SBCe SmartSpheres Team Description Paper

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Abstract. The 3D platform of RoboCup Soccer Simulation is a new test-bed for experiments on multi-agent systems. Many improvements have been made in comparison with the old 2D platform, which make it an ideal choice for further researches in the area of autonomous multi-agent robots. Aside from developing a robust world-model and agent architecture, our primary point of focus is on real-time cooperation and coordination of agents in a homogeneous environment.

1 Introduction

RoboCup [Kitano et al., 95] is now a well-known platform for researchers interested in multi-agent robotics. In current form, it provides various test-beds for different researchers with different approaches to a common goal: providing a team of robots, capable of playing against human soccer players.
Last year the soccer simulation competitions, took another step towards a more realistic platform for modeling soccer playing robots. The new 3D platform, based on SPADES [Riley03], provides an efficient simulation engine, supporting agent distribution in a reproducible way. The soccer simulator is built on top of a customizable, modular generic simulator named Oxygen [Kogler and Obst, 2003], which is versatile enough for carrying out virtually any kind of experiment and learning scenarios.

2 Agent Architecture

The agents have a three-layered design. The lowest-level layer is the communication layer, which has the role of sending/receiving data to/from SPADES' Communication Server.
The second layer is the low-level utilities and world-model representation, which are the basic facilities for an agent to base its higher-level decision-making on them. Trying to avoid reinventing the wheel, we imported many ideas from Helli-Respina 2002 soccer simulator team.
In later sections, we will discuss the third layer in more detail.

3 Situation-based Action Selection

In every situation, we define a set of *task*s. The trick is how to assign the most important tasks to the most appropriate agents. Fulfilling each task may contain some risks and/or benefits. We have tried to formalize the risks and benefits of every possible task from different *aspect*s. A fuzzy number is assigned to each aspect of a given task, reflecting the risks and benefits of the task from that aspect.
The situations are classified into different *situation class*es and each class specifies how to take into account different aspects of a given task, when evaluating it.

Armed with this knowledge, the agents choose the most appropriate tasks to fulfill in the situation at hand.

4 Agents Coordination and Collaboration

Achieving a good level of performance in a soccer team deeply depends on the coordination of players in a seamless manner. Reinforcement Learning comes handy in solving many collaboration glitches in a noisy multi-agent world.
The key point to understanding our reward system is that agents reward or punish other agents. We have taken advantage of the open architecture of Oxygen, and added a new effector for our agents. Using this new effector, an agent can reward or punish other teammates based on their recent actions. The agents have a criteria composed of many predefined actions marked as good or bad.
If a coordination problem occurs as a result of the existence of different opinions among agents, the agents may cast their opinions and thus the minority shall be punished.

Coordination problems mostly arise due to different assumptions and decisions among agents, in which case each agent will cast its own opinion and the minority gets negative feedback about the recent actions.

We emphasize on heavy experimentation and therefore at current stage we cannot give any rigorous detail about this process.

5 Conclusion and Future Works

This is our first experience with 3D soccer simulation environment, and aside from the above stated experiments, we are currently concerned with building our agent architecture.

References

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