Representing Agent reasoning with Meta-Knowledge on ASP Modules Combination

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ABSTRACT

In this work, we focus on multi-agent systems in dynamic environment. Our interest is about individual agent reasoning in such environment. For reasoning in dynamic environment, an agent needs to be able to manage his knowledge in a non-monotonic way. To reach his goals in a changing environment, an agent needs to adapt his behaviours regarding the current state of the world. Our objective is to define a method which makes easier to design agent knowledge and reasoning in such environment. We use the expressivity of answer set programming to represent agent knowledge. To design agent reasoning, we propose a method based on ASP modules combination and meta-knowledge. We also propose a framework to implement and use this method in multi-agent systems.

Categories and Subject Descriptors

H.4 [**Information Systems Applications**]: Miscellaneous

General Terms

Design

Keywords

Multi-Agents System, Answer Set Programming, Meta-knowledge, ASP modules

1. INTRODUCTION

2. STATE OF THE ART

3. DYNAMIC ENVIRONMENT

Our interest is about representing agent reasoning in dynamic environment. To make our work more understandable we will follow an intuitive example along our propositions: a survival game which represent a MAS in a dynamic environment. In this game there are three groups of agents: wolfs, rabbits and flowers. Each kind of agent have specific goals and behaviours. To be simple, wolfs eat rabbits and rabbits eat flowers.

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Wolfs have only one goal: feed themselves. To reach this goal they have to catch and eat rabbits. A wolf can be in two situations: a prey is in sight or not. If there is no rabbit in the sight range of a wolf, the predator have to explore his environment to find one. When a prey is spotted a wolf will try to perform a sneaky approach if he is not spotted himself, otherwise our predator will rush on his target. To resume, a wolf have three behaviours: exploration, approach and attack.

4. ASP MODULES

An ASP module is an ASP program which have a specific form and a specific use. The first advantage of these modules is their simplicity: a module is a little program which represent specific knowledge. We can have a module which contain observations about surroundings, an other one to define what is a prey and a module dedicated to compute path. To obtain all paths to surroundings preys an agent will combines this three modules. By combining modules an agent can produce knowledge, it the purpose of our ASP modules.

4.1 Background theory

Definition 1 (Rules module). *A rules module is a set of rules which represent knowledge about a specific domain. The content of such module is static: it does not change regarding time. The purpose of these modules is to organise knowledge representation and produce new knowledge by combine it with others modules.*

4.2 Observations

Definition 2 (Observations module). *An observations module is a set of facts which represent related observations. The content of such module is dynamic: it change regarding time. An agent use it like a specific memory database. The purpose of these modules is to organise observations to facilitate their use and update.*

4.3 Meta-knowledge

Definition 3 (Meta-knowledge module). *A meta-knowledge module is a set of rules which define the conditions to use an ASP module. The content of such module does not change regarding time. It contains knowledge on modules combination. The purpose of these modules is to guide reasoning and represent dynamic behaviours.*

5. EXPERIMENTS

6. CONCLUSIONS

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