

The Application of Multi-Agent System in Robot Football Game

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Abstract. A robot football game as a typical multi-agent system requires several robots to accomplish a common goal by cooperation in an environment full of real-time antagonism, which provides a rational platform for studying robot cooperation. Through a study of cooperation and application of multi-agent system, this paper applied a real-time agent model to improve teamwork.

Keywords: robot football game. agent. multi-agent system. cooperation

1 Introduction

The study of multi-agent system is an important issue and evolution direction in the nowadays artificial intelligence field [1-4]. The robot football game is a typical multi-agent system in which every robot footballer is an agent, has become an experiment platform for agent control and artificial intelligence[5,6]. How to realize effective cooperation and teamwork among each agent member in a changeable environment presents itself as a principle problem to the study and research of multi-agent system.

Agent is characterized with autonomy, social ability, reactivity and spontaneous action. The multi-agent system comprises several agents. As an effective solution to complicate system problems, multi-agent system divide the complicate system into relatively independent agent subsystem and the cooperation and competition among agents shall provide an answer to the complicated problem.

2 Model of Cooperation among Agents in a Robot Football Game

The robot football game proceeds in an environment of real-time and dynamic changes and antagonism. To take each robot footballer as an agent and organize them, each agent not only requires more than independent ability to handle the situation, but also coordinative teamwork with other agent to act as a group. The real-time agent

model adopted in this paper has the ability of making independent decision as well as cooperating with other agent shown as Fig.1.

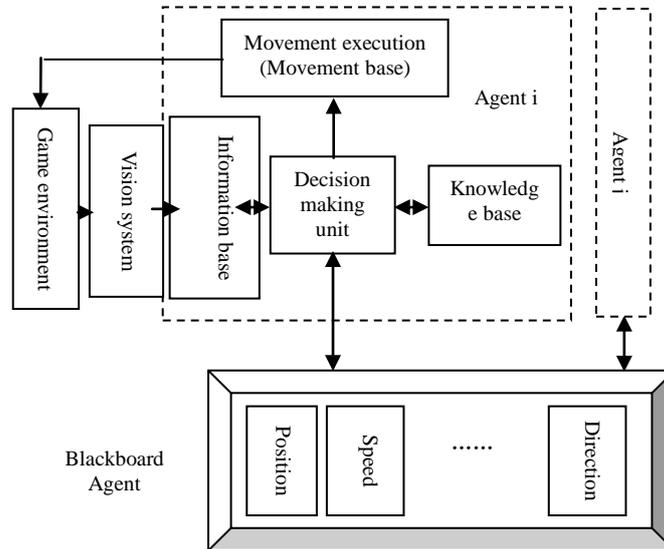


Fig. 1 Agent cooperation model

In the agent model structure shown in Fig.1, information base is used to store decision making information transmitted from the decision making unit and field information, and game situation information provided by vision system. The decision making unit has two functions: the information amalgamation and movement selection. The information amalgamation function is responsible for collecting all information related to this agent and evaluating the game situation, where as movement selection function for selecting right movement based on the result of information amalgamation. The Knowledge base includes related knowledge information to the decision making. Movement execution unit is responsible for the accomplishment of execution of specific movement. Blackboard agent serves as a communication modular to bring cooperation among several agents to reality by handling information transmission between an agent and other teammate, reporting the position, direction and speed of ball and players of each side, behavior of teammate to prevent fall afoul with behavior of teammates.

3 Execution of Multi-Agent System

3.1 Description of Strategy

The cooperation of a multi-agent system is based on the strategy comprising certain occasions. The description of strategy shall direct each agent how to act on every

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occasion. All occasions in the strategy shall not appear but it requires the agent to make selection among them accordingly. A description of strategy in XML language given by this paper embraces the name, code, priority, number of the member, number of the occasion, defeat condition of the strategy and each occasion included in the strategy.

3.2 Cooperation Based on Strategy

The cooperation based on strategy is built on displayed communication, namely, a particular agent decides a strategy then extends requests to other participants of the strategy, and other participants will grant the request or turn it down, the cooperation shall be formed only if all participants agree on the strategy. Upon formation of cooperation, each agent shall select different action according to the description of strategy. The termination of cooperation takes two forms: accomplishment and abortion, of which the former means smooth execution of strategy and the organizer of the cooperation shall inform every participant of it; but the later is a result of the fact that a participant has selected some cooperation of higher priority or the current cooperation can not be successfully executed.

3.3 Formation and Termination of Cooperation

The content of communication of connection formation includes the following three parts:

- Sign of cooperation formation.
- Number of cooperator.
- Content of strategy.

We only need to convert the strategy into code to transmit in communication. The content of communication to form cooperation is arranged in Table 1.

Table 1 Cooperation communication

A	Strategy code	Cooperation organizer	Cooperator 1	Cooperator n
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Since the number of cooperation in which each agent can take part is only one, when agent receiving cooperation request, it will check if it has be in another cooperation, if not, it will grant the request, otherwise it will make a choice between the current cooperation and the one it is requested to join, if it takes the new request, it will quit the current cooperation and send out message of quitting.

If it choice to continue the current cooperation as good as turn down the request of new cooperation, it has to send out a refusal message.

The termination of cooperation takes two forms: abortion and accomplishment, of which the latter means the goal of the current cooperation has been attained, the cooperation organizer will send out message of accomplishment.

3.4 Execution of Cooperation

Once the cooperation is formed, each agent shall select different actions to execute on different occasions according to description of strategy.

The cooperation in a multi-agent system in a robot football game shall go through the following stages:

- 1) A certain agent forms a strategy.
- 2) Send out cooperation request, the cooperation shall be formed when no one turns the request down.
- 3) When the cooperation is not aborted or terminated, the participant is allowed to decide its own action according to strategy and the strategy stage.
- 4) Termination or abortion of cooperation.

In each specific robot football game, strategy is continually variational and robots' movement is also continually variational with cooperation execution. As a result, robots' movement determines that if the cooperation execution is successfully completed. Movement mainly comes down to the several aspects, which are teammate's position, shoot, movement and defence etc.

4 Conclusion

In a complex and dynamic environment, the multi-agent system provides communication among each distributed agent for the real-time accomplishment of a common task. The multi-agent system, so to speak, is a new breakthrough in the development of artificial intelligence which has made the once closed and isolated knowledge system an open and distributed system and brought artificial intelligence into more fields of practical application.

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