UNIVERSITY OF TOULOUSE CAPITOLE
FACULTY OF COMPUTER SCIENCE/ IRIT/ SMAC TEAM

Post-doc:

Machine learning surrogate models for the exploration and calibration of agent-based simulations

Function: **Research Engineer/Post-doc**

The contract is for a **fixed term**, under public law, full-time, for a maximum period of **3 years**.

Remuneration: between 2300 and 3200€ **gross monthly**

Start date: **06/01/2025**

Degree: PhD in Computer Science or Mathematics

The University of Toulouse Capitole is recruiting a post-doctoral fellow for its **IRIT** laboratory (Institut de Recherche en Informatique de Toulouse) as part of the **ANR-JCJC MIMICO (http://www.irit.fr/MIMICO).** The post-doctoral fellow will join the **SMAC** (Cooperative Multi-Agent System) team.

PRESENTATION OF THE UNIVERSITY

The University of Toulouse Capitole includes the following components: Faculty of Law and Political Science, Toulouse School of Management, Faculty of Administration and Communication, Faculty of Computer Science, IUT of Rodez, and two component institutions: Toulouse School of Economics and Sciences Po Toulouse.

With nearly 20,000 students, its 700 teacher-researchers and 600 administrative staff contribute to its influence. Its ambition: to create a multidisciplinary and international research centre, to develop local and international partnerships, to promote pedagogical innovation and to promote the attractiveness of the Toulouse University site.

PRESENTATION OF THE LABORATORY

The Institute for Research in Computer Science of Toulouse (IRIT, https://www.irit.fr), one of the largest Joint Research Units (UMR 5505) at the national level, is one of the pillars of research in Occitanie with its 600 members and about a hundred external collaborators. Because of its multi-supervisory nature (CNRS, Toulouse Universities), its scientific impact and its interactions with other fields, the laboratory is one of the structuring forces of the IT landscape and its applications in the digital world, both at the regional and national levels.

PRESENTATION OF THE ANR-JCJC MIMICO PROJECT

Agent-based models (ABMs) are interesting tools for modelling and studying complex phenomena in which many heterogeneous entities with nonlinear interactions are geographically distributed and modelled at different scales. Scientists interact with ABMs by changing the values of the model's parameters, either during a calibration process to produce realistic data or to explore possible outcomes in "what-if" scenarios. Exploring the parameter space of an ABM in depth is difficult due to the relatively large number of parameters, the potentially high computational costs per model execution, and the nonlinear relationship between the parameters and the results. The MIMICO project proposes to design and evaluate a new approach based on the construction of a **surrogate model** to emulate the relationship between a scenario and the results of the agent model. The novelty of the project is to design **new active learning strategies**, which implies that the surrogate model will itself observe its learning process to ask for new examples. The key assumption is that if the learning algorithm is allowed to choose the data it learns from, and therefore be curious, it will perform better with less training. The surrogate model can then discover new scenarios to explore, providing interesting information for the expert while improving its own ability to mimic ABM. The framework is evaluated on two fields of application: the first is the evaluation of the impact of new urban policies on the mobility model, and the second is the calibration of the dense crowd simulation.

MAIN ACTIVITIES

As part of the SMAC team, you will carry out your research on the themes of ensemble machine learning and active learning for the exploration and calibration of multi-agent models.

CANDIDATE PROFILE

- PhD in Computer Science or Mathematics
- Experience in machine learning (ensemble learning, active learning, surrogate models) demonstrated by recent publications
- Knowledge of agent modelling and model calibration issues is appreciable
- Ability to work in a team and supervise PhD students, research engineers and interns

Apply

The application (***curriculum vitae*** **and cover letter**) will be sent by email to: nicolas.verstaevel@ut-capitole.fr

Information

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