

Internship proposal

Graph and Automata Algorithms for Verification

Where:

Laboratoire Spécification et Vérification
École Normale Supérieure de Cachan
61, avenue du Président Wilson
94235 Cachan CEDEX
FRANCE
<http://www.lsv.fr>

Keywords: graph planning, automata theory, algorithms.

Description:

Graph and automata theory are widely used in the algorithmic solution of fundamental problems in verification. Verification problems often boil down to solving reachability questions in graphs, optimization problems, and combinatorial problems in automata.

Fundamental algorithmic problems in computer science have been well studied, such as the shortest path problem, the travelling salesman problem, etc. A similar classical problem in discrete planning is the *finite-horizon* planning problem [2], where the input is a directed graph with weights assigned to every edge and a time horizon T , and the goal is to find a path of length T that maximizes the total utility defined as the sum of the weights of the path. This computational problem for finite-horizon planning has applications in artificial intelligence and robotics [4, Chapter 10, Chapter 25], as well as in control theory and game theory [1, Chapter 2.2], [3, Chapter 6].

In this internship (with possible continuation as a phd thesis), we consider relaxations of the finite-horizon problem where the original question with a fixed horizon T is replaced by an expected time horizon, either given through a fixed stopping-time distribution, or through an adversarial distribution where the stopping-time distribution is unknown and decided by an adversary. We are looking for algorithmic solutions and structural properties in the case of graphs, as well as in more powerful models such as Markov processes, pushdown graphs, and timed systems. Several theoretical questions can be investigated and the solutions and heuristics can possibly lead to prototype implementations.

Expected skills of the student: Knowledge in automata theory, combinatorics, and algorithmics. Language: French or English.

Contact:

[Laurent Doyen](#)

CNRS Researcher - LSV, ENS Cachan

61, avenue du Président Wilson

94235 Cachan

Tél: +33 (0)1 47 40 22 74

Email: doyen@lsv.fr

References

- [1] J. Filar and K. Vrieze. *Competitive Markov Decision Processes*. Springer-Verlag, 1997.
- [2] S. M. LaValle. *Planning algorithms*. Cambridge University Press, 2006.
- [3] M. J. Osborne and A. Rubinstein. *A Course in Game Theory*. MIT Press, 1994.
- [4] S. J. Russell and P. Norvig. *Artificial Intelligence - A Modern Approach (3rd ed.)*. Pearson Education, 2010.