HERMES:
Soccer 2D Simulation
Team Description Paper 2016

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Abstract. This paper describes important facts of Hermes 2D Soccer
Simulation Team, such as our main ideas, important actions and achieve-
ments, current situation and our future plans. We describe our new meth-
ods and ideas as well as our main scientific activities and research results.

1   Introduction

HERMES 2D simulation team, which is based on Agent 2D [1], is a sequent to
Mersad [2] (2005), HelliBASH [3] (2009) and Eskilas [4] (2010) teams by Allame-
hHelli Highschool. AllamehHelli Highschool is competing in Robocop Soccer 2D
competitions since 2003. It is the third year that HERMES is AllamehHelli High-
school's leading team. In the first year we nearly completed all basic defense and
offense actions so that we could start working on plans. In the second year we
upgraded our actions and improved our plans. This year most of out effort was
on defensive and offensive plans for scoring goals as many times as possible.

2   Basic Actions

Unlike the first and the second year, this year we focused on planning agents,
dynamic positioning and defense plans. Some of old actions has been rewritten
and some of them has been upgraded. Our main goal is to calculate the possibil-
ities quickly and virtual calculating. Most of our current methods are described
in HERMES 2015, HERMES 2014 and Eskilas 2011 and Eskilas 2010.

2.1   Offensive Basic Actions

New Dribble & SRP   In 2014 Robocop competition, we spent most of our
time working on basic and low-level actions so we could achieve suitable results
for plan making. For instance, we rewrote a new pass and positioning action

showing promising improvements over the older methods.

In order to do the above, first we concluded that for better decision making and producing better plans, we should define a new evaluation metric. Hence we found it helpful to have our own actions for decision-making process.

Therefore, we started to have our own dribble & SRP (long dribble) action. The main reason for redefining these actions is that we found default dribble, SRP and the evaluation between them unsuitable for our team plan. On the other hand this would give us capability to use our Advanced FastIC calculations which would improve the result of the codes, hence the whole team play a more efficiently.

DirPass & Improved LA2 Pass After IranOpen2014 competitions, we discovered that there were a lot of opportunities for passing which we were missing. These situations were the ones with the possibility of making indirect passes. As a result, we modified our pass structure coming up with a total of 3 different pass types in the team:

1. Direct Pass
2. Course Pass (through offside pass)
3. Indirect Direction Pass

Each of these types has some passing factors such as insecure mode, LA mode, LA2 mode, VirtualPass mode, etc. (Fig. 1.) Then another problem started to appear which was intercepting arriving passes. For solving this problem, we completely rewrote Pass say. With the new say system, Pass receiver agent would know:

1. How many cycles does it take to prepare the ball for passing the ball (hold cycles + kickStep cycles)
2. Final ball velocity after preparing cycles
3. Final ball position in passer kickable distance

After arranging this say system, we also decided to make changes to the ball intercept action, so that it would be possible for the agents to intercept the ball correctly when pass is coming.

3 Offensive Plans

3.1 Look Ahead Pass (LA Pass) and FastAC

One of main parts of our offensive plans is LA Pass. We first introduced LA Pass in Eskilas 2010. In the first version we had LA Pass 1 and LA Pass 2. In the first version of LA Pass 1, one of our players would first receive the ball and then it would communicate with other player (with say and hear) to go to one of the

Fig. 1. All Types of passes: yellow is DirectPass, Red is CoursePass, Blue is DirPass.

good points and then when it reaches there, we Pass the Ball. It was a useful action but one of its problems was long waiting cycles and its heavy calculation that led to lost cycles and we could not use it in the Dangerous situation. This year we upgraded it to the second version. In the second version we define area instead of Points. Then we calculate the best area based on success probability, the ball Position, the Player Teammate number and the probability of recovering ball (taking unsuccessful passes into account). We also start calculating the best area and points before reaching the ball. In LA2, we start calculating and saying before using Pass (similar to LA1). In the new version we start Calculating for other Actions as explained below.

