AMORDAD Soccer Simulation Team Description Paper for RoboCup 2013

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Abstract. This paper briefly describes ideas and skill which are implemented in Amordad team. Our team focused on improving some basic actions such as Multi-Step Kick as well as developing some fresh ideas like using Voronoi diagram for optimizing dribble path.

1 Introduction

Amordad team was first established on Mersad Base[1] in October 2011 and participated in IranOpen 2012 competition. Due to constant updates and better implementation of some basic actions in agent2d[2] the team is now porting the skills to be used in this base. Our version of agent2d has some of the Mersad Base codes which our codes depend on. This version can be downloaded here[3].

2 Defense System:

Our defense system consist of two parts: Block & Mark

To avoid marking one opponent by two or more defenders at the same time and sync defenders decisions each defender gets its commands from player 11 using say commands. When the opponents attack us

[1] https://github.com/MersadBase/MersadBase
[2] http://rctools.sourceforge.jp/
[3] http://ce.sharif.edu/~akhavan/2D/agent-mersad.tar.gz

Player 11 goes to the center of the field to gain a good position and a good vision for commanding defenders.
Player 11 gives the orders based on opponent's attackers and determines a marker for each of them.

Block: Block skill is used to intercept the ball possessor path and obtaining the ball. Two important parts in this skill is to determine which teammate blocks the opponent and how to do this procedure. All of the players send their own information for the commander player and based on this information it decides to choose one or two players to block the opponent and sends this information back to the defenders.
There are two steps for obtaining the ball:
Step1. In this step the player approaches the opponent, and tries to move to the predicted path of the opponent.
Step2. The player tries to get the ball from the opponent using side dash , back dash and tackle.

Mark: Mark-table is constructed by player 11 by considering dangerous opponents and all the teammates which are able to mark the opponents and constructing a bigraph using them as its vertices. Then we calculate different matchings between graph vertices to find the one with the minimum sum of the edges lengths. Edge length is defined as the Euclidean distance between two players. Finally the best vertex matching which results to the best mark-table is broadcasted.

3 Pass System

In order to find the best possible pass we simulate common pass situations such as kicking the ball directly to another player or through pass. We extract different information after simulating each pass such as duration of pass, minimum distance of opponents during the pass and etc. Different passes are compared to each other by their values which are calculated using the extracted information. For example if we have n different argument for each pass the total value will be:

$$totalValue = \sum_{i=1}^{n} f_i(v_i)$$

Which v_i is the argument i value and f_i is a function which gives an appropriate point based on the amount of value. The functions growth rate and range are determined based on the importance of the argument.

Our experiment shows that having a dynamic weighing system is much more efficient than constant. Since each team has different weaknesses and strength we can optimize these functions based on the opponent actions. for example if the opponent players prefer to hold their position rather than intercepting the ball we can decrease the effect of minimum distance of opponents during the pass.

4 Multi-Step Kick

For kicking the ball with a higher velocity we need to kick the ball more than once inside the player kickable area so it can gain more acceleration. Of course changing the body direction may be as effective as kicking the ball twice since the effective power has a direct relation to the difference between the body angle and ball angle. So we have to find which position is better to kick the ball before the final kick. In order to reduce processing time we implemented our own Multi-Step Kick. The main idea for doing so is to eliminate all unnecessary states. For example for kicking the ball within 2 cycles instead of processing different angles and different radiuses to kick for the first cycle, we only used 3 optimized different states which reduces the processing time significantly. In addition we save the kick commands for the future cycles in order to prevent processing the same thing again.

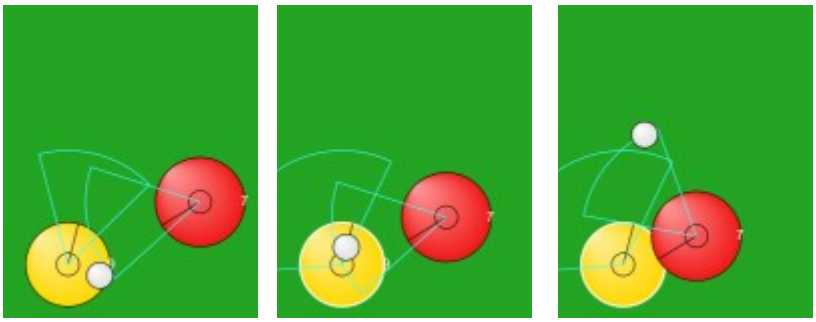

Figure 1 the player moves the ball toward it's body direction and then kick the ball. an example of a 2 step kick.

