Apollo2D 2011 Team Description Paper

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Abstract: This paper describes the main features of the Apollo soccer simulation team. Apollo2D won the RoboCup China Open 2004 Simulation league champion in Guangzhou and first prize award in RoboCup China Open 2007 and RoboCup China Open 2008 2D Simulation League and 2nd place in IranOpen 2010. In this paper, we briefly present our current research effort and some newly introduced techniques of improvement, since the last competition.

1. Introduction

Apollo is a robot soccer team of 2D Simulation League. It comes from Nanjing University of Posts and Telecommunications. We have been participating in RoboCup since 2004. Although Apollo2D has achieved good results in its previous matches, there are many deficiencies and shortcomings.

Due to the dated program code, it has been amended for many years. Although these two years we have made a lot of improvement in this program, we did not obtain very good effect. Due to several defects such as the imprecision of location; too little information interaction between the players and so on, the upper level decision cannot be support very well. So in RoboCup 2010 we drop to 13th place. In view of such situation, we solved several problems and rewrite all the code of Apollo2D. Compared to Apollo2D2010, Apollo2D2011 has made great progress.

In this paper, we present a brief description of location in the WorldModel and the dribble skill.

2. Location

2.1 Raise the issue

In the SoccerServer, in order to introduce noise in the visual sensor data noise, the value sent from the server is quantized. For example, the distance value of the object, in the case where the object in sight is a ball or a player , is quantized in the following manner:

$$d_0 = \mathrm{Quantize}(\exp(\mathrm{Quantize}(\log(d), \mathrm{quantize\_step})), 0.1) \qquad (2.1.1)$$

Where d and d_0 are the exact distance and quantized distance respectively, and

$$\mathrm{Quantize}(V, Q) = \mathrm{rint}(V/Q) \times Q \qquad (2.1.2)$$

In terms of flags and lines, the distance value is quantized in the following manner:

$$d_0 = \mathrm{Quantize}(\exp(\mathrm{Quantize}(\log(d), \mathrm{quantize\_step\_l})), 0.1) \qquad (2.1.3)$$

where $quantize\_step$ and $quantize\_step\_l$ is constant in SoccerServer， $quantize\_step = 0.1$，

$quantize\_step\_l = 0.01$.

This means that players can not know the exact position of a very far object. For the adjusting formation and players' movement, also the player's execution of the upper strategy, how to get the exact position information is of great significance.

2.2 Figure out

We through studying the quantitative formula establish the mathematical model. We propose a method for getting exact position-----"Half—Reverse—Infer".

To introduce the method of locating the dynamic objects with formula (2.1.1), Quantitative formula is made up of logarithmic function, index function and integer function. In the game we only get the quantized data. According to quantitative formula figure 2.2.1 is made. The corresponding mapping graphics with logarithmic function, index function and integer function are as shown in figure 2.2.1.

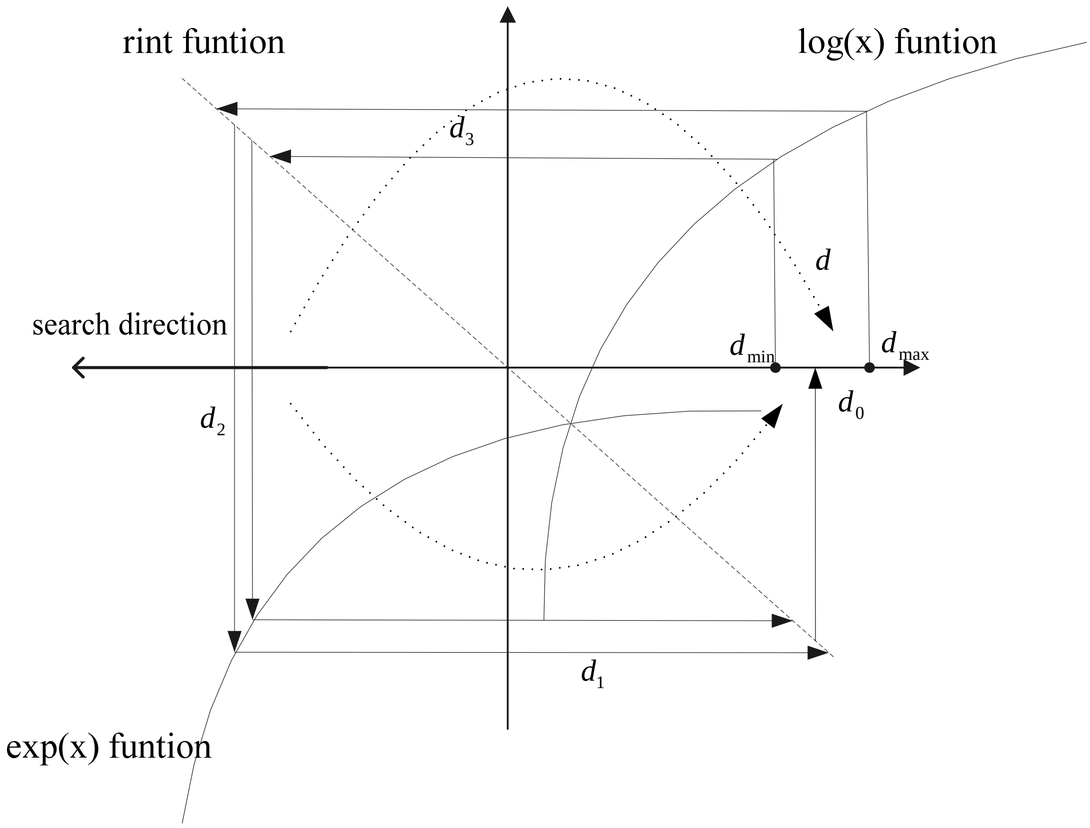


Fig2.2.1 the mapping with logarithmic function, index function and integer function

In figure2.2.1, when actually received distance value d_0, because of the formula(2.1.1), the corresponding exact distance is any value of a interval range, like this: $d \in [d_{min}, d_{max})$, that is to say, when SoccerServer judge exact distance d in the range of $[d_{min}, d_{max})$, through quantitative processing, actually received distance value all is d_0.

Therefore, the actually received values of the distance are some discrete points, through the mapping relationship in figure 2.2.1, we can find out that the value of exact distance should be successive distance scales with the corresponding. Apollo2D team have received some conclusions by researching the process of quantification formula: in theory the scale of the accurate distance at the competition area is $d \in [0,125.1]$,when we quantificate the exact distance, the datas are a series of points of a fixed step length equal to 0.1 with the corresponding after interged at the first time, and in fact the datas which are quantificated again are the series of the value of the distance. Therefore, Apollo2D team take out a series of quantification spots and use use it to infer quantitative formulas at the both ends(Corresponding the virtual direction arrow at the figure 2.2.1) by using this relationship in quantitative formula at the middle position which after the first integer after a series of fixed step length the corresponding points, and corresponding figure 2.2.1 is along the rough arrow search direction, find out the scope of the corresponding exact distance and receive the actual values of the distance after quantification, get the corresponding relationship between them, in this way we can provide the effective data for the next process. This paper names this method “Half—Reverse—Infer”.

Through “Half—Reverse—Infer”, Apollo2D team established the corresponding relation of d_0 and d such as table 2.2.1.

Table 2.2.1 The corresponding relationship between d_0 and d

d_0	d			
	d_{min}	d_{max}	d_{mid}	$\pm\Delta\delta$
0.0	0.0	0.0523	0.0262	0.0262
0.1	0.0523	0.1572	0.1048	0.0525
0.2	0.1572	0.2592	0.2082	0.0510
0.3	0.2592	0.3499	0.3045	0.0454
0.4	0.3499	0.4724	0.4112	0.0613
0.5	0.4724	0.5769	0.5246	0.0522
⋮	⋮	⋮	⋮	⋮
5.0	4.7115	5.2070	4.9592	0.2478
5.5	5.2070	5.7546	5.4808	0.2738
6.0	5.7546	6.3598	6.0572	0.3026
6.7	6.3598	7.0287	6.6943	0.3344
⋮	⋮	⋮	⋮	⋮
134.3	127.7404	141.1750	134.4577	6.7173
148.4	141.1750	156.0225	148.5987	7.4238

From the table, we can conclude that: exact distance is continuously, but the quantitative distance is a discrete point, and the quantization noise is bigger as exact distance value bigger, error value also becomes bigger. Apollo2D make some processing on the data, and then apply to the actual games, make our location in the world model is more exact than before, the same as, the upper decision is more reasonable.

3. Dribble

In figure 3.1, we defined a Dribble Channel. It is in fact an open area constructed with two rays and a semicircle. The solid disk represents the body of Player *P* and the bigger circle shows the control area of *P*. The location of ball is marked with *b*. The vertical distance of two rays is twice the length of Margin, which is defined as:

Margin=kickable_margin+player_size+ball_size

Since the movement of the objects is discrete in every single cycle, a successful process of dribble can be described as: from the beginning status S_0 to ending status S_n, the ball *b* always stays in this Dribble Channel and Player *P* always stays closer to the ball *b* than any other opponent.

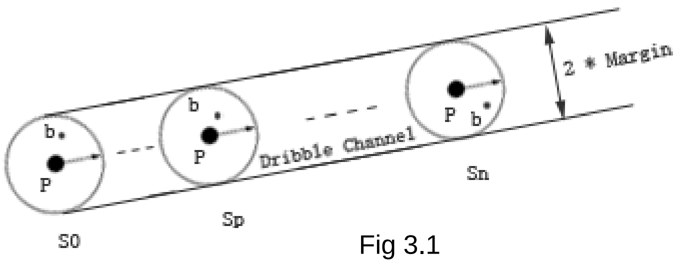


Fig 3.1

We believe that the core issue of dribble skill is that we decide the proper dribble time *n*, then calculate the ending status S_n ,which is the time when the player obtain control of the ball again. In addition, we also use predict and compensate mechanism to keep in possession of the ball.

So we defined several basic dribble actions as below:

Action Type	Effect of the action
StopBall	Stop the ball
Turn	Adjust the player's body to the proper direction
Dash	Dash for a cycle
TurnBall	Turn the ball to certain position
SameSide	At the end of the dribble process the ball is located on the same side as the current position

OppSide	At the end of the dribble process the ball is located on the opposite side as the current position
KickThrough	Kick the ball through two opponents

As is shown in Fig 3.2, we divide the field that one player can control the ball into two sections, A and B, based on the facing direction of the player. If the ball is located in the same section, then the dribble action is defined as SameSide. Otherwise, it is defined as OppSide.

Also in Fig 3.3, there's such a occasion usually occurs that it is unwise to choose either SameSide or OppSide. In this occasion, it is better to kick the ball through two opponents rapidly to get rid of them and we define this action as KickThrough.

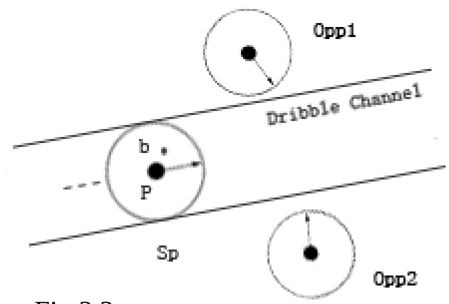


Fig 3.3

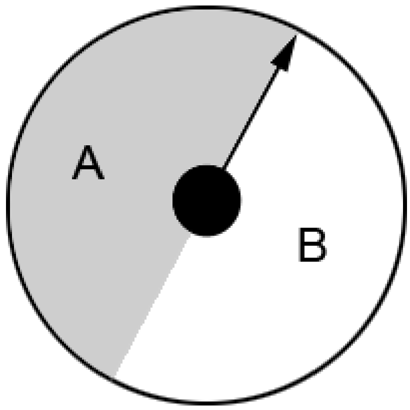


Fig 3.2

The main process is show in Fig 3.4

if Turn this cycle and could obtain control of the ball in next cycle **then** DribbleAction=Turn

else if Dribble has started **and** Ball not in control **then** DribbleAction=Dash

else if Ball in control

then

if Dribble has started **then** Log as successful dribble **endif**

Select the dribble action
Decide the proper action by Mediator
Execute the action

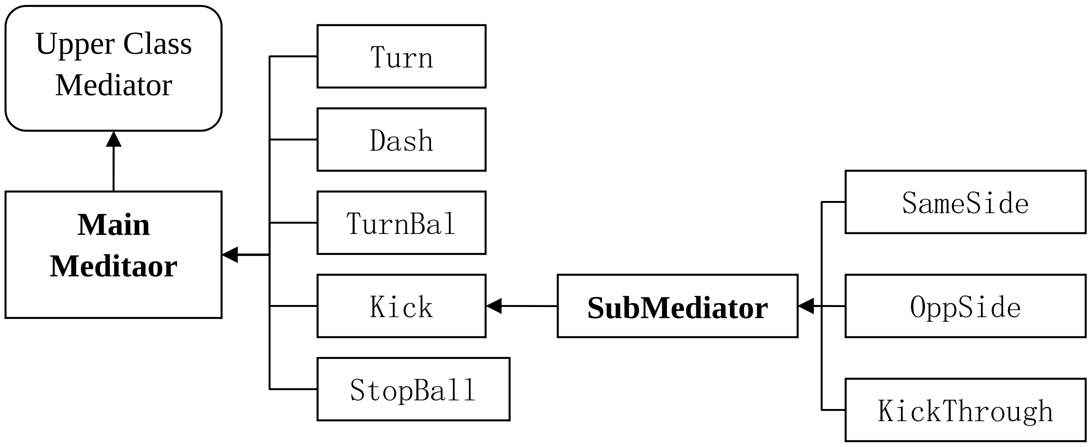
endif

endif

endif

Fig 3.4

In the main process, how to mediate to decide the best dribble action is the core of the algorithm. The process of mediating is illustrated in Fig 3.5.



4. Conclusion and Future Work

In this paper, we introduced the Apollo2D 2011 simply and exhibit our work. Because some improvement of the program is put forward comparatively late, and the rate of improvements are subject to the development team, we don't test effect of the latest changes by the numbers.

For future directions, we are interested in formation, the role of player and coach, and how to improve agents act intelligently.

Reference

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