FastAC: This year we introduced FastAC, the fast action calculator. The idea behind this method is very simple and intuitive yet very effective. In cases such as LA2 or shoot or pass in the opponent field, we simply start calculating the best action before reaching the ball. In Hermes 2014 and IranOpen 2015, we took advantage of the idea of the leader player. We define one player standing in the midline for helping us to build a Position map using the say command. This year we changed it and instead of Position Map, now its going to help with Action Calculating and Positioning.

In the first step of this action sequence, our player (which is confident that can get the ball) starts calculating the best area and the best LA2Pass. When our player selected the teammate player and target area, our player (the target teammate) start moving through the target and in the meantime it calculates the best actions (pass or shoot or dribble or). But because it is having very heavy calculations, the leader player (whose job is watching) also starts calculating

with his own FastAC. The FastAC of the watching player job is calculating bad actions and areas (actions or area that we might lose the ball) and saying it to the targeted teammate player (the teammate that is moving for reaching ball). The FastAC of the targeted player hears the "say" comment of the leading player and consequently limits its calculations, avoiding calculation for the bad action or points. It will then focus on the good actions or points. Because of this algorithm, its very fast and can easily use algorithms and calculation without losing precious cycles.

3.2 Dynamic Offensive Positioning

This year we completely changed offensive positioning. The main idea behind Our offensive positioning is to use the FastAC and LA Pass and say and hear commands. But unlike the attack sequence (described earlier) we are using a pair or tringle say or hear system. Here, we are using the FastAC for intercepting, SRP and in our dribble. Therefore we can use LAPass1 and even regular pass.

In the Offensive Positioning, all the areas (or points) matter. This is unlike the attack sequence which was described earlier. We use the triangular player forms instead of pair players. In the triangular form, the first player commits a FastAC with the target player and the calculations is done by the second player. But the second player (unlike the attack sequence) calculations is for the third player. But for times that the third player's goal is not to shoot or LA2pass (that the LAPass2 target player is getting ready for shoot), the third player calculations are for first Player. The interesting thing is that most of times we have two triangles but 5 players. In these situations the first player is shared between the two triangles. So at first it calculates the better place then start calculating for the better player.

4 Defensive Actions

4.1 Line Mark Action

Line Mark action is the action defined in HERMES team, taking the responsibility to stabilize our defense line (offside line for opponents) and to avoid opponents to run through defenders and get behind offside line passes. As a result opponent offender would not be able to reach one on one situation. Agents, who take this task, are the last defenders who always stay on the last line of defense. Moreover, this action is helpful for Blocking ball owner opponent so the front opponent would always face one of our defenders for blocking as soon as he owns the ball. (fig 2.)

The task of this action for every defender is set by Leader Player. Leader is the player who assigns task to other players. The tasks can be Line Mark, Normal Mark or Positioning. Complete description about Leader player and his duties is available in HERMES 2014 TDP [**?**].

Fig. 2. Team mates 5, 2, 3 are Line Marking opponent offenders Picture taken from SoccerWindow2 application.

4.2 Defensive Arrangement Algorithm by Leader

One of the most important problems in defending against opponent offenders, when opponent owns the ball, is matching players to opponents for marking and to decide which team mate should Line Mark and who should Normal Mark. Also it is important to match suitable players for positioning in key defensive positions. For that, at first, the Leader, who is usually an offender who has a good view on our defense players and opponent's offense players, finds the front offense line of the opposite team then matches them with last defenders.

Now there are n opponents left to match with defenders. Leader separates these n opponents to k groups of opponents (a_1 to a_k). a_i is the group of opponents which are in the same line. In the other word Leader makes k ranges of Xs and in every range there are opponents in the same line (approximately). Now, the Leader starts from the first range and goes on until a range which has more opponents than teammates remains (R_i). Now with a value of opponents Ys in R_i we find the last opponents who are appropriate for marking.

After these calculations Leader has 3 types of players: first, players which do LineMark, second, players who do NormalMark, players who do Positioning. Then Leader performs a "say" on all the data he calculated about defensive tasks.

References

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