Team Description of the NITStones-99

NITStones99

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Abstract. Since the offside rule was adopted in RoboCup-98, many teams without teamwork ability got offside penalty many times in their matches. Those teams who have dribble skill won, because most of other teams have not efficient defence strategy. In this paper, we consider an efficient teamwork-based defence method called line defence. To achieve the line defence, a set of basic teamwork abilities (including positioning, marking, notifying and avoiding) are proposed. We design five types of soccer players by combining those basic abilities in various ways. The simulation results showed that all of teamwork abilities are important to the line defence.

1 Introduction

It is an important problem in multi-agent systems how an agent cooperates with others to achieve the goal of the systems[1]. The soccer server of RoboCup, therefore, has introduced many new rules like offside and neighborhood that need complex cooperation among the agents[2]. RoboCup98 showed that those teams without teamwork strategies were often punished by the offside rule[3]. Hence, complex teamwork strategy including dribble and line defense should be considered in the soccer games.

This paper focuses on a special teamwork strategy called line defence to against the offside rule. We propose some basic teamwork abilities for implementing the line defence. Various teams are constructed by combining the basic teamwork abilities in different ways. The simulation results show that the team with all teamwork abilities is strongest.

2 A Teamwork in Line Defence

The offside rule makes the soccer agents have to consider new offensive strategies and new defensive strategies.

The line defence is an efficient defensive strategy which means that a group of defenders locate at a line (called offside-line) paralleled with the bottom
line between the goal and the ball. To achieve effective line defence, we propose four basic teamwork abilities.

### 2.1 Positioning

Each defender has a home position. Usually, each defender keeps at his home position if the ball is not close to. The home position of each defender is changed dynamically depending on the position of the ball. We call the behavior of an agent to move back to its home position area as positioning. This ability is a necessity for the line defence.

### 2.2 Marking

Each defender should pay attention to the opponent players who are close to the offside-line, because it may break through the offside-line with the ball. That is the most dangerous situation. The defender should move to the cross point of the offside-line and the line connects one of the opponent player and the goal (see Fig.1). We call the behavior of the agent to move to that cross point as marking.

Without this ability of marking, the offside-line is possibly broken through by opponent players who have a dribble skill.

### 2.3 Notifying

When the ball is being close to a defender, the other defender should notify the defender that the ball is coming. This behavior of agents is called notifying. This ability is also used by the player who is close to the ball to tell the other players the location of the ball. This ability is helpful for passing the ball from a defender to a midfielder and catching the ball from the opponent offence.

### 2.4 Avoiding

Since the home positions of defenders are possibly overlaped, it is possible that a player comes into a collision with others. Moreover, a player chasing the ball may collide with the backbone of the player dribbling the ball. Hence, agents need an ability to avoid collision with others. This special behaviour is called avoiding.

### 3 Experiments

To confirm the efficient of the line defence, five types of soccer players are constructed as follows.

**Full Player** This type of player has all of four teamwork abilities, including positioning, marking, notifying and avoiding.
**Markingless Player** This type of player is as the same as the Full Player except that the marking ability is removed.

**Notifyingless Player** This type of player is a Full Player without notifying ability.

**Avoidingless Player** This player is as the same as the Full Player except that the avoiding ability is removed.

**Normal Player** This type of player has only the positioning ability.

In our experiments, five teams are constructed which members are from each type of player, respectively. Furthermore four sets of games are run, each repeats 50 times. The following table is the results that Full Player team competes with the other four teams.

Table 1: Results of the Full team competes with the other four teams

<table>
<thead>
<tr>
<th></th>
<th>Win</th>
<th>Lose</th>
<th>Rate of Win</th>
</tr>
</thead>
<tbody>
<tr>
<td>Markingless Team</td>
<td>17</td>
<td>33</td>
<td>0.34</td>
</tr>
<tr>
<td>Notifyingless Team</td>
<td>14</td>
<td>36</td>
<td>0.28</td>
</tr>
<tr>
<td>Avoidingless Team</td>
<td>18</td>
<td>32</td>
<td>0.36</td>
</tr>
<tr>
<td>Normal Team</td>
<td>5</td>
<td>45</td>
<td>0.10</td>
</tr>
</tbody>
</table>

From the games, we found that the Markingless Team’s players take back the ball rapidly from opponent forward-players, the Notifyingless Team’s defenders often failed to pass the ball to some midfielders, the Avoidingless Team’s players are blocked by opponent team’s players when they were chasing the ball, and the Normal team’s players were inferior to all points in the game.

The results in Table 1 shows that Notifyingless Team lost in a higher rate than that of Markingless and Avoidingless Team. Hence notifying is very important ability. Similarly, Normal Player Team lost in almost all of the matches. It indicates that combining of the teamwork abilities is very efficient.

4 Conclusion

In this paper, we described an efficient defence strategy called line defence. A set of teamwork abilities which is necessary for the line-defence are proposed. We confirmed that those teamwork abilities are efficient for the line-defence. Especially, notifying is a very important ability.

In our current implementation, the offside-line is fixed. It means that our agents cannot change the location of the offside-line while the opponent player’s strategy changed. To implement the complete positioning ability is our further work.

References

[1] Nobuhiro Ito. A Description-Processing System for SoccerAgents, RoboCup98: Robot Soccer World Cup II.