



Institut de Recherche
en Informatique de Toulouse
CNRS - INP - UT3 - UT1 - UT2J

Post-doctoral position

Learning personalized mobility profiles using adaptive multi-agent systems

Context and issues

This post-doctoral position is part of the TIGA VILAGIL project, led by *Toulouse Métropole*, which is one of the 24 winners of the "*Territoires d'Innovations de Grande Ambition*" call for projects launched and supported by the French government. The ambition of this project is to address the problem of congestion in the Occitanie region and its negative externalities in economic, environmental, social and public health terms, in particular through the deployment of new integrated mobility services.

In concrete terms, the VILAGIL project aims to encourage the inhabitants of the Toulouse metropolitan area to leave their personal cars and use more virtuous modes of transport.

This postdoctoral research is part of the "Mobility as a Service" (MaaS) action of the VILAGIL project, which aims to promote urban mobility services, such as carpooling and car-sharing, which will be integrated with a personalized mobility assistant (IA4M: Intelligent Assistant for Mobility).

The aim of this mobility assistant is to offer each user, via his or her smartphone for example, the most appropriate multimodal means of transport (bus, streetcar, metro, carpooling, etc.) to his or her mobility profile.

Objectives

This postdoctoral research focuses on the definition and the implementation of the mobility profile associated with each user. This mobility profile is specific to each user. It will be developed by observing the user's daily activities and by learning what her or his recurrent activities are. It will therefore highlight the user's behavioral patterns, particularly in terms of needs/constraints (leaving on a particular day at a particular time / arriving at a particular time, etc.) and preferences (mode of transport cost, ecological footprint, meeting the fewest people, etc.).

This profile is not static but must evolve as the user travels. It will be built using an "edge computing" approach and will be locally stored on the user's assistant. It will therefore have to consider the technological constraints of the device on which the assistant is running, i.e. its storage, memory and computing capacities.

The mobility profile is used by the assistant to make, at the appropriate time, proposals (following an expressed or spontaneous need) for multimodal modes of transport to its user.

This postdoctoral research will individualize the user by observing his or her daily activities to highlight behavioral regularities and provide truly personalized assistance in the context of his or her trips.

The aim will be to learn mobility profiles for each user (i) by focusing on her or his mobility preferences and daily modes of transport, (ii) by considering changes in her or his habits.

Organization of research work

The first step involves doing a state of the art on the definition and implementation of mobility profiles. It will also involve collecting relevant data to learn these profiles from concrete data coming from Toulouse Metropole but also from the partners of the VILAGIL project.

The second step will consist, from these data, in observing the mobility behaviors of users in order to learn, for each of them, their preferences and modes of transport habits, in other words, their mobility profile. The solution to be defined will be based on the paradigm of multi-agent systems.

In a third step, these mobility profiles will have to be used in test scenarios to propose to users a set of multimodal modes of transport allowing them to go from a starting point to a destination according to the context, their habits and their respective preferences. These proposals will first respond to a request expressed by the user and will then be made spontaneously without the user's explicit request.

Possible combinations of multimodal modes of transport to meet a travel need are not part of this work. An existing tool will be used for this point.

Finally, this work will have to be evaluated and experimented with concrete data from *Toulouse Métropole* and the project partners.

Applicant profile

Doctor in Computer Science in the field of AI.

Have interests around the concepts of multi-agent systems, collective problem solving, optimization and/or personalization.

Be able to write technical and scientific documents.

Have a good command of both written and spoken English.

Be autonomous and have scientific rigor.

Funding and duration

This postdoctoral position is funded within the framework of the VILAGIL project. The gross monthly salary is about 2800€.

The position is for a period of 12 months (renewable twice for an equivalent duration) and can start on February 1st, 2021.

Supervision and environment

This postdoctoral position will take place at IRIT (*Institut de Recherche en Informatique de Toulouse*), in the SMAC (Adaptive Multi-Agent Systems¹) team which is interested in modeling and solving complex problems using multi-agent systems. Its research aims to address the scientific challenges of endogenous and exogenous dynamic learning, solving difficult problems and designing and evaluating adaptive systems.

Contacts

CVs, letters of recommendation, PhD reports and cover letters (indicating in particular the outlines of your solutions) have to be sent in PDF format to Valerie.Camps@irit.fr, Stephanie.Combettes@irit.fr, Elsy.Kaddoum@irit.fr and Marie-Pierre.Gleizes@irit.fr.

Bibliographical references

- Personalization of the access to information through self-organizing multi-agent systems
 - https://www.irit.fr/publis/SMAC/DOCUMENTS/RAPPORTS/TheseSylvainLemouzy_011.pdf
 - "AMADEUS: an adaptive multi-agent system to learn a user's recurring actions in ambient systems", Valérien Guivarch, Valérie Camps, and André Péninou, *Advances in Distributed Computing and Artificial Intelligence Journal*, Special, Issue 3, 2012
- Agent Model for Collective Problem Solving
 - "Cooperation", Jean-Pierre Georgé, Valérie Camps, Marie-Pierre Gleizes, in *Self-organizing Software*. Giovanna Di Marzo Serugendo, Marie-Pierre Gleizes, Anthony Karageorgos (Eds.), Springer, p. 193-226, *Natural Computing Series*, 2011, <http://www.springerlink.com/content/r444353816j80851/fulltext.pdf>

¹ <https://www.irit.fr/departement/intelligence-collective-interaction/equipe-smac/>