Team YowAI-2000 Description

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Abstract. Team YowAI-2000 is an improved version of YowAI-1999 which was originally developed by Takashi Suzuki. It won the RoboCup Japan Open 2000 Championship. However, it does only slightest dynamic cooperation among agents. For example, `say` and `hear` commands are not used. It was developed as an experiment to examine how far player's individual skill can go without cooperation.

1 Introduction

Team YowAI-2000 is an improved version of YowAI-1999 which was originally developed by Takashi Suzuki. The name YowAI may allude something relevant to AI, but it comes from a basic Japanese word *yowai* that means "weak" and it is an honored name that will be given to the strongest team among those developed in the Takeuchi laboratory of the University of Electro-Communications when a representative team needs to be selected for a championship competition.

The team was originally named Dango-Evolution I by Suzuki. As its name indicates, the team is an evolved version of Dango which was also developed by Takashi Suzuki.

We first sketch the team Dango and then the team Dango-Evolution I which was improved to the YowAI of year 2000.

2 Team Dango

Team Dango, whose name is also a Japanese word that means "a number of persons or things which gather closely to each other in rather a wide space", has a good stamina management system, so that agents can run all the time without being apparently worn out. It also employs dynamic positioning and dynamic role change of the agents by some implicit relative positioning strategy and by simple negotiation using `say` and `hear` commands.

The Dango agents tend to be more or less "ball-centric" so that they seem to follow the ball in a mass within area of about 20 meter radius without taking care about global positioning balance. Seemingly relentless running of agents is, however, so cleverly controlled by the stamina management system that no one agent actually runs too much compared with others. The team could make a good game with some of Japanese top teams in early 1999. But it was easily defeated by a team that kicked and passed the ball widely across the pitch (soccer field).

P. Stone, T. Balch, and G. Kraetzschmar (Eds.): RoboCup 2000, LNAI 2019, pp. 509-512, 2001.

3 Team Dango-Evolution I

Suzuki decided to develop a totally different kind of team based upon the team Dango, when he noticed that it was too early to develop a sort of dynamic cooperation among agents and it was much more important to promote the agent's individual ability, especially for constructing accurate world model in real time based upon the sensed information, for running, for kicking, for dribbling etc.

Suzuki's methodology was a little extreme on developing the Dango-Evolution I. He decided to abandon any dynamic cooperative action, thereby any usage of `say` or `hear` command. This controlled experiment principle would reveal the importance of individual agent ability before cooperative actions, he thought.

But it does not mean that Dango-Evolution I excludes all cooperation among agents. Its agent passes the ball if it thinks passing is more appropriate than dribbling in a given situation. Field player agents take fixed area positioning. For example, the left-side defender will not move out of his fixed area, left-side of its own half ground. There is no dynamic role change among the players. This fixed positioning allows an agent to kick the ball to a predefined direction if it cannot decide the best pass direction within the limited time, because his partner is probably there. Most of these cooperative actions can be considered static, that is, programmed as predefined actions.

On the contrary, each agent is highly tuned to make his own world model as precise as possible without communicating with each other. To achieve this accurate world modeling ability, Suzuki analyzed the soccerserver source program extensively. Fundamental idea is to retain sensed information with error estimation (Fig 1). Multiple sensing would reduce the error estimation quite efficiently. Basic skills of the agent are also thoroughly tuned to exploit this accurate world modeling.

Combined with the Dango excellent stamina management , these individual abilities of agents enhance the team power considerably. At 1999 year end, Dango Evolution I became to be able to play almost even games with CMUnited 1999, the 1999 World Champion team. It was honored with the name YowAI-2000.

Suzuki's successor Shinnosuke Asahara improved the YowAI further with respect to these basic skills and the following two tactical points. First, when a player runs with the ball near opponent field corner, it will make a centering kick toward a team mate who is presumably ready to make a shot directly when receiving the centering. This is the first of cooperative tactical moves incorporated into YowAI. Second, forward player's shooting range is enlarged in order to overcome excellent goal keeping skill some team developed up to that time. That is, offensive players became to make a shot at more distant position from the goal mouth. This simple improvement made YowAI be able to win CMUnited 1999 more often.

