

# HfutEngine2012 Simulation 2D Team Description Paper

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**Abstract.** This paper describes the background, the framework and the design feature of the HfutEngine2D. We put forward a new approach to do research on Multi Agent System.

The method is based on mining teammate behavior. In this scene, an autonomous coach agent is able to get the current information of all teammates without noise, which can be modeled to compose patterns of teammates. At first coach agent gathers data from noisy environment to identify pattern of player agent. Then compute the probability of pattern compared with current situation by statistical calculations. Then the player agent analyzes the communication messages from teammates and the see message from server. The player agent decides the best message to choose and enforces the former behavior. Finally the player agent makes best decision according to the result of mining teammate behavior.

## 1 Introduction

Team HfutEngine was founded in 2002 and took part in the RoboCup ChinaOpen2002. In the following years, HfutEngine developed fast and joined many matches.

From 2005, we used UVA\_BASE\_2003 as our base code, we've added our own AI methods to it and updated the code along with the server's upgrade. We took part in RoboCup ChinaOpen , World RoboCup, RoboCup IranOpen. We hope to obtain a better grade in 2012. We want to probe into Multi-Agent System and Robocup with anyone interested in them.

## 2 Basic Framework of The player

In order to solve the problems which in the face of players. Usually the player contains the basic frame structure as shown in Figure 1.

In the picture, Coarse arrows represent data flows and the program flow, Thin arrows represent data flows.

Firstly, Players use the multi thread program structure. The perceived part, behavior part and other parts are in a different thread. In this way, when the thread of sense receive a server information and send to other threads and then change

to wait for the next message. In order to receive the latest information of Server. When the command is sent at the time, the thread of Act can send commands directly and without waiting for the other parts. The command can be sent in a correct cycle in time.

Secondly, The players introduce the World Model part. All the absolute position of object, the information of speed and the information of other players need to use are stored in the World Model part. In this way, the decision module of players can make decision by the information of the World Model part.

Finally, the players use a module of Advanced skills to provide high-level behavior and transform high-level behavior into basic commands and parameters of commands.

This structure is shown in Figure 1.

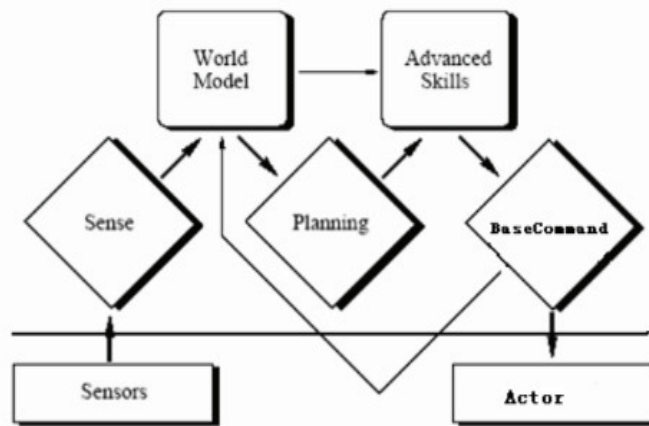


Fig. 1. Framework of The player.

### 3 The information collection of HfutEngine2012

The information collection of HfutEngine2012 include two parts, communication system and visual system. The importance of information processing is self-evident. It is the foundation of decision making and it will decide the team to make decision is good. That is, if not a good information process, the team will be blind and accomplish nothing. The information includes game mode, the player's position and physical strength value, the position of the ball, and so on. The team's senior decision-making contained a kind of strategic decision, and this decision is based on the high efficiency processing of information that the all on the field. The information processing can be roughly divided into two parts, information communication and information collection. Only there is good

information communication and information collection to make the team really be effective visual sharing. The following content is overview of information communication and information collection.

### 3.1 Communication System

The exact location of objects on the pitch, the decision has always been the key to the world's model. The combination of the visual information and auditory information has been an important method to improve the level of our team.

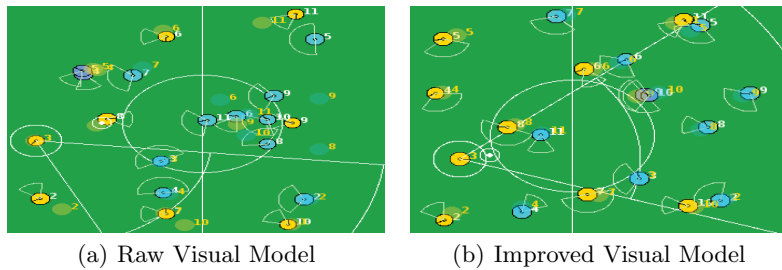
We improved our communication system. When the players can not see some objects he will obtain information through auditory information. The auditory information is useful when a player is serious lack of visual information. Through the auditory information the player can get more information of invisible area, and through it players can manage better cooperations. This improved communication system improves the ratio of pass success.

And we take the advantage of the coach. When a player fouls, gets a card or is of low stamina, the coach's substitutions takes great effect.

### 3.2 Visual System

We put forward a new visual decision method that based on degree area value. We apply Advisor-Evaluator model to raise a request of object what is necessary in collaboration decision and basic action decision. Then we use evaluator to evaluate the value of this request, and accumulate the value to the degree which is relative Agent itself. Finally, we choose the highest value decision to execute which is in the Agents view area.

This method has been applied in HfutEngine2012. And the method shows an effective performance because it can gain more accurate, approximate comprehensive information in soccer field. In Figure 2, light yellow dots represents location of certain player, and dark yellow ones represent real position of the players. Obviously, improved visual model is better than the old one.



**Fig. 2.** Contrast Of Different Visual Model.

## 4 The new defensive strategy of HfutEngine2012

In the previous code, when the opponent attacks, our defenders will gather together, then the opponent pass ball fast and use the defensive vacancy to goal. So we adjust the formation of HfutEngine2012 and improved the function to guarantee that we can have a better defense.

## 5 Conclusion and Future Works

The practice prove that the design idea of value-judge is very successful. The achievement that we have got in the past years further improve that point and the ability of our team made a great leap. In Table 1, we can see the result of competing with some teams. It shows that HfutEngine2012 with this design have good match-ability.

**Table 1.** The Result Of Competing With Some Teams

Team	Ave Goals Scored	Ave Goals Conceded	win	draw	lose
HfutEngine2010	2.0	0.50	15	4	1
HfutEngine2011	1.8	0.60	10	7	3

We hope that we can improve more segments of our team. We will further optimize this framework and exert it's flexibility advantage. We will solve the problem of our team gradually. Also, we may change our base code, and we plan to make a new way to forecast the situation in the playground based on experience which include the states of teammates, opponents, ball and so on. Based on this new method we can get the value more correctly. We also continue to make research on the Multi-Agent System and Machine Learning in order to enlarge the ratio of learning in our team. Meanwhile, the research will be focused on the fast-online learning not the off-line accumulated learning. The fast-online learning makes the player learn to change on-time. In the coming time we will work hard to make a better result in the World RoboCup.

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