UBU Team

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1 Introduction

The aim of developing UBU is to subject a series of tools and procedures for agent decision support to a dynamic real-time domain. These tools and procedures have previously been tested in various other domains, e.g., intelligent buildings [2] and social simulations [6]. The harsh time constraints of RoboCup requires true bounded rationality, however, as well as the development of anytime algorithms not called for in less constrained domains (cf. [3]). Artificial decision makers are in the AI and agent communities usually associated with planning and rational (as in utility maximising) behaviour. We have instead argued for the coupling of the reactive layer directly to decision support. A main hypothesis is that in dynamic domains (such as RoboCup), time for updating plans is insufficient. Basically depending on the size requirements of agents, and on the communication facilities available to the agents, we have placed decision support either in the agents, or externally. In the former case, deliberation is made in a decision module. In the latter case, a kind of external calculator which we have named pronouncer provides rational action alternatives. The input to the pronouncer is decision trees or influence diagrams. The structure and size of these models are kept small, to guarantee fast evaluation (cf. [7]). The pronouncer can be made into an agent too, e.g., by using a wrapper. The coach function is particularly interesting in this context, since it is "free" and since it could hold the pronouncer code. An important problem here is the uncertainty and space constraints on the communication with the coach. The concept of norms as constraints on agent actions has also been investigated [1]. A team in which each boundedly rational player maximises its individual expected utility does not yield the best possible team: Group constraints on actions must be taken into account (see, e.g., [4]). Norms is our way of letting the coalitions that an agent is part of play a part in the deliberation of the agent.

The participation in RoboCup'99 was not successful as there were problems with the server-timing. UBU was among the least successful teams, ending up among the last in our group. It is not an issue whether we win or loose, it is for the scientific results we are participating.

2 Team Development

The work has been done over a period of more than two years, with two different versions of the team. The current version is the product of the latter six months.

Team Leader: Johan Kummeneje
Team Members:
Magnus Boman (Associate Professor)
David Lybäck (M.Sc.)
Håkan Younes (Graduate Student)
Web page http://www.dsv.su.se/~robocup

All of the team members are connected to the DECIDE research group, and all attended RoboCup-99.

In addition, Johan Sikström, Jens Andreasen, Helena Åberg, and Åsa Åhman have made significant contributions to the different parts of the team.

3 World Model

Our players are always aware of the overall state of the game, according to the referee's messages, by internally representing the last known state.

In addition to the states given by the referee, our agents also express a degree of the certainty of their "belief" in that their team has the ball, i.e. they can determine the state, and act accordingly when they have the ball. The referee's messages in combination with the belief of having the ball, yields the situated automaton shown in Fig. 1.

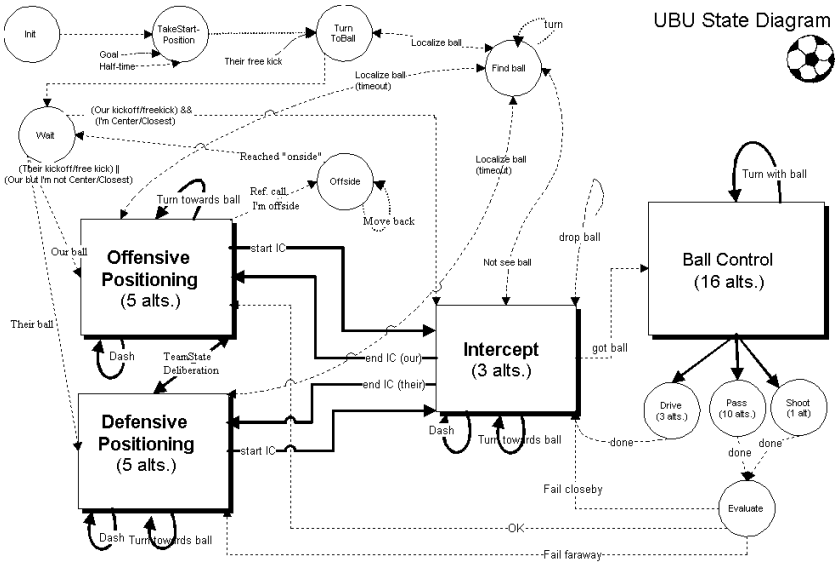

Fig. 1. The situated automaton of UBU.

The states consist of several options for what to do next, of which some are reactive (reacting to referee messages mostly) and some are deliberative. The

options determine the state transitions, and through the careful design a player will never be "between" states.

We are not using the *libsclient* as we have developed the basic functionality by ourselves.

4 Communication

The inter-agent communication in the team has been very limited, and is not of any practical use yet. Each player has, however, built-in support for the communication of formation swapping, e.g., the team is able to change the formation from 2-4-4 to 4-4-2 based on messages from the libero.

Every formation swap is propagated when the libero decides to change the formation, and when a kickoff occurs.

5 Skills

The players are simple in their behaviour, as they do not make use of any special skills. When intercepting the ball a player does not calculate an intersection with the ball path. The player instead uses two rules to follow the ball. If the ball is more than 5 degrees to the left or right of the center of the player's viewcone, then turn to face the ball, else run straight forward. This works surprisingly well in most situations.

As the players have a degree of obstacle avoidance built in they can usually, by driving the ball in front of them, dribble past fairly simple opponents. We have not spent a lot of time on creating or training the dribble-behaviour of the team.

The goalie is in almost every aspect the same player as the rest of the team, with the small difference of having the capability to catch the ball. The main difference between the different roles of the team (i.e., the goalkeeper, defenders, midfielders, and forwards) is a variable that controls the defensiveness of the players.

6 Strategy

The foundation of our team is the idea that there is insufficient time for planning, and thereby the team does not in any way (yet) plan. We have instead used a lot of decision situations in which we have identified what is reasonable to do. Extending the team, we will incorporate the concept of norms, i.e. mutually agreed-upon constraints or heuristics, which each agent can decide to follow or not. When possessing the ball, each agent has three distinct choices to perform, pass, shoot at the goal, or dribble. This choice is made with respect to the situation, i.e. the position of each player, and several other factors. When not possessing the ball, the main task for each of the agent is to optimise its position on the field in order to be able to intercept the ball easily or be close to their home position.

7 Special Team Features

Our main aim of developing UBU is to subject a series of tools and procedures for agent decision support to a dynamic real-time domain. As stage, we use neither machine learning, nor opponent modelling.

We have in our team created effective thread-scheduling, i.e. by having 10-15 threads running in each player every cycle. Besides the multi-threading we have used several concepts inherent in Java, such as events and listeners. By using standard components we have been able to create a flexible and easily extensible basic foundation to build higher level functionality upon [5].

8 Conclusion

During the summer of 2000 our team will enter both the European championships and the world cup. We will be working on the improvement of the functionality of the team, and initiating several smaller projects in which we will investigate the benefits of machine learning in our team. Besides the already mentioned projects we will also incorporate concepts from the social sciences, such as incentives for coalition formation, and norms.

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