In fact, YowAI-2000 won the championship of the RoboCup Japan Open 2000 held at Hakodate (a north city of Japan) in June, 2000, defeating the defending champion 11-Monkeys-2 of the Keio University with the score 7-0 in the final game. It did not allow any goal by opponent teams throughout the competition.

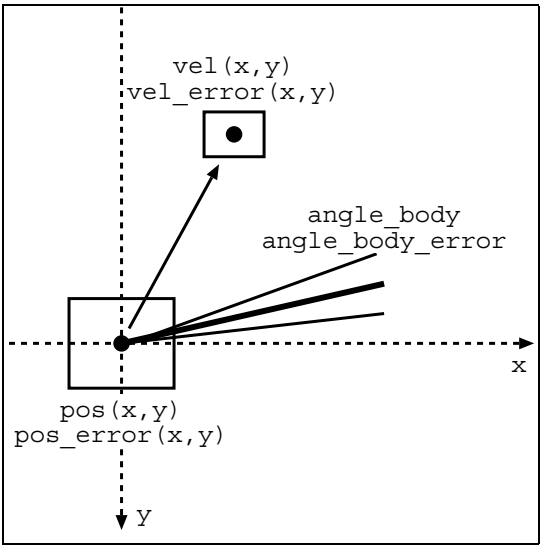

Fig. 1. The internal representation of sensed information

YowAI-2000 is written in C++ (about 10,000 lines). It should be emphasized that its CPU load is very light compared with other teams. On Pentium III 400MHz processor, it consumes only below 5 or 10 percent CPU time even when all eleven agents are run on a single CPU.

4 Soccerscope

Here, it is worth introducing the Soccerscope developed by Hideaki Kurita, which played a great assisting tool for Suzuki to develop YowAI-2000. Improvement of basic skills needs a good visualization tool to make sure what can be achieved or lost by a program modification. Without such a tool, the programmer can only guess the effect of his effort indirectly by conducting a number of exercise games. Especially, the accuracy of an agent's world model cannot be examined only by inspecting the soccermonitor display. Figure 2 shows the real position of players and a player's world model simultaneously with different colors, so that error in the world model can be easily examined. Kurita's Soccerscope is a visualization tool by which the programmer can examine what he wants. Soccerscope is written in Java and is upward compatible with the soccermonitor.

For the YowAI development, Suzuki and Kurita made a joint work so that Kurita implemented features one after another, which were requested by Suzuki in the course of his development. The Soccerscope communicates with the soccerserver with some program patches, so that it can display player's view range, stamina, world model, and even its intention if the user desires. Other features

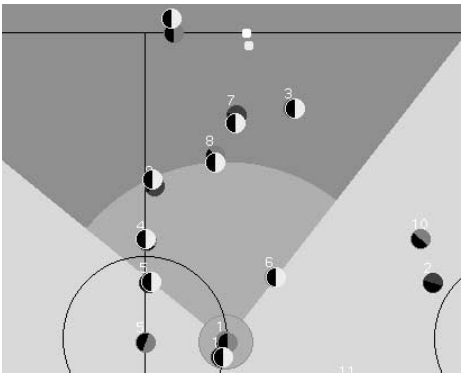

Fig. 2. Display of a world model overlapped with the real world

of the Soccerscope are slow motion, zoom-in display, reverse play, trajectory display etc. Zoom-in display helped the dribble skill improvement significantly.

It would not be possible to tune skills up to this level if there were not the Soccerscope.

5 Toward Next Step

YowAI-2000 could not be ranked as one of world top teams in the RoboCup 2000. The reason is obvious. It excludes almost all dynamic cooperation among agents because of a sort of controlled experiment principle. The next step of YowAI is surely the incorporation of cooperative actions based upon the achieved individual skills.

We are now porting the YowAI-2000 C++ code into Java in order to make the improvement easier. A lot of software components are extracted in this porting process. The lightweightness of the YowAI code is successfully inherited to the Java code.

However, the next YowAI (YowAI-2001) would not be a direct successor of YowAI-2000. Koji Nakayama is now developing a more strategically cooperative team, taking after some of excellent features of YowAI-2000.

The Soccerscope is also under improvement to make it able to display more about cooperative actions and intentions of agents.