Internship offer

Modelling human behavior using LLM-based generative agents in a multimodal transport system

Information about the internship offer

Supervision	Kamaldeep Singh Oberoi (CESI-LINEACT) and Benoit Gaudou (UTCapitole,IRIT)
Subject	Modelling human behavior using LLM-based generative agents in a multimodal transport system
Dates	6 months – from 01/02/2025
Location	Université Toulouse Capitole (Manufacture des tabacs)
Application	Applications should be sent by email to ksoberoi@cesi.fr and benoit.gaudou@ut-capitole.fr with your CV, a motivation letter et votre relevé de notes

Missions

Keywords

Generative agents, agent-based modeling and simulation, multi-modal mobility, LLM, RAG (Retrieval-Augmented Generation), GAMA platform

Context

Faced with the current climate crisis, optimizing the daily mobility sector can help to reduce greenhouse gas emissions. The aim of a personalized multimodal transport system is to help people to combine different transport modes efficiently, taking into account individual preferences and the travel context. However, different users, belonging to different social categories, have different profiles, opinions, and needs, which makes offering a personalized mobility service at the individual level, while preserving privacy, a very complex task.

With recent advances in generative AI, the concept of generative agents (GAs) is being studied more and more. These agents are based on Large Language Models (LLMs) and are capable of making decisions and performing actions for various application domains. These agents can also be extended to have a memory stream that updates with interactions between agents and between agents and the environment and can be used to form high-level thoughts and opinions from raw observations of the environment.

Objectives

This internship has two main objectives.

The first objective is to use GAs to model humans within a multimodal transport system. These agents should be able to perceive their environment, reason about their mobility choices, make multimodal journeys according to their needs, and update their mobility preferences. Preferences could be updated either autonomously or after communication between agents. In addition, different personality types (such as the OCEAN model) can be assigned to each agent to simulate various types of behavior.

In addition, different types of external open-source data should be integrated (using retrieval-augmented generation, RAG) to provide the context of each journey to the GAs. This includes GIS data from OSM, public transport data in GTFS format, weather data from OpenWeather API, etc.

The multimodal transport system will be simulated using an open-source agent-based simulation platform, GAMA (https://gama-platform.org/). The second objective is therefore to integrate these generative agents into GAMA. In addition to setting up a data exchange pipeline between GAMA and an LLM, the main task will be to develop a generative agent meta-model in order to integrate it into the architecture of a GAMA model.

The intern will work in collaboration with the research engineer responsible for developing the multimodal environment simulated on GAMA.

Missions

The missions are the following ones:

- Conduct a literature review on various LLMs to understand the context and the generative agents (GAs)-based modeling approach
- Develop the capacities of GAs to perceive, decide, act, form reflections and emergent social connections
- Integrate GAs into the multimodal transport system simulated with the GAMA platform
- Evaluate the behavior of agents and the overall system in different scenarios
- Write an activity report and the support for the oral presentation at the end of the course
- Take part in seminars and discussions organized with other members of the MIDOC federation.

The planning of the internship is the following:

Tasks	M1	M2	M3	M4	M5	M6
Understanding of the context and literature review						
Learning existing codes and GAMA platform						
Design and implementation of GAs and integration in GAMA platform						
Evaluation of GAs' behavior and of the whole system						
Comparaison with various LLMs						
Writing the report						

Profil recherché

The trainee recruited must :

- be enrolled in M2 computer science, with solid experience in Python and Java/C++.
- have knowledge of data science in general, generative AI, and LLMs in particular. Experience with the GAMA platform is a plus.
- be passionate about intelligent mobility as a field of application
- be independent and curious about research
- have a good level of English and French

References

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Fundin – the MIDOC federation

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