

Zeng99 : RoboCup simulation team with Hierarchical Fuzzy Intelligent Control and Cooperative Development

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Abstract. This paper discusses the design of the team Zeng99. The goal of team Zeng99 is to show a performance of Hierarchical Fuzzy Intelligent Control system in the field of multi agent problems. It worked well at RoboCup99 competition, even with little error in an invoking clients. It also allow independent/cooperative development client by client.

1 Introduction

The goal of robocup simulation team Zeng99 is to show a performance of Hierarchical Fuzzy Intelligent Control system (HiFIC) [1] in the field of multi agent problems, such as soccer simulation. The HiFIC is a scheme of controller for ill-defined/described objects.

These days, there are many studies on intelligent control systems to perform high level control such as human operators do. Human knowledge based controller model is an approach to realize an intelligent control system. In this paper, HiFIC is adopted to soccer agent cooperative behavior planning and reactive control.

The HiFIC controller is a derivative of three layered control model by Jens Rasmussen[2]. HiFIC also consist of three levels: lower layer to regulate primitive reactive control, middle layer to perform skill level behavior and highest layer to make decision on strategic and tactical playing plan. A main ability of this system is easy construction of hybrid controller which combines feedback loop regulator facility and feed-forward control facility.

2 Team Development

Zeng99 team development model was a independent and/or cooperative clients programming.

Team Leader: Tomomi Kwarabayashi (Offensive Mid-fielder)

- Graduate student
- attend the competition

Team Director: Junji Nishino

- Faculty: Assistant professor
- attend the competition

Team Members: – all members below did not attend the competition

Takuya Morishita (Defensive Mid-Fielder), Hiroki Shimora (Goalie)

- Graduate student

Takenori Kubo (Defender, Sweeper), Kyoichi Hiroshima (Goalie 2)

- Graduate student, PhD candidate

Hironori Aoyagi (Forward)

- Undergraduate student

Hisakazu Ogura

- Faculty: Professor

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We have six independent client programs that was created by different programmers respectively. The clients were preassigned to their own position in the 4-4-2 soccer formation that is shown in the figure 1.

3 World Model and Communications

Zeng99 use libscclient4.0 for offensive mid-fielder, the source cord of CMUnited-98[3] for defender and side mid-fielder, and special developed low level libraries for goalie. They are just ordinary models for time interpolation.

Zeng99 didn't use any on-line communication for emerging cooperative play, in another words the team didn't use say command. They used eye-contact communication, which is occurred by matching of behavior rules.

4 Skills

All clients except the Goal keeper don't have tuned skills such as a boll keeping faint move. CMUnited-98 based clients only have the skills of the CMUnited-98 source code.

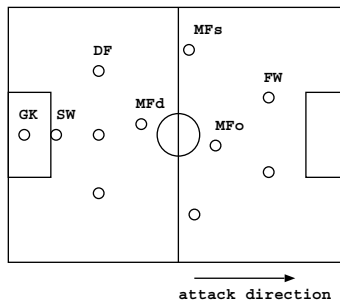


Fig. 1. Zeng99 4-4-2 Formation

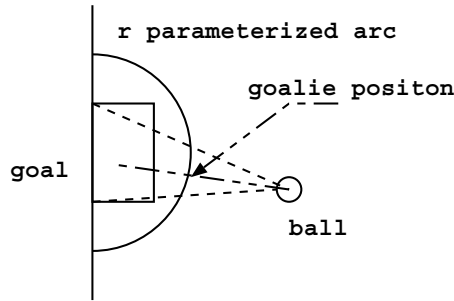


Fig. 2. Goalie positioning

The Goal keeper have two special skills. It have 1) middle term boll prediction and 2) trace moving on an arc. Here, middle term means several simulation steps among two and five. The goalie predicts two to five steps ahead, and then tests the boll position and his possible position to determine whether he can catch it or not at that time. If he decides that it can be caught, then he goes to appropriate position and catch the ball. If not, he goes to goalie position described in the figure 2 .

5 Special Team Features and Strategy

For the Zeng99 team's strategy, human soccer players' knowledge is implemented in the form of HiFIC. The HiFIC system allow us to write a knowledge in natural language like form of fuzzy inference model with ambiguous words by fuzzy logic facility.

The team clients were developed separately under the agreement of programmers, that is cooperative strategy with 4-4-2 formation system. In the process of development, it takes repeated three phases. The steps are as follows; 1) analyzing human players' knowledge, 2) brain storming and discussion on the knowledge by whole development members, 3) independent development and testing. This sequence was repeated once a week.

Programmers had a common workspace to store current version of one's client so that they were able to test his client with newest another position clients. They were brushed up by trial and error toward the agreements made at a discussion phase. This style of development could provide quickly actual prototypes of several clients which are pegged on particular rolls. In the knowledge analyzing phase, we interviewed real armature human soccer players and/or studied soccer books.

Zeng99 have neither learning mechanism nor modeling ability at the version of Stockholm. Though the Goalie was tuned very well. it needed a sweeper just in front of our goal. This style is not available very often in the usual soccer play. However, indeed, a combination play between goalie and back ground sweeper

was worked very well. Because goalie moves strictly only ON THE ARC LINE shown in the figure 2, he couldn't catch balls behind him, even if the ball run very slow.

6 Results

We had errors in the startup script instead of the program, so the Zeng99 team couldn't gain a point at the regular competition. Therefor we like to show some result from friendly match results which has played in the simulation league site and on the same machines. At the regular round-robbin, because of startup script

Table 1. Results

Regular round-robbin group A		Friendly match results			
0-11	CMUnited99	2-0	Footux99	12-0	Polytech
0-1	UlmSparrows	1-5	Cyberoos99	9-0	Robolog
0-3	HCIH	2-0	UlmSparrows	0-7	BrainStormers
				4-0	NITStones

error, zeng99 clients couldn't read correct server.conf file in the game against CMUnited99, the champion team. Thus they couldn't kick the ball. Therefore CMUnited99 always keep the ball, however the goalie and the sweeper had saved their goal 30 times in 41 shoot trial. At the friendly matches, the goalie, the sweeper and defender also played well, repaired the error.

7 Conclusion

Human knowledge based cooperative soccer playing rules are implemented using Hierarchical Fuzzy Intelligent Control System architecture and they worked well on matches with other teams. This type developments allow us to separately developments. In the future work, make a common knowledge based strategic level controller for both simulator and real robots.

References

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