

# RoboCup 2017 - 2D Soccer Simulation League Team Description Ri-one (Japan)

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**Abstract.** In this paper, we will outline methods which we have incorporated in preparation for RoboCup 2D Soccer Simulation 2017. In this year, we make the program for optimization of evaluation state by using genetic algorithm, the program for selection of attack method by analyzing opponent's defense tendency, and the program for classify opponent's formation.

## 1 Introduction

Ri-one is the project team which belongs to the Information Science and Engineering department at Ritsumeikan University. The organization has participated in the 2D Soccer Simulation League and Rescue Simulation League in previous years. Our members are working with agent 2D base (release 3.1.1) made by H. Akiyama [1]. In RoboCup 2016 in Leipzig, our team finished in third place. In Robocup Japan Open, we won the championship in 2012 and 2015. This paper will include the following sections:

1. Introduction
2. Optimization of evaluation value using genetic algorithm
3. The relationship between defense tendency of the opponent and effective attack method
4. Formation estimation system of opponent team
5. Conclusion
6. References

In this fiscal year, we focused on improving the stability of the team's performance than last year, such as analyzing trends of opponent teams and optimizing evaluation values.

## 2 Optimization of evaluation value using genetic algorithm

In Agent2d, the main selections of actions are decided by using evaluation value. Our team took a pair of a condition and an evaluation taking ideal actions on the condition as an evaluation function, and got evaluation values by combining them. However conditions to work evaluation function became complicated, so we didn't know it well. That was why we decide the proportion of evaluation functions by using genetic algorithms and optimize the groups of evaluation functions in this theme.

### 2.1 Experimental procedure

In this experiment, we choose twelve out of evaluation functions implemented in our team, then assign reflection rate of 0% to 100% to each their function. For one of evaluation functions, a value which is defined rate of reflecting this function is called reflection rate. We define these twelve reflection rates as an individual and optimize each evaluation function by using the genetic algorithm.

We define a fitness of an individual as a result of subtracting total loss points from goal points in 300 games.

### 2.2 Result

We decide reflection rates by the above procedure and find the most suitable reflection rate about CSU\_Yunlu [2] and FURY [3]. The result of before the change (All reflection rate is 100%) and the result of each generation are shown by Fig 1.

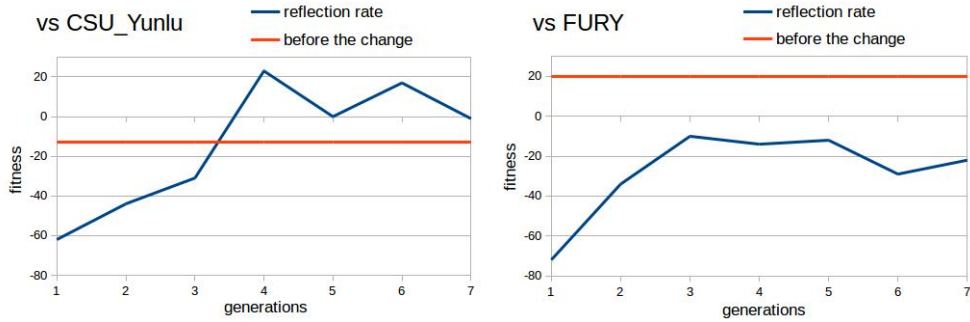


Fig. 1. Fitness graphs

We can see increases of reflection rates by using a proposed method. There are some individuals which have better result than that of before the change to CUS\_Yunlu. However, there are no individuals which have better result than that of before the change to FURY.

## 3 The relationship between defensive tendency of the opponent and effective attack method

Our team has adopted an attack method that place importance on a pass. We may have an advantage in game if pass enable our team to keep high ball retention. While some team think dribble is more effective than pass. Therefore, we conducted an experimental test in order to examine the appropriate attack method.

We focused on two tactics of defense tendency. First, press or action going to ball. Second, mark or action going to near opponent player.

### 3.1 Examining methods

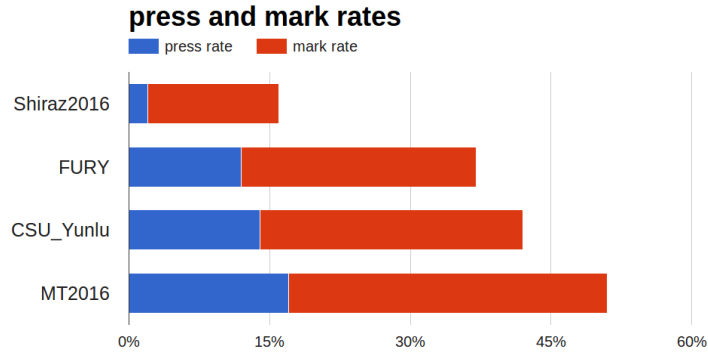
In this experiment, we make five teams from A to E which has different percentages of using pass and dribble. These teams play games with percentages of Table 1.

**Table 1.** Teams of different tactics

|         | team A | team B | team C | team D | team E |
|---------|--------|--------|--------|--------|--------|
| Pass    | 86%    | 64%    | 52%    | 35%    | 16%    |
| Dribble | 14%    | 36%    | 48%    | 65%    | 84%    |

While we focus on two points and set the next rates in a tendency of defense. First, whether a team has a Press rate or not. Second, it has a Mark rate or not. Press rate means the percentages whether there is an opponent player or not which moves to a ball when we are offensive. Mark rate means the percentages whether there is an opponent payer or not near by our player doesn't have the ball when we are.

We got these rates from logs of games with Ri-one which didn't change and focused on the four teams Shiraz2016 [4], FURY, CSU\_Yunlu, MT2016 [5]. These teams demonstrated trends which was shown in Fig 2.

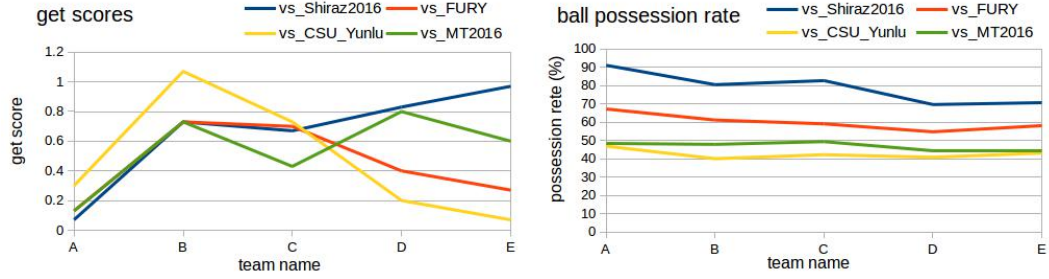


**Fig. 2.** Press and mark rates

We make 30 games these teams which have different tendency of a defense and our team, and get average points, points given up and percentages of holding the ball.

### 3.2 Result

By these processes, we knew results of games like Fig 3. The graphs show average get scores, lose score, ball possession rate.



**Fig. 3.** Difference in result by tactics

This is the reason we know dribble is effective measures against Shiraz2016(little defence) and MT2016(much defence) because the teams have a big bias. And ball possession rate becomes lower by doing dribble.

## 4 Formation estimation system of opponent team

In 2DSoccer Simulation, formation is one of the most important tactical elements. Moreover, if we can classify formations of the opponent team, we can create tactics that correspond to various teams. Therefore, we estimate formations of the opponent team. In this experiment, we estimate the formation (4-3-3, 3-1-3-3 etc.) of the opponent team and the position (FW, MF, etc.) of each player from the arrangement of opponents during the game.

### 4.1 Experimental procedure

During the game, acquire the coordinates of opponents for a certain cycle and estimate based on the coordinates averaging them. Although there's room for improvement in this method, this one provides stable results around 1000 cycles from the start.

Adopt the K-Means method to estimate the formation. At first, set the number of clusters to 2. In addition, clusters used are lines parallel to the Y-axis, and assign each opponent to the cluster that has the closest X-coordinate. Next, based on the assigned data, calculate the centroid of each cluster. After that, assign the all opponents to the appropriate cluster again. If the total distance between each cluster and the opponents is larger than a certain value, increase the number of clusters. And, apply the K-Means method again. By repeating this process, determine the appropriate number of clusters in the formation. Finally, determine the formation from the number of clusters and the number of opponents belonging to each cluster.

### 4.2 Result

From the match between Ri-one and the teams shown below, the result of experiment is as shown in Fig 4. Fig 4 shows the average coordinates 1000 cycles from the start of the game and formation that estimated using the proposed method.

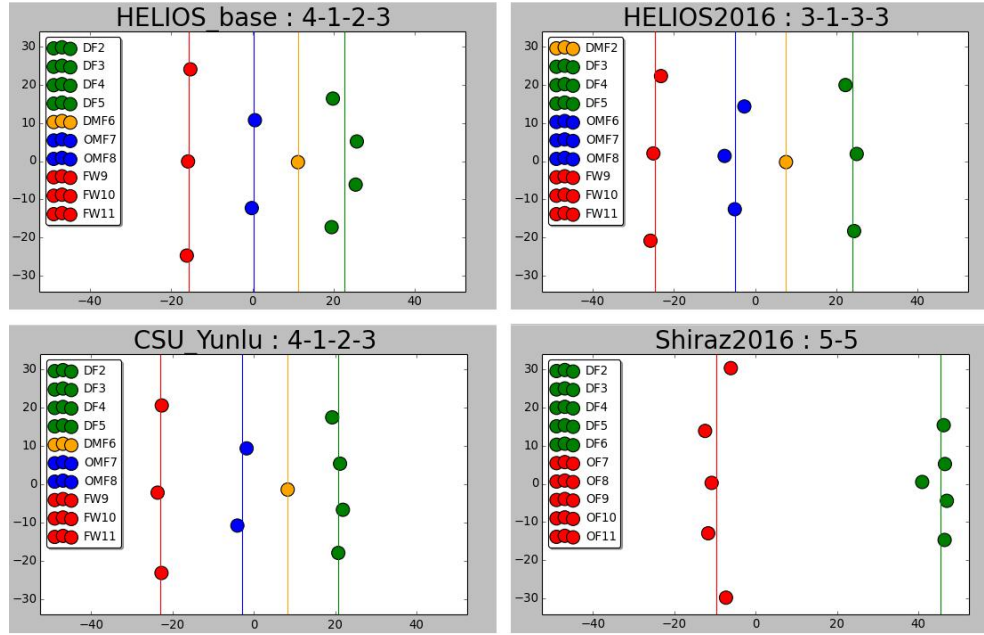


Fig. 4. Formations estimated by proposed method

Each result was roughly the same as the result judged from the arrangement of the opponents by humans.

## 5 Conclusion

We examined each method from the results of the experiment. At optimization of evaluation value using genetic algorithm, we can get application rate of evaluation function to some extent. On the other hand, there is a problem that the result is not stable even with the application rate of the same combination. However, good individual trend is also useful, because it can be used for evaluation function. As a result of experiments about defensive tendency of opponents and effective attack method, dribble valid on biased team in defensive method. In the formation judgement of opponents, we could classify the formation of opponents in a relatively early stage. Also we are considered to be able to carry out strategy in accordance with situation because we can judge the position name of each player relatively.

## References

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