Neural Networks and Deep Learning (Tir 1402)

Assignment #4: Deep Neural Networks

Due date: 31th Tir 1402

In this project, you are going to get familiar with <u>LSTM network and Attention mechanism</u>.

Phonocardiography

The phonocardiogram (PCG) detects and records heart sounds, the sounds made by the various cardiac structures pulsing and moving blood. The opening and closure of the heart valves is associated with accelerations-decelerations of blood, giving rise to vibrations of the entire cardiac structure (the heart sounds and murmurs). These vibrations are audible at the chest wall, and listening for specific heart sounds can give an indication of the health of the heart. In some studies, the heart sounds usually include four states which are first (S1) and second (S2) heart sounds, Systole and Diastole. Figure 1 illustrates a short section of a PCG recording.
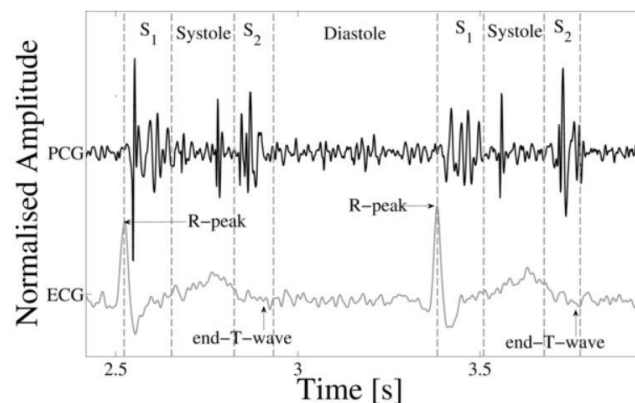

Figure 1: A PCG (center tracing), with simultaneously recorded ECG (lower tracing) and the four states of the PCG recording; S1, Systole, S2 and Diastole.

In phonocardiography the heart sound is important in appraisal of heart disease and pulmonary hypertension. In this project we want to build a sequential model to recognize **normal or abnormal** heart sounds.

Your Task

- Read '.wav' files of PCG records and specify their normal or abnormal labels from 'REFERENCE.csv' files.
- Normalize values of each signal in order to be between -1 and 1.
- Find minimum length of signals and make the length of all signals equal to this minimum.
- You can down sample your signals in order to reduce their time steps. (<u>Optional</u>)
- Split %20 of signals for test dataset.
- Build the LSTM network with attention mechanism for classification and train it. (You can use Bi-directional LSTM layer.)
- Plot loss values of your model on train and test data during the training.
- Evaluate your classifier with metrics like accuracy, precision, recall and F1-score on the test data.

Dataset

Dataset of this project is from **2016 PhysioNet/CinC** Challenge which aims to encourage the development of algorithms to classify heart sound recordings collected from a variety of clinical or nonclinical (such as in-home visits) environments. The heart sound recordings were collected from different locations on the body. The typical four locations are aortic area, pulmonic area, tricuspid area and mitral area. The heart sound recordings were divided into two types: normal and abnormal. The normal recordings were from healthy subjects and the abnormal ones were from patients with a confirmed cardiac diagnosis.

You can download dataset from <u>here</u>.

Notes:

- Pay extra attention to the due date. It will not extend.
- Be advised that submissions after the deadline would not grade.
- Prepare your full report in <u>PDF</u> format and include the figures and results.
- Feel free to use any predefined functions.
- Email your files as a folder in this format (HW#_student#_name_family.zip).

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