Master2 Internship (stage),

Title: Traffic speed prediction incorporating topology, temporalities, and space using Sequential Graph Neural Networks.

Location: Lyon 1 University, LIRIS lab (La Doua) and LICIT lab (Bron)

Keywords: Machine Learning, Traffic prediction, Network Science, Neural Networks

Supervision: Rémy Cazabet, Angelo Furno

Duration: 5 or 6 months.

What's the stage about?

Several urban transportation applications, such as traffic monitoring and route planning, heavily rely on traffic speed forecast. These predictions are today largely based on machine learning techniques exploiting massive data.

In recent years, Deep Learning models have made significant progress in this context. Their application to complex data requires specific techniques: Convolutional Neural Networks (CNN) to integrate the proximity of elements (pixels in images, etc.), Recurrent Neural Networks (RNN) to integrate the order of the elements (order of words in a sentence, etc.).
A specific kind of neural networks, Graph Neural Networks (GNN)[1], has recently been proposed to integrate complex relationships that can be represented by graphs. A good prediction of the speed of displacement must indeed necessarily take into account both the structural aspects (topology of the road network, link capacity) and the dynamic and historical aspects (traffic demand, speeds / flows observed). Very recent work has proposed to use Sequential Graph Neural Networks (SeqGNN) [2] integrating both aspects, applied to the speed forecast problem.

The objective of this internship is to explore, apply and rigorously compare these new techniques (SeqGNN) with more traditional ones (e.g., Artificial Neural Networks, ARIMA models, Kalman filters, KNN, etc.) [3] and to enhance SeqGNN models by taking into account phenomena which could significantly degrade traffic at the local level (accidents, works) and at a global scale (heat waves, transport strike).

Spatio-temporal datasets (GPS trajectory data of floating vehicles), road networks, maps and weather-related information for the agglomeration of Lyon will be provided as part of the stage.

Where the stage will take place?

This subject is proposed as part of a collaboration between a computer science lab and a traffic engineering laboratory. The LIRIS DM2L Team specializes in data mining and machine learning, especially on complex data. The LICIT laboratory is at the forefront of road traffic modeling and regulation techniques, as well as in the analysis of mobility data. LIRIS and LICIT have been working together regularly for many years. The student will work at both labs, LIRIS (La Doua Campus) and LICIT (Cité de Mobilités, 25 avenue Francois Mitterand, Bron), depending on the specific needs.

Stage Allowance: The student will receive the legal internship allowance in France, approximately 500€/months

References

[1] Wu, Z., Pan, S., Chen, F., Long, G., Zhang, C., & Yu, P. S. (2019). A comprehensive survey on graph neural networks. *arXiv preprint arXiv:1901.00596*.
[2] Xie, Z., Lv, W., Huang, S., Lu, Z., Du, B., & Huang, R. (2019). Sequential Graph Neural Network for Urban Road Traffic Speed Prediction. IEEE Access.
[3] Jia, Y., Wu, J., & Du, Y. (2016, November). Traffic speed prediction using deep learning method. In 2016 IEEE 19th International Conference on Intelligent Transportation Systems (ITSC) (pp. 1217-1222). IEEE.