5 Future Plans

Path Finding For Dribble:

Our Goal for improving the players dribble path is to maximize the minimum distance between the opponents and the path chosen. Using the Voronoi diagram calculated by opponent's positions, we can find which paths are safer. In mathematics, a Voronoi diagram is a way of dividing space into a number of regions. A set of points (called seeds, sites, or generators) is specified beforehand and for each seed there will be a corresponding region consisting of all points closer to that seed than to any other. The regions are called Voronoi cells. It is dual to the Delaunay triangulation. So the points within the regions border (Fig.2) have the maximum

distance between the nearest point (which is an opponent). This allows us to bias the path and reduce the distance of the path to the diagram segments in order to have a more secure dribble. Since the diagram is completely based on the points it may change each cycle during the game but because of slight changes it doesn't affect the performance and decision making will remain stable. Of course there are some special cases which will be handled separately.

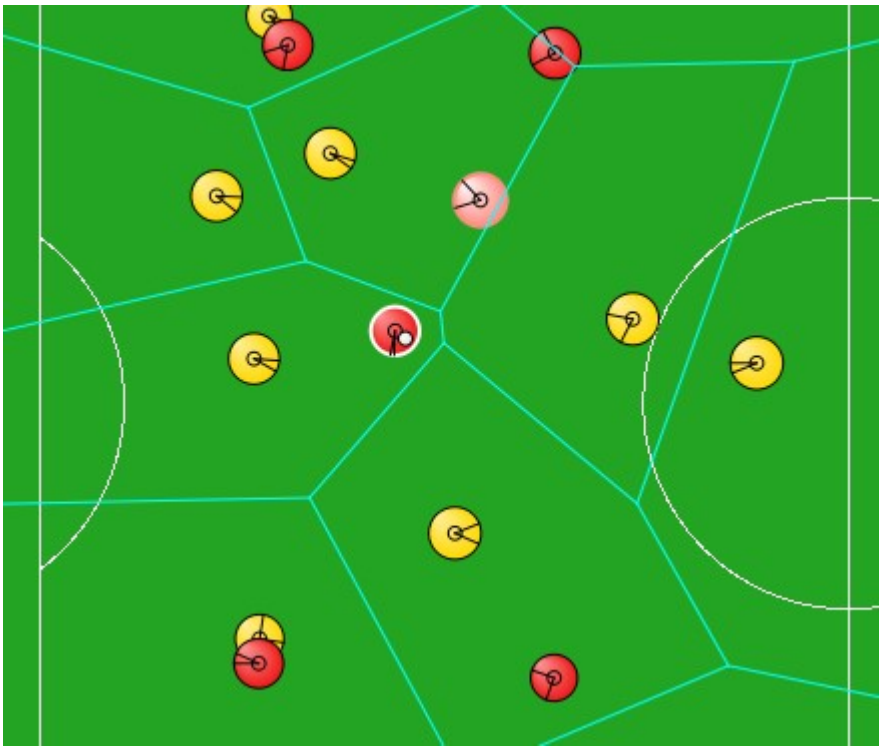

Figure 2 Blue segments separate different Voronoi regions and are the most secure path for dribbling.

6 Summary and Conclusion

Our experiments shows that improving basic skills such as multi-step kick can affect the gameplay but using AI techniques and having dynamic evaluation for more skills based on the opponent team and gameplay can improve the team significantly, Such as dynamics scoring for pass which is described in section 4.

7 References

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2. Daniel Reem (2011). The geometric stability of Voronoi diagrams with respect to small changes of the sites
3. Mao Cheny, Klaus Dorer, Ehsan Foroughi, Fredrik Heintz, ZhanXiang Huangy, Spiros Kapetanakis, Kostas Kostiadis, Johan Kummeneje, Jan Murray, Itsuki Noda, Oliver Obst, Pat Riley, Timo Steens, Yi Wangy and Xiang Yiny: RoboCup Soccer Server Users Manual