Neural Network Lab 2

The second lab session on neural networks uses Jupyter notebooks. As these notebooks include quite a bit of Python code used to prepare data, train neural networks, etc., you do not need to understand everything. However, you should have a general idea of how to define models, train them, and evaluate their performance.

The notebooks include questions that should be answered in a separate document for the lab report.

Setup

(Recommended) Here are the steps to run the experiments using last week setup:

1. Complete the last week lab directory with the new notebooks (*ecg_rhythm_classification.ipynb* and `hr_estimation.ipynb`) and the new datasets (`ecg_rhythms.npz` and `ppg_dalia.pkl`).
2. Open the terminal in the last week lab directory.
3. Activate virtual environment:
   Linux: `source venv/bin/activate`
   Windows: `venvScripts\activate`
4. Start JupyterLab.
   `python -m jupyter lab`

Here are the steps if you prefer to run the experiments in a new environment:

1. Uncompress the compressed file with the experiments.
2. Open a terminal in the uncompressed directory.
3. Create a Python virtual environment to avoid package conflicts and activate it.
   `python -m venv venv`
   `source venv/bin/activate` on Linux or `venv\Scripts\activate` on Windows
4. Install the requirements with pip.
   `python -m pip install --upgrade pip`
   `python -m pip install -r requirements.txt`
5. Start JupyterLab.
   `python -m jupyter lab`

Notebook Shortcuts

Here are a few useful keyboard shortcuts to work with Jupyter notebooks

- Run current cell and move to the next one: SHIFT + ENTER
- Run current cell: CTRL + ENTER

Exