Communication (2 students)

Responsible for:
- Implementing the communication style between agent and humans and between agents over the network.
- Integrating the whole project to deliver a final product and do that in parts.
- Communicating bug reports to implementation team.
- Recording meeting minutes for the team members and tasks assigned in each meeting.

6- Interface team (3 students)

Responsible for:
- Designing and implementing a good GUI of the project.
- Recording meeting minutes for the team members and tasks assigned in each meeting.

7- Testing and Documentation team (2 students)

Responsible for
- Reviewing and analyzing the agent design and speculating missed scenarios if any.
- Creating test cases, running and reporting problems after each phase.
- Creating good scenarios for project delivery.
- Delivering progress and final reports. They do not write the whole document other groups should provide them with the material. They are allowed to create templates for team members reporting to facilitate their report compilation.
- Recording meeting minutes for the team members and tasks assigned in each meeting.
- Integrating the final project document including all documents produced from every team.
- Writing about one page of the competition experience day.

Evaluation*

- Every person will be evaluated with respect to his/her responsibilities within the team and the quality of the deliverables delivered, which is worth 75% of the project grade as mentioned in Table 1.
- 10% will be based on a normalized evaluation of leader, and co-leader.
    - 10% for the leader and co-leader will be based on evaluation by all team members.
- 5% will be given to the winning team members (best maximum grade and the rest scaled downward)
- 10% evaluation of the TAs for the final code.
- 75% for the oral discussion with instructor of all members except documentation team will also be evaluated based on the document in addition to timely deliverables to the TAs.
- It is the responsibility of each member to ask and know his exact date and hour for his oral evaluation and if missed he gets a zero even if he has actively participated in the work.

Table 1: Deliverables

	Deliverables
Leader/Co-leader	- Time plan - Evaluation sheets - Meeting minutes - Signed teams agreement - Short commercial for the team agent and final presentation
Research Team	- Research Document - Meeting minutes
Design Team	- Design Document - Meeting minutes
Implementation Team	- Version-controlled code - Updated bug-reports with actions taken

	- Meeting minutes
Integration & communication Team	- Communication code committed to the version-control code repository. - Integration code committed - Bug-reports issued to implementation team - Meeting minutes
Interface Team	- Friendly GUI - Working GUI showing clearly both the agent and opponent actions taken. - Meeting minutes
Testing and documentation Team	- Final Document - Prepared test-cases scenarios document to be used in design and implementation stages. - Bug-reports issued to implementation team. - Meeting minutes.

 * **Complete Projects from the internet will get zero.**

Project Milestones

1. 12th of October: Documentation team deliver first document giving team structure names and team ID.
2. 26st of October: Research team evaluation. Leaders and co-leaders should attend presenting team progress (time plan, meeting minutes, evaluation sheets)
3. 23rd of November: Design team evaluation. Leaders and co-leaders should attend presenting team progress (meeting minutes, evaluation sheets, communication rules signed agreement) (Mid-term is in this period, that is why we are giving it extra time span)
4. 14th of December: Project contest. Documentation team deliver final document and leader and co-leader deliver and supervise participating in the tournament. Evaluation of Implementation, Integration, Interface & Communication and Testing teams. Leaders and co-leaders should attend presenting team progress (meeting minutes, evaluation sheets). Final document to be delivered by e-mail to (ndarwish@ieee.org).

On the day of the project contest a CD should be delivered that contains:
   a. Project time plan
   b. Meeting minutes & evaluation sheets
   c. Program source code and any tools used
   d. An introductory interface to explain how the game is played
   e. A short commercial to advertise the game.
   f. The final document

** Documents should be in pdf format to avoid any mis-compatibility formatting issues and are to be delivered electronically by email and be on your laptops on the evaluation days. We need to reduce the papers printed for the sake of environment.