Internship subject M2 Research

Internship subject	Heuristics for Hierachical Task Netwok Planning
Supervisors	Damien Pellier, Humbert Fiorino

Duration : 5 mois
Research laboratoiry : Laboratoire d'Informatique de Grenoble, 700 avenue Centrale, 38058 Grenoble cedex 9 (Équipe Marvin)
Keywords : Artificial intelligence, automated planning

1. Context

Automated planning and scheduling is a branch of artificial intelligence that concerns the realization of strategies or action sequences (plans), typically for the execution by intelligent agents, autonomous robots and unmanned vehicles [1 ,2]. Given a description of the possible initial states of the world, a description of the desired goals, and a description of a set of possible actions, the planning problem is to find a plan that is guaranteed (from any of the initial states) to generate a sequence of actions that leads to one of the goal states.
There are several techniques to solve planning problems and produce plans. Among them, one is very interesting because of its expressiveness and efficiency. This technique is called HTN (Hierarchical Task Network). Planning problems are specified in a hierarchical task network approach by providing a set of tasks, which can be: primitive tasks, compound tasks, which are decompositions of simpler tasks and goal tasks.

A primitive task is an action that can be executed. A compound task is a complex task composed of a sequence of actions. A goal task is a task satisfying a condition. The difference between a primitive task and the other tasks is that the primitive actions can be directly executed. Compound and goal tasks both require a sequence of primitive actions to be performed; however, goal tasks are specified in terms of conditions that have to be made true, while compound tasks can only be specified in terms of other tasks via the task network outlined below.
Constraints among tasks are expressed by task networks. A task network is a set of tasks and ordering and/or existence constraints among them. Such a network can be used as the precondition for another compound or goal task to be feasible. This way, one can express that a given task is feasible only if a set of other actions (those mentioned in the network) are done, and they are done in such a way that the constraints among them (specified by the network) are satisfied. A task network can for example specify that a condition is necessary for a primitive action to be executed. When this network is used as the precondition for a compound or goal task, it means that the compound or goal task requires the primitive action to be executed and that the condition must be true for its execution to successfully achieve the compound or goal task.

2. Objectives

In this Master thesis you will have to propose new heuristics [1] to solve HTN planning problem. To test and implement your encoding, we provide a planning library called PDDL4J [2]. The internship is paid and will hold in the computer sciences laboratory of Grenoble (LIG) in the Marvin team. Depending on the results obtained, participation in the international planning competition will be considered.

3. Profile of the candidate

The candidate must have:

- be registered in Master 2
- advanced programming skills (design and implementation), especially in Java
- knowledge of how to take users into account in interactive systems
- a good academic level attesting to his ability to combine practice and theory
- a level of professional oral and written English
- general knowledge in the fields of data analysis and artificial intelligence is a plus

4. Contact procedure

Send to Damien.Pellier@imag.fr and Humber.Fiorino@imag.fr

- Your Master marks 1
- Your CV

Applications are managed on a case-by-case basis. You will be informed promptly by email of the admissibility of your application and if you are invited to a first interview.

5. References

[1] M. Ghallab, D. Nau, and P. Traverso. Automated Planning Theory and Practice. Morgan Kaufmann Publishers, 2004.
[2] http://aima.cs.berkeley.edu/2nd-ed/newchap11.pdf