FURY 2D Simulation Team

Description Paper 2016

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Abstract. In this report the ideas, algorithms and a summary of function and performance of the two-dimensional football simulation team of "Fury" has been described. This team is consisted of second grade students of Tehran atomic energy high school studying mathematics course. The base code that Cyrus used is agent 3.11.

1 Introduction

in the previous year, Members of the two-dimensional simulation team of the Atomic Energy High school could obtain the permit of presence in Iran Open Championships and the world championships of 2015 under the name "Phonix".
This team gained the first rank of the technical competition in the Iran Open Championships and also won the award for the New Team in the world championships. In this report, algorithms implemented by new members of the team including shoot, block, mark and defensive decision are described.

2. Shoot

Regarding that shoot is one of the most important manners in the two-dimensional football simulation league, efforts have been made to use a suitable shoot algorithm. In the algorithm, by applying the idea of Phonix team, considering the average error in every hits angel, we assumed the goal smaller to prevent the ball from missing the goal. Then, we separated the obtained zone into 24 even and identical parts or in the other words, into 25 points with the same distance from each other. We simulated the factor of the ball owner by simulating the ball movement in two different states of the initial velocity in the kick of the ball path, up to any paths and obtained the shoots which are led to goal. These two different states which are explained for the velocity are equal to the most possible velocity of kicking on the ball without the limitation on the number of manner. In the figure 1, we observe the issue mentioned above.

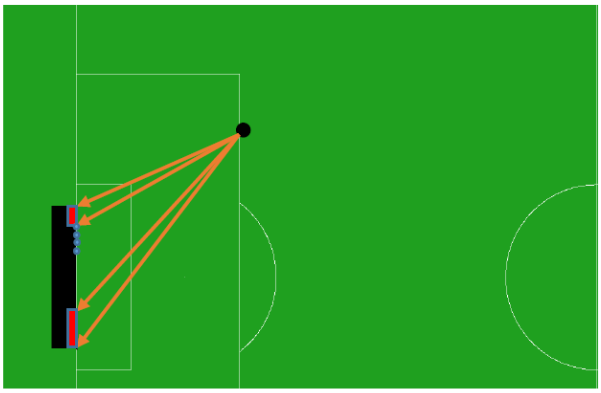

Figure 1 make goal smaller to prevent the ball from missing

After specifying the shoots which are led to the opponent goal and the opponent player which cannot stop the ball into the goal, we select the largest successive interval in which all shoots toward it will be goal, as the best interval. Then we choose the middle point as the best target.

The player first investigates shoots which are obtained from the maximum velocity in the one-hit condition, under these two circumstances:

First: When the opponent player that is close to the player having the ball, has the priority of one-hit kick.

Second: If the opponent player is not close to the insider-player and if the large successive interval is achieved by using simulation with the maximum one-hit velocity, it is selected as a center of the interval, unless simulation of shoots with the maximum velocity is applied without considering number of manners for forwarding the ball to that initial velocity.

In the figure 2, you observe selection of the best shoot among the possible shoots.

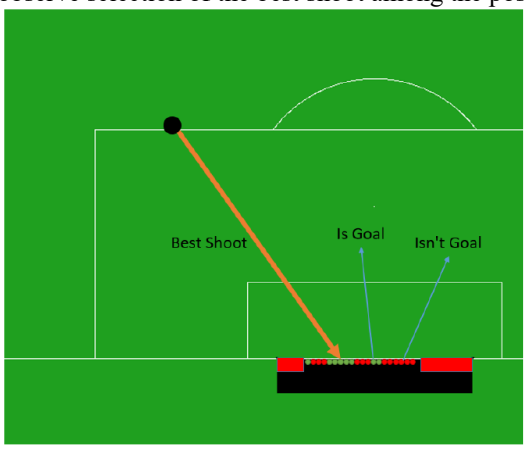

Figure 2 show best shoot target

In the future, we intend to use from neural networks in order to lower the shoot process, so that the position of the opponent players is given to the neural network and output of the neural network is the best target for the shoot.
With respect to the test of the base shoot and Fury team shoot, the table 1 was obtained, this test was achieved in a number of different plays and 100 shoots among it has been discussed for both conditions.

Table 1 difference Percentage of the ball forwarding into the goal between Fury And Agent2d

Algorithm	Percentage of the ball forwarding into the goal
Base	54%
Fury	68%

3 Decision-making in the defensive estate

In the defensive decision making, first all players of the opponent are considered without existence of the ball in the ground and any player specify the best goal separately for himself by considering insider-players and opponents in a greedy algorithm, then if the opponent player was the owner of the ball, it would perform the block manner and otherwise, would perform the mark manner.
In the greedy algorithm, for selecting the best goal among the opponent players, we first dedicate a score to any opponent players. Regarding that most of the teams utilize from the decision of Chain Action in the Base Agent, this inverse scoring is Chain Action scoring which is obtained from the formula 1.

