Term project – Fall 2020
Time series analysis with a Convolutional Neural Network

This project must be done <u>individually</u>.
Any form of fraud or any cheating suspicion will be documented and reported.

This project is structured into two distinct parts:
- The first part is purely conceptual: you will have to explain how you would address the problem described in the project
- The second part is more technical: you will have to actually implement a solution to the problem

You have to submit a report for the first part before Dec. 14. At that point, a conceptual solution will be made available to all of you and you will have to use it to do the technical implementation: you will then have to submit a notebook with your implementation and supported by an analysis of your work (methodology, experiments and tests, results, conclusions).

PART I

We wish to process a time series with a convolutional neural network. A time series is a sequence of chronological data points describing how variables varies through time (e.g. stock market evolution, sensor data, …). Figure 1 below shows a few data points from a time series. The first attribute is the timestamp, so as you see, those data are sequential. The five next attributes are the features of the data that can be used to predict the state of the system (the last column).

2018-05-17 22:56:06	27897490.0	19824230.0	125.6859	4059666.0	97.55283	0
2018-05-17 22:56:07	27897450.0	19824230.0	125.6859	4059666.0	97.55283	0
2018-05-17 22:56:08	27897360.0	19824230.0	125.6859	4059666.0	97.55283	0
2018-05-17 22:56:09	27897430.0	19824230.0	125.6859	4059666.0	97.55282	0
2018-05-17 22:56:10	27897500.0	19824230.0	125.6859	4059666.0	97.55282	0

Figure 1: Data points from a time series

We have studied Convolutional Neural Networks (CNN) in class, and you have used them during your practical work: you now know how these architectures process data.

Your first task is then to **propose a way to use a 1-dimension CNN to analyze a time series** such as the one in fig. 1.

In particular, you must first explain *why* the CNN architecture is relevant in the context of time series analysis (and why 1D convolutions will do the trick). Then, your work must focus on explaining how you would pre-process such data in order to be processed by a CNN.

If you lack inspiration, you are free to look for any resources you need. However, you will have to describe your solution with your own words, and precisely cite the references you used (that is, no plagiarism), no matter their nature: tutorial, book chapters, scientific articles, etc.

==You must submit your pdf report (2 pages maximum; illustrations and references included) on Moodle before December 14.==

PART II

Later! Let's keep things general and at the conceptual level for now.