

Postdoctoral fellowship proposal

Monitoring cyberphysical systems with quantities

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Context

Cyber-physical systems are ubiquitous in our society (automated subways, smartphones, medical devices, etc.). These systems must avoid any unforeseen errors (bugs) that could threaten lives, and a formal verification as exhaustive as possible is highly desired.

For cyber-physical systems for which full formal verification is not feasible (due to state space combinatorial explosion, or for black-box systems for which no model is available, e.g., for confidentiality reasons, or for systems based on unreliable AI), applying lightweight verification techniques, such as *monitoring*, is a highly interesting option.

Subject

A key challenge in monitoring is to formalize complex requests involving *quantities* such as “the vehicle always remains at a minimum distance from other vehicles, with energy consumption maintained below a predefined threshold (where this threshold is not necessarily known a priori with full precision), except in the event of exceptional danger at most one minute per hour”; and then to detect possible violations of these requests on huge quantities of data. This implies being able to define expressive quantitative formalisms, as well as efficient verification algorithms. This post-doctoral fellowship fits within this framework, with both theoretical and algorithmic/implementation aspects.

The goal of the postdoctoral fellowship may include:

- propose expressive formalisms (logics, automata) capturing quantitative values in multiple dimensions (time, cost, energy, etc.);
- propose efficient monitoring algorithms;
- implement these algorithms and evaluate them against benchmarks.

Keywords

Monitoring, formal methods, model checking, timed systems, parametric systems, hyperproperties

Skills

The following skills are not compulsory, but would be welcome:

- monitoring
- model checking
- temporal logics
- timed automata
- parametric timed automata

Conditions

The postdoctoral fellowship will take place at [LIPN](#) (Laboratoire d'Informatique de Paris Nord) within Université Sorbonne Paris Nord. LIPN is an internationally recognized research laboratory comprising over 100 scientists.

The postdoctoral fellowship is for a duration of one year. Standard brut salary: from 2932€ to 3371€ monthly if less than 2 years of prior experience. Health insurance and partial reimbursement of Paris transportation card ("Navigo") is included in the package.

The postdoc can start anytime from now, and latest in October 2024.

Application: by email first.

References

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