Equation 1 Opponents Evaluation

$$Point = -pos.x;$$

$$Point += \max(0.40 - dist\ pos\ from\ my\ goal)$$

Then, by calculating the distance of the insider player to the most dangerous opponent, closest insider player to that opponent would be selected as the marker of that opponent and thereafter, by removing the most dangerous opponent from the list of the opponent players and receiver of that opponent from the list of the insider players, the previous algorithm will be executed again and will be continued until there is no opponent player for marking. For example, in the figure 3, the result of the mentioned greedy algorithm is shown.

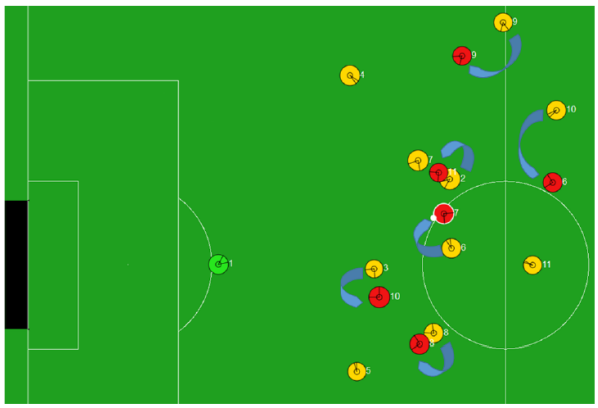

Figure 3 Result of Mark Decition Example

Regarding that any player has information separated from other players, and that the possibility of convergence in decisions is so little, for instance, it is possible that two insider players select one player of the opponent as the goal or one of the player would never be selected, any insider player arrange the insider and opponent players again based on the inverse of Chain Action Scoring and then inform other players about the position of three factors from factors which their PosCount is equal to zero. With respect to the conducted tests without using from informing action and by using this action, the following tests indicate the preference of this method:

Table 2 Average of the received goals in ten games

Average of the received goals in ten games		Teams
By using informing	Without using informing	
1.3	2.1	YUSHAN2015
4.3	2.2	HELIOS2015
3.3	2.1	GLIDERS 2015

4 Block Manner

Block manner is one of the most important manners during the defense. In FURY team, the block manner is divided into three sections:
1- Prediction of the path of dribbling the opponent.
2- Simulation of the opponent movement along that direction.
3- To find the best place for getting the ball from the opponent.

The first section, i.e. prediction of the path of the opponent's dribble is again obtained from inversing the Chain Action Scoring Function. For this purpose, in Phonix team, regular points with the radius of 10m is considered around the player having the ball and the point with the most score in the view of the opponent is considered as the best direction. In Fury team, if we suppose that the opponent can kick the ball and then again catch it in another point, instead of using the regular points explained above, the following algorithm is used:

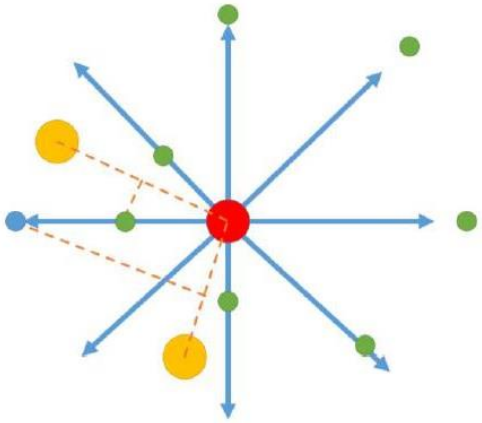

Figure 4 Example of block targets

In this method, 36 angels are acquired around the player having the ball and a point is selected on any direction which has the most possible distance to the opponent player, but the distance of that point to the players of our team is more than of the opponent. In the other words, most possible distance from the opponent while there is still a safe point for dribbling. After executing this algorithm for all directions and when one point was achieved in any direction, the best point in the opponent view is selected by the inverse of Chain Action scoring function and that direction is predicted as the direction of the opponent's movement.
In the second section, it is assumed that the opponent player starts to dribble with a constant velocity and in the third phase, a point which the insider player can reach to earlier than the opponent player in the simulation, is selected as the best target for blocking.

5 Future Prospect

In FURY Team, after achieving the permit of presence, before Iran Open Championships of 2016 take place, we intend to work on the strategy of Chain Action attack and after that, optimizing our algorithms by neural intelligence algorithms.

6 References

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