YuShan2014 Team Description Paper for RoboCup2014

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Abstract. This paper describes the overall design and the main strategy of YuShan2014. YuShan2014 uses data mining to analyze and model pass data, uses Neural Network to study formation,optimizes evaluation and shot strategy.

1 Introduction

YuShan Soccer 2D Simulation Team was established in 2009 and affiliated to Computer Department of Anhui University of Technology,China.Since established,we had taken part in RoboCup twice,RobCup China Open five times and RoboCup Iran Open twice.Among them,we got the seventh place in RoboCup2012.In 2013,we had got the third place in RoboCup2013,the second place in RoboCup China Open,the third place in RoboCup Iran Open and the champion in Robot Competition of AnHui Province.

The development of YuShan2014 is based on Agent2D_Base,with version 3.1.0. Download address is given in reference[2].

The reminder of this paper is organized as follows.Section 2 introduces the framework of YuShan2014.Section 3 describes the offense strategy and Section 4 describes defense strategy. Section 5 shows us the neural network techniques,and finally the paper is concluded in Section 6.

2 Overall introduction of YuShan2014

YuShan2014 still uses the main framework of YuShan2013 and optimizes partial offensive and defensive model combined with the real experience from RoboCup2013. By using data mining to analyze log files,YuShan2014 finds valuable patterns and then uses such pattern to guide team strategy design.Specifically speaking, YuShan2014's characters can be described as follows:

2.1 Offense Strategy

Firstly,ThroughPass[1] technology is one of the main offense strategy in YuShan2013. In order to improve the stability,YuShan2014 optimizes the search of pass point,pass talking model and receiving ball logic.Secondly,YuShan2014 uses the partial least squares method to further study pass data, results indicate that long pass is one key of the outcome of competition. According to this conclusion, YuShan2014 optimizes the passing strategy, and this optimization proves its good effect in 2013 RoboCup China Open. Thirdly,YuShan2014 uses Neural Network to evaluate pass,shot and the overall

situation based on imitating BrainStorm.The experiments show that using Neural Network method is more effective than the experiential data method.

2.2 Defense Strategy

Firstly,through analyzing log files in real game achieved from RoboCup2013 and 2013RoboCup China Open, we find some problems existed in defense.YuShan2014 mainly optimizes the slide tackle mode and the active position of back players. Secondly, YuShan2014 optimizes goalie's interception strategy combined with block model. The following will highlight several core parts used in YuShan2014.

3 Offensive Strategy

3.1 Pass data modeling

Pass action is the most basic synergetic action between agents, which influences the result of competition strongly. YuShan2014 uses partial least squares to analyze pass action deeply. Partial least squares method is a new kind of multivariate statistical analysis method, which can solve the problem that general multivariate regression method couldnot solve.PLS not only can reflect the information of explaining variable as far as possible,but also have a stronger explanation on dependent variable.Since the components are independent to each other,PLS can effectively avoid the problem of multicollinearity between explaining variables.

YuShan2014 takes the log files of 55 games as the study object and extracts data from related rcg and rcl files.According to pass distance,we classify the related data in five types,they are HoldBall,Dribble,DirectPass(DP),LeadingPass(LP), ThroughPass (TP).In addition,YuShan2014 calculates the frequency of each type. Table 1 shows the result of a game.In each game, it takes the left as the standard and lets the left data minus the related right data.A data recording with six attributes will be got.The difference of score of this game as the dependent variable, expressed with y,the five pass types as explaining variable,expressed with x1,x2,x3,x4 and x5 respectively.

Table 1 The analysis result of a game

	Score	HoldBall	Dribble	DP	LP	TP
Left team	4	0	421	59	25	9
Right team	1	3	283	43	30	3
Difference	3	-3	138	16	-5	6

Through PLS fitting,the relationship between explaining variable and dependent variable is showed in Fig 1,t1 stands for the dependent variable, u1 stands for the explaining variable.The figure shows an obvious lineal relation between t1 and u1.

Fig 2 shows the importance of explaining variable to dependent variable,the higher value the more important.We can see that x5 has the most important on y, and x1 has the least important on y.In real match,the more TP the more chance to get score. On the contrary,the more HoldBall the more possibility to be intercepted. YuShan2013 reinforces TP and gets a good result finally.YuShan2014 optimizes the TP

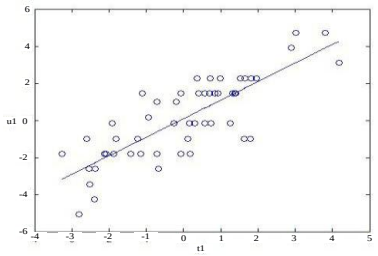

Fig 1 t1-u1two-dimensional diagram

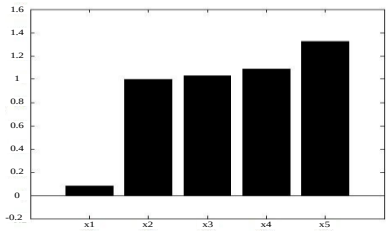

Fig 2 The histogram of explaining variable

logic. Combined with the intercept positioning,we improve receiver moving accuracy by using talking,and improve the evaluation of TP.The new model is more steadier.

3.2 Shot kick analysis

Shot kick is an important offensive method,YuShan2014 uses data mining to analyze and model the shot kick data.The experimental results are showed from Fig 3 to Fig 5.

Fig 3 is the comparison of initial speed of shot among YuShan2014, HELIOS2013 and WrightEagle.X-axis stands for initial velocity values, y-axis stands for the proportion of initial velocity in all initial shot velocity.Combined Fig 3 with the video,we can see that a better team have a higher velocity.HELIOS2013 and WrightEagle have a large percentage over 2.8,while YuShan2014 is in 2.4-2.6 and 2.7-2.8.When speed is above 2.8 the easier to get score.The kick action of better teams can be executed in

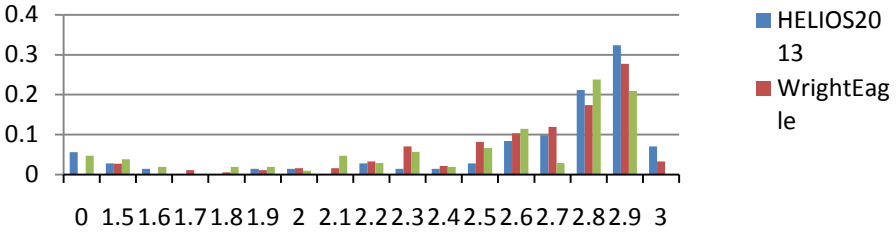

Fig 3 The proportion figure of shot speed

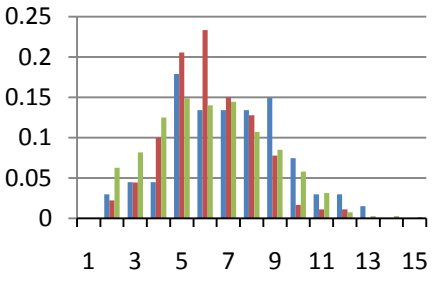

Fig 4 The proportion figure of shot cycle

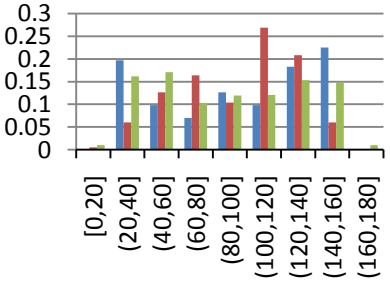

Fig 5 The proportion figure of shot angle

one or two cycles.Howerver YuShan2014 maybe take more cycles, so YuShan2014 optimizes the kick model.YuShan2014 adds the force kick model when the kick action cannot meet the one step kick condition.The force kick logic kicks the ball with maximum speed current can be provided,the direction keep the same.

Fig 4 is the proportion of shot cycle,better teams always have shot cycles in five or six,the shot distance is appropriate relatively. Fig 5 is the proportion of shot angle, dividing with 20 degrees.The blue is HELIOS2013,the red is WrightEagle and the green is YuShan2014. YuShan2014 analyzes the above data for finding the different influence in shot to optimize decision-making.

4 Defense Strategy

YuShan2013 can not make full use of Tackle in defense,the fail of tackle will lead to break easily.YuShan2014 strengthens the modeling on this aspect. YuShan2014 adds another two parameters in primitive function.In the new model,the times of tackle are increased and the efficiency of tackle has increased obviously. The rate of our players serve after tackle has a high increase.Following is the change:first,executing tackle instead of pass and other kick action when ball is within the distance of kick and the defense situation is urgent.Second,in order to prevent the opponent from attacking secondly,the direction of tackle should be partial to the outside of the ground when executing tackle action during defense.Third,increasing the probability of tackle.Table 2 shows the average time of tackle analyzed from related rcl files.

Table 2 The average time of tackle

YuShan2014	32	HELIOS2013	17	Axiom	36
WrightEagle	38	Gliders2013	29	Oxsy	31

YuShan2013 cannot get back in defense when opponents do fast break,so YuShan2014 emphasizes defense on getting back quickly in Block.YuShan2014 optimizes the positioning model of backs,once opponent players cross over our defensive line, our backs get back quickly to stop their crossing tactical.The strategy can relieve defensive pressure effectively combined with tackle model.

5 The exploration of Neural Network technology

Neural Network technology is an important technology in the field of artificial intelligence.BrainStorm[7]who depends on Neural Network strategy got first place three times and second place twice during 2004 and 2009. YuShan2014 studies the Neural Network deeply which is the later research direction of YuShan.YuShan2014 works mainly in strategy evaluating,shot logic judgement,and formation learning.

5.1 Strategy evaluation

YuShan2014 uses Neural Network as evaluation strategy based on WE_Base[3]. The Neural Network model is 2 input layers,6 hidden layers,1 output layer.When you input the x component and y component of coordinate,it will output corresponding evaluation.Fig 6 and Fig 7 are Agent2D_Base evaluation and WE_Base evaluation.

The surface shown in Fig 7 is smoother than in Fig 6,especially in the corner

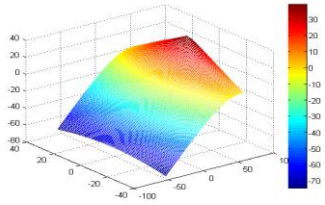

Fig 6 Agent2D_Base evaluation

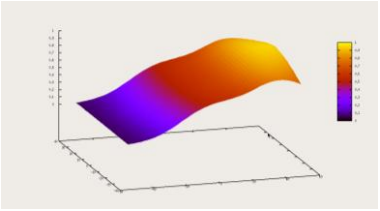

Fig 7 WE_Base evaluation

area.The test results show that the Neural Network is more effective.

5.2 Shot evaluation

Based on Brainstorm open source, YuShan2014 designs the shot evaluation model which is 2 input layers,10 hidden layers and 1 output layer.Shot is the most important part of offensive strategy. YuShan2013 loses lots of chances in this part. YuShan2014 wishes to use Neural Network to solve this problem,but the experimental result is not good.The reason maybe software coupling or parameter setting problem.

5.3 Neural Network in formation training

YuShan will study the formation recognition which is very important in defense and offense. YuShan2014 uses Neural Network to train formation files.Fig 8-Fig 10 are the contrast before and after learning formation files.The three formations are Agent2D_Base,HELIOS2013 and Axiom2013 defensive formation. YuShan2014 uses average error as evaluation which is measured with the Neural Network formation coordinates minuses DT formation coordinates of same player under the same ball position.

We choose three players who have the largest average error of each formation. The three players of Agent2D_Base-defense-formation are Num7, Num8, Num9,the error is showed in the parentheses;as the same,three players of HELIOS2013-defense -formation are Num3, Num4, Num6; three players of Axiom2013-defense-formation are Num6, Num8, Num9. We can see that there is a larger error of midfield player and the defensive position retreats obviously.So YuShan2014 strengthens block and intercept in midfield.In addition,the wing players change a lot in defense and many long pass can break through easily. Becasue of this, YuShan2014 strengthens the wing player positioning and it is confirmed effectively.

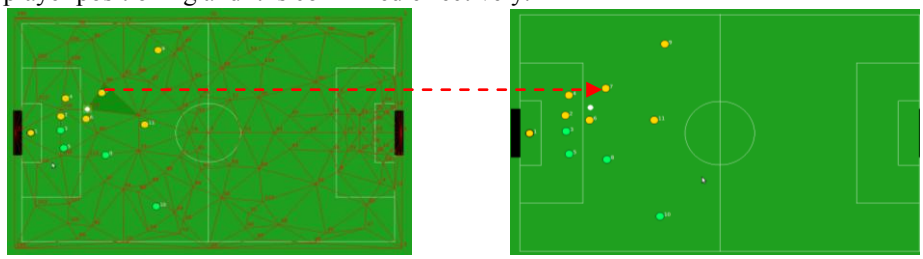

Fig 8 Agent2D_Base-defense-formation

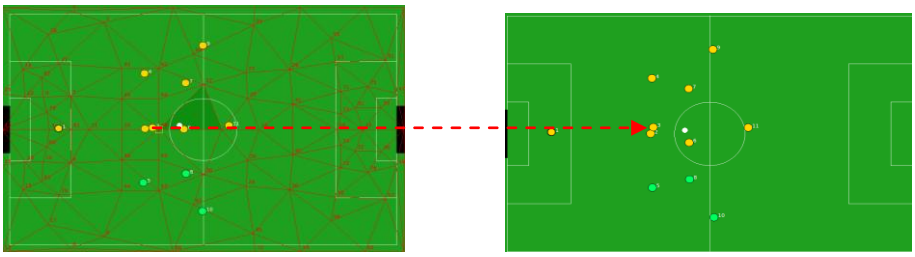

Fig 9 HELIOS2013-defense-formation

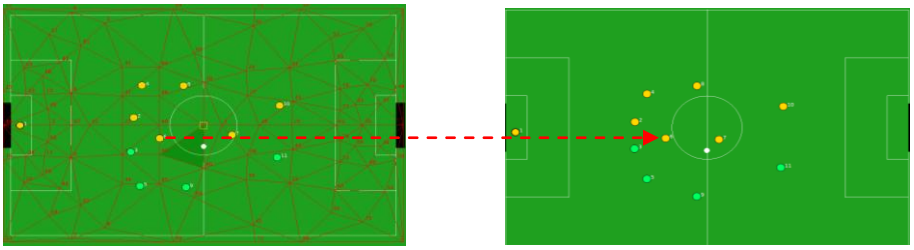

Fig 10 Axiom2013-defense-formation

6 Conclusions

YuShan2014 continues to use the main framework of YuShan2013.Our emphasises are that the using of data mining in detailed action of players,PLS to analyze pass data, and uses Neural Network to learn formation files.In the future,we will find out the relationship between shot speed and shot angle and so on,we will use the boost technology in machine learning to change the weaker adaptive formation to a stronger one.

Although YuShan had already got impressive achievements in 2013, but we are still in the growth.YuShan2014 uses data mining to learn the advantage of those stronger teams to make our own better.We hope we can achieve artificial intelligence in strict significance,and a robot team can beat the World Cup champions by 2050.

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