Deep Learning Architectures - Final project

Deep Learning architectures for ECG classification

Context

The cardiology department of a hospital is needing you! Every days, they have to analyze many ECG signals recording heartbeats of their patients. In particular, hey are interesting in detecting heart attacks in these signals. A heart attack (myocardial infarction) happens when one or more areas of the heart muscle don't get enough oxygen. This happens when blood flow to the heart muscle is blocked. While heart attack can be visually detected by humans, an automatic method able to process several signals per minute would be largely faster and more interesting for therapists. That is why they are requiring your support in order to study, identify, develop and anlalyze Deep Learning algorithms for distinguishing normal and abnormal ECG signals.

Time series data

For this project, we will consider the ECG200 dataset from the UCR archive. This dataset was formatted by R. Olszewski as part of his thesis "Generalized feature extraction for structural pattern recognition in time-series data" at Carnegie Mellon University, 2001. Each series traces the electrical activity recorded during one heartbeat. The two classes are a normal heartbeat and a Myocardial Infarction. Figure 1 shows example signals belonging to the two classes included the dataset.

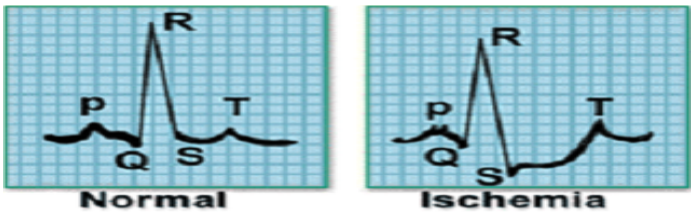

FIGURE 1 – Example ECG signals from ECG200 dataset

The training and testing set can be found here :

— Train : https://maxime-devanne.com/datasets/ECG200/ECG200_TRAIN.tsv
— Test : https://maxime-devanne.com/datasets/ECG200/ECG200_TEST.tsv

File format is "tabular separated values" (`.tsv`), similar to (`.csv`) but values are separated with tabular character instead of comma.

What you have to do

— The cardiology department is requiring your support to carry on a study on how deep neural networks may be used for distinguishing normal and abnormal ECG signals.
— You have to build and compare the performance of at least **two Deep Learning models** including one **Convolutional Neural Network** and one **Recurrent Neural Network**.
— You can use every techniques we have seen during lectures or additional ones if you want.
— You have to provide an extensive analysis of your experiments motivating the architectures, the regularization techniques, etc.

What you have to provide

You have to send to maxime.devanne@uha.fr the following documents :

— Your final code in order to reproduce the experiments. It should be clear and easy to run your code. Do not hesitate to provide a Readme.

— A report explaining in details your experiments, motivating your choices and analyzing the performances of your developed models.

Evaluation criteria

— Motivation of the selected architectures, regularization techniques, etc. : **10%**

— Performances of the proposed models : **30%**

— Robustness of the evaluation : **20%**

— Analysis of the experimental results and discussion : **20%**

— Clarity and reproducibility of the code : **10%**

— Clarity of the report : **10%**