Université Gustave Eiffel

Berkeley UNIVERSITY OF CALIFORNIA

MASTER OR ENGINEER DEGREE INTERNSHIP OFFER

Agent-based dynamic traffic simulation: Demand and supply calibration

Date: 14 January 2022

Internship description

6 months internship, starting date: As soon as possible
Tutors: Mostafa AMELI, PhD, Prof. Alex Bayen
Location: University Gustave Eiffel, COSYS department, GRETTIA Lab., 77420 Champs-sur-Marne, Paris area, France.
Team: CIRCLES

Developing high-fidelity simulation tools that exhibit realistic traffic instabilities is a crucial task in traffic management. Recently, due to use of emerging technologies in collecting and processing traffic data (e.g., image processing, trajectory analysis, etc.) as well as the need to have realistic mathematical models for transportation systems, the topic of traffic simulation and calibration were widely studied [1]. Online calibration is a process of adjusting the estimates of the different model parameters based on the data processing to better represent the actual traffic condition. The online process consists of two parts, i.e., data processing and simulation with calibration and prediction [2]. To make accurate decisions from traffic simulations, they must be properly calibrated for the specific network, rather than using the default model parameters provided in the simulation software.

This internship aims to develop an online calibration framework for agent-based dynamic traffic simulators in order to benefit from updated daily traffic data to deal with the demand and supply parameters for a given road network. The intern will work in the scenario team of the Congestion Impacts Reduction via CAV-in-the-loop Lagrangian Energy Smoothing (CIRCLES) project. The main goals of this internship are to (i) build a calibrated simulation tool based on SUMO [2] for a given test case based on the aggregated data; (ii) solve the calibration problem for dynamic traffic assignment (DTA), agents departure time and route choices, based on the existing approaches [3] and available data [4]; (iii) design an online calibration framework to be benefited by the data that will be collected by sensors and data collectors of the project.

To this purpose, the steps of this research work are:

- To perform a literature review on demand and supply calibration of SUMO
- To represent the test case with features considered by the simulator.
- To formulate DTA calibration based on the available data.
- To develop a data-driven framework for DTA.
- To benchmark and validate the proposed framework.

Keywords: agent-based simulation, traffic dynamics, calibration, micro-simulation, SUMO

References:

[1] Krajzewicz, D. (2010). Traffic simulation with SUMO–simulation of urban mobility. In Fundamentals of traffic simulation (pp. 269-293). Springer, New York, NY.

[2] Flötteröd, Y. P., & Behrisch, M. (2021, September). Online calibration with SUMO for network-wide traffic and emission monitoring–Case study ITS Huainan. In Proceedings of SUMO User Conference 2021.

[3] Ameli, M., Lebacque, J. P., & Leclercq, L. (2020). Simulation-based dynamic traffic assignment: Meta-heuristic solution methods with parallel computing. Computer-Aided Civil and Infrastructure Engineering, 35(10), 1047-1062.

[4] Lee, J. W., Gunter, G., Ramadan, R., Almatrudi, S., Arnold, P., Aquino, J., ... & Seibold, B. (2021). Integrated Framework of Vehicle Dynamics, Instabilities, Energy Models, and Sparse Flow Smoothing Controllers. arXiv preprint arXiv:2104.11267.

Profile and Competences	
Education: Master level, in the field of computer science, applied mathematics and/or transportation engineering. **Main skills:** mathematical modelling and optimization, skill in computer programming Python, Basic knowledge of numerical simulation. Knowledge in transportation engineering domain and experience with SUMO will be a plus, Good level of English (reading and writing). **Know-how:** Autonomy, sense of initiative, excellent relationship, rigor, taste for experiments	
Contacts	Candidates CV, grades and cover letter should be sent to: mostafa.ameli@univ-eiffel.fr