Internship R&D at ENGIE Lab - Deep Graph Representation Learning for Traffic Prediction

Description:

ENGIE Lab CRIGEN is a centre of research, development and operational expertise dedicated to gas, new energies and emerging technologies. Located in the Paris region in the city of Stains, it has about 200 employees. It supports the business by providing cutting edge expertise and develops tested, proven and marketable industrial applications. CRIGEN is committed to sharing novel ideas, scientific knowledge and technical expertise and its ability to innovate is a key advantage for the ENGIE Group.

The trainee project will concern the application of Deep Learning techniques to the road traffic prediction (see [1] for example). The specificity of the traffic data is that it is organized as graphs, where the nodes are street intersections, and the edges are road segments. There are two main approaches how to do Machine Learning on graphs. The first one is called Graph Representation Learning [2], it aims at embedding graph structures into a N-dimensional vector space in order to use the "traditional" Machine Learning further. The second one tries to adapt Machine Learning methods directly to graphs. For instance, the convolutional neural networks were traditionally used for images, but they were also successfully spread on the graph-type data [3]. During the internship, you will get acquainted with this exciting area of modern deep learning on graphs; you will test the existing methods, improve them, develop your own techniques. In addition, the algorithms you will work on, might be applied to a wide range of close topics like road accident prediction, internet traffic prediction, air traffic forecasting, etc.

As a trainee, you will explore different tasks for graph representation learning such as:

- Unsupervised, supervised, generative and adversarial learning tasks for graph representation.
- Link prediction for instance where the aim is to build node representations that are similar if an arc connects the associated nodes.
- Supervised graph learning tasks meanwhile include node classification, graph classification and graph regression.

You will have the opportunity to join Computer Science and Artificial Intelligence Laboratory (CSAI). You will be integrated in the group and work closely with scientists and engineers.

Tasks and Responsibilities:

1. State of the art on deep graph representation learning;
2. Proposal of a new graph representation learning approach;
3. Designing and development of the proposed approach;
4. Drafting of work documentation as required;
5. Contributing to academic research papers.

Trainee profile
M2, computer engineering school, you have a technical profile in software development and a knowledge on machine learning, deep learning and data science.

Requirements:

- Good knowledge (theoretical and applied) in Machine Learning (ML), Deep Learning and Graph Representation Learning;
- Strong knowledge skills on Python and ML frameworks (sklearn, tensorflow, pytorch);
- Self-driven and comfortable working independently and in teams;
- Fluent English;

Other details:

- We propose 6 months contract for start-up as soon as possible.
- Please attach your CV, cover letter and transcripts.
- Localisation: CRIGEN (Centre de Recherche et d'Innovation dans le Gaz et les Energies Nouvelles) ENGIE in 4, rue Joséphine Baker 93240 - Stains - (RER D, Tram 11).
- Contacts: rim.hantach@external.engie.com and dmitriy.slutskiy@engie.com (CV, cover letter, transcripts)

References:
[1] L. Zhao, Y. Song, C. Zhang, Y. Liu, P. Wang, T. Lin, M. Deng, and H. Li, *T-GCN: A temporal graph convolutional network for traffic prediction*. IEEE Trans. Intell. Transp. Syst, Aug 2019, pp. 1-11, doi: 10.1109/TITS.2019.2935152, arXiv:1811.05320v3
[2] Zhu W., Wang X., Cui P. *Deep Learning for Learning Graph Representations*. In: Pedrycz W., Chen SM. (eds) Deep Learning: Concepts and Architectures. Studies in Computational Intelligence, vol 866 (2020). Springer, Cham; arXiv:2001.00293v1
[3] Zhang, S., Tong, H., Xu, J. et al., *Graph convolutional networks: a comprehensive review*. Comput Soc Netw 6, 11 (2019).