

Kakitsubata Team Description

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Abstract. In a multi-agent system, it is important how an agent cooperate with the others. However, it is difficult for an agent to cooperate appropriately in a dynamic environment, such as the RoboCup soccer. Therefore, Our team has two main features which allow appropriate cooperative activity, a cooperative protocol and a coach-agent[1]. With these features, our team can cooperate with each other in such environment.

1 Introduction

One of the important problems in a multi-agent system is how an agent cooperate with the others in order to achieve the goal of the system[2]. However, it is difficult for an agent to cooperate appropriately in a environment where the circumstances and the role of the agent often change. Therefore, precise circumstantial judgment and flexible strategy are necessary so that the agent cooperates appropriately in a dynamic environment.

Our team has two main features which allow appropriate cooperative activity in such an environment. The first feature of our team is concerned with to a Strategy Relay Cooperative Protocol. More specifically, when soccer players perform cooperative activity, they communicate to each other by broadcasting their playing strategy to the other players. Second, our team has a coach-agent. The coach-agent can obtain all the information about the game. Thus the coach-agent can make appropriate judgment during the game as well as select a suitable team formation according to the circumstances. Furthermore the coach-agent evaluate the player's strategy. The coach-agent informs the players about the result his evaluation, therefore each player can create an appropriate strategy according to the circumstances.

With the features mentioned above, the players can cooperate with each other in several situation.

2 Strategy Relay Cooperative Protocol

Here, we introduce the Strategy Relay Cooperative Protocol which allows the agents to cooperate in a dynamic environment. In this protocol each agent communicates with the others by broadcasting a Cooperative Strategy and making cooperative activity. In the Cooperative Strategy the agents in an organization cooperate with the other agents in order to solve problems. A cooperative knowledge is created based on the previous strategies used during the game. Each player has such strategy consisting of some steps.

When an agent solve problems in cooperation, he decides the Cooperative Strategy by using the cooperative knowledge, and broadcasts the strategy to the agents around him. The agents which have received the strategy will then evaluate it, and execute its next step or different strategy related to it. In this way, the agents perform dynamic cooperative activity. At this point, a cooperative group formed by the agents in the message arrival range is created dynamically. This is the group of agents which will perform the cooperative activity. Thus, the agents dynamically form a group in order to solve occurring problems. In figure 1, we illustrate a situation of cooperative activity using this protocol.

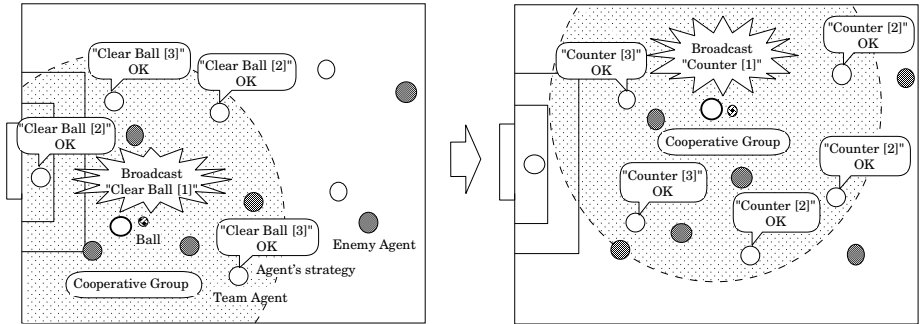


Fig. 1. Strategy Relay Cooperative Protocol

Our team can perform cooperative activity in a dynamic environment by using the protocol described above. Furthermore, by broadcasting the Cooperative Strategy, agents can perform cooperative activity by themselves. In addition, by creating the cooperative group dynamically, our team can compose a strategy of organization according to the circumstances.

3 Coach-agent

Our team has a coach-agent. The coach supports cooperative activity among player agents.

Suggestions of the coach are based on the following:

1. defense line

Our team takes a flat line defense. During the game, the coach checks the formation of an opponent team by analyzing their attack patterns. The attack pattern of the opponent is defined by y-coordinate where the opponent breaks our defense line.

The following cases are assumed that the opponents break our defense line.

- Our defenders spread in a line. (The interval of our defender is 7.5m at most.) The average of their x-positions is regarded as our virtual defense line.
- The ball crosses the virtual defense line toward our goal after the opponents pass or dribble.

And, in order to classify the attack patterns of the opponents, the soccer field is divided into 10 areas (figure.2).

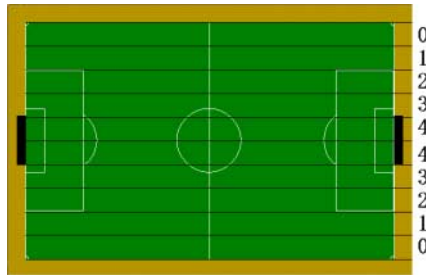


Fig. 2. classifying field

For example, when the opponents attacks along the side (0 and 1 in figure 2), the defense formation will be changed to a wide one.

2. Team formation in response to player status

A robust multi-agent system is a system that the agents compensate troubles that they did. In soccer, lacking their stamina or dead lock situations are examples of agents' troubles. The coach checks the player's motion, and change defensive formation when our agents lose their stamina and our team is defeated.

3. Set play

When play_mode is our goal_kick, the coach analyze who looks like to receive the ball. And, tell the goalie it. The goalie will judge the pass direction by himself, taking the message into consideration.

When the play mode changes into "play_off", the coach will also send the information mentioned above.

The coach can evaluate its suggestion by checking successive plays, and change its own strategy of advice.

4 Evaluation of strategy by a coach-agent

A player strategy may not be always effective to the opponent type. Therefore, the coach-agent evaluates the player strategy and suggests the more suitable strategy according to the circumstances. In the following, we give a description of the steps for strategy evaluation.

1. A player performs a strategy by using the Strategy Relay Cooperative Protocol.
2. The coach-agent evaluates the strategy based on the information sent by each player.
3. The coach-agent sends to the players the result of his evaluation.
4. The player modifies the strategy by himself.

A player can execute the strategy according to the opponent.

5 Conclusion

In this paper, we described three methods of flexible cooperative action.

In the first method, a coach-agent analyzes the circumstances of the game and advises the team formation to the players. In the second one, as a result of using the Strategy Relay Cooperative Protocol, an agent can perform cooperative activity in a dynamic environment. In the third one, a player can execute a suitable strategy to the opponent based on the strategy that the coach-agent evaluates. Evaluation of strategy by a coach-agent is now under-work. To complete such implementation as well as perform experiments under cooperative action remain the objective of our research.

References

1. Soccerserver Manual, in <http://www.dsv.su.se/~johank/RoboCup/manual/>
2. Nobuhiro Ito. A Description-Processing System for SoccerAgents, RoboCup98:Robot Soccer World Cup II.