

Rule Based Passing in Multi Agent Humanoid

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Abstract— Here we will discuss how to select best teammate to pass ball in multi agent robo soccer. We will use a score based approach for choosing best teammate to pass. We will consider various factors including our expected kick distance, players position and orientation etc. Finally we will discuss how to combine all of above mentioned parameters to select the best player.

I. INTRODUCTION

Passing is one the most important skill that can help a team win the match. Selecting best passing position is therefore of vital importance. Here we will see how can we optimize the passing position selection. We will also briefly touch upon how can we use communication with passing for better results. For each teammate we will calculate score corresponding to all kicks available with us.

Therefore we will have

$$score[NUM_TEAMMATES][NUM_KICK_TYPES]$$

Based on the maximum score, we decide the team-mate to pass and the specific kick type to pass with.

II. IMPORTANT PARAMETERS

Expected kick distance for a particular kick type.
Expected time to adjust before kicking.
Our speed of turning around.
Distance of team-mate from me
Our orientation wrt the team member we are passing.
Opponents near me
Opponents near team-mate.
Angular distance of opponent from line of pass.

III. EXPLAINING PARAMETERS

Kick distance is the expected distance till which we can kick with a certainty. Kicking to a small distance is not beneficial as we are kicking with a small speed, and the time needed to prepare for kick makes it unfavorable. So, we can have a penalty function for kick distance, which is minimum when we are kicking at the certainty radius and increases depending upon the distance from the radius. Then suppose you have to kick to a team-mate situated at some angle to you, ours being a straight kick we have to turn towards that team-mate. So we give a penalty for this.

We select opponent players within certain distance threshold as potential threat to kick, and prune them by the angle they are aligned wrt me, for example an opponent in front of me at some distance is more dangerous than an opponent behind me at the same distance. (This is wrt to me.)

Then we take all the team-mates inside a certain threshold distance(very Far) and outside a certain threshold distance(very Near) as potential team-mates to pass and prune them with respect to their orientation wrt me. We also neglect the team-mates beyond the off-side limit.

Now for all the potential team-mates we see how many opponents are between me and the opponent to pass. If any opponent comes within a certain angle limit to the line of pass, we term it an invalid pass and move on to next team-mate.

Based on all the above mentioned parameters like: distance of team mate from us, distance of opponent from me, orientation of team-mate from me, the angular distance of opponents from the line of pass, the distance of various opponents from the team-mate I am going to pass.

Final score for all teammates for all kick types is calculated by choosing appropriate weights for above mentioned parameters. Based on the max score we select the team-mate to pass and the specific kick type to pass.

The time complexity in worst case for a specific kick type can be $O(\text{Number of teammates} * \text{Number of Opponents})$.

IV. FUTURE WORK

We can look into our opponent's speed at the match's run-time, and based on that we can fine tune the parameters. Also we can communicate to our team-mate and pass to a point. Then we can also add score depending on different situation, like a pass(if possible) is more favourable when we are surrounded by four opponents, while the team-mate to pass is surrounded by two.

ACKNOWLEDGMENT

The authors would like to thank Akshay Gupta (B.Tech CSE IIT Kharagpur) for his guidance and support.