Zeng01 Team Description: Formation Decision Method Using Game Theory

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Abstract. The combined team, Zeng01, have players developed by several subject of investigation. We have analyzed better player combination based on game theory. We look up the formation property through changing a opposite team strategy on every games. Comparing formation property on every games, we decide own team formation.

1 Introduction

Zeng01 team consist of many players who are accomplishments of each researchers[1, 2, 3, 4]. Decision making based on game tree search, each study is parameter tuning by GA, realtime learning by GA, circumstantial judgment routine by GA, optimization of recognitive routine by GA, flexible agent making by fuzzy decision making system. Each program (player agent) was developed individually. Player agents are developed with each role such as FW, MF, DF, and GK, to be constituted team easily. Accordingly, our team have many independent player agents that was created by different programmers respectively. These players are four kinds of goalkeepers, eighteen kinds of Defenders, twenty one kinds of Mid-Fielders and twelve kinds of Forwards.

It is necessary to decide a formation and combination of players. It is difficult to decide player combination suitability.We prepared the test team in order to decide formation. Probing Zeng01 team property, we decide our team formation and player combination. In this paper, we proposed a method for decising formation using game theory[5].

2 Basic Skills

Most of programs in our team was based on the published source code (CMUnited99[6]). In this year, client programs was changed to use a library which was developed newly. This library was based on the old library that Zeng's

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goalkeeper had used. An action (i.e. KEEPBALL, DRIBBLE, SHOOT, PASS, etc) was pushed into queue. Accordingly, it is easy to execute complex continuous action.

3 Implementation and Experimentation

We prepared a test team which has two strategies; center-breakthrough strategy and side-breakthrough strategy. Playing game with the mixed strategy, we look up the formation and/or team characteristic.

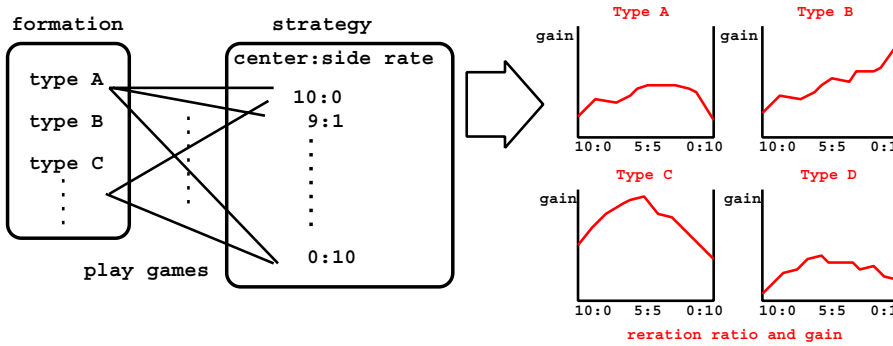

Fig. 1. Relation of mixed ratio and estimate value

Figure1 shows relation of ratio and gain obtained from games with changing strategy ratio. Doing games with changing strategy ratio, against team formation type, we obtain the relation with each formation type. Existence of saddle point and higher gain imply better formation.

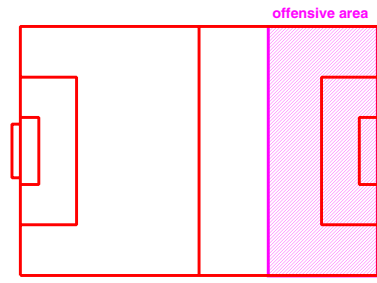

Fig. 2. Offensive area (over 20m–line)

If there was ball in a offensive area, the estimation of the match increased. The offensive area was shown in Figure2.

Table 1. Results of competition in Seattle (Zeng01 is left side)

Opponent	Score	Offense Ratio(%)	Control Ratio(%)
ATTUnited01	0-0	28.0	61.1
MRB	0-0	19.1	55.3
DrWeb	4-0	62.4	56.1
AnderLecht	7-0	63.8	61.2
RoboLog2k1	0-0	17.6	51.4
living_systems	2-0	25.4	57.2
WrightEagle2001	0-0	20.6	55.8
Brainstormers01	0-4	20.7	39.5
Gemini	4-0	50.7	69.0

Table1 shows results in Seattle. Two ratios are calculated by formulas following:

$$OffenseRatio = \frac{T_0}{T_{all}}$$
$$ControlRatio = \frac{T_1}{T_{all}}$$

T_0:The time of a ball existed in the offensive area(Fig.2).
T_1:The time of keeping control of a ball.
T_{all}:The time of whole game.

Let us begin our analysis by comparing score and shown ratios. It is likely that there is a close relation between these ratios and results of matches. In this result, although this statistics are not completely reliable, it seems reasonable to suppose that those ratios used to estimate match. We use these validation in order to decide team formation. In Seattle, Zeng01 formation was decided by human hand coding. The reason for this is that this work was not completed yet and an examination was not performed.

4 Summary and Future Works

In this paper, we proposed formation decision method using game theory. In the future, we will be working on the improvement of the functionality of the team, and we will finish implementation completely. Moreover, we will apply this evaluation method to decide formation with GA.

References

[1] Nishino, J., Kawarabayashi, T., Morishita, T., Kubo, T., Shimora, H., Aoyagi, H., Hiroshima, K., Ogura, H.: Zeng99 : Robocup simulation team with hierarchical fuzzy intelligent control and cooperative development. In Veloso, M., Pagello, E., Kitano, H., eds.: RoboCup-99:Robot Soccer World Cup III, Berlin, Springer Verlag (2000)

[2] Morishita, T., Kawarabayashi, T., Nishino, J., Aoyagi, H., Kubo, T., Shimora, H., Hiroshima, K., Ogura, H.: Zeng00 : The realization of mixed strategy in simulation soccer game. In Stone, P., Balch, T., Kraetzschmar, G., eds.: RoboCup-2000:Robot Soccer World Cup IV, Berlin, Springer Verlag (2001)

[3] KUBO, T., NISHINO, J., ODAKA, T., OGURA, H.: Evolutional acquistion of condition recognizer in the robocup soccor agent. In: Proceedings of Fuzzy, Artificial Intelligence, Neural Networks and Soft Computing (FAN'99). (1999) 155–158

[4] Kubo, T.: Gnez: Adapting knowledge to the environment with ga. Technical report, RoboCup (2000)

[5] Smith, J.M.: Evolution and the Theory of Games. Cambridge University Press (1982)

[6] Stone, P., Riley, P., Velose, M.: The CMUnited-99 champion simulator team. In Veloso, M., Pagello, E., Kitano, H., eds.: RoboCup-99:Robot Soccer World Cup III, Berlin, Springer Verlag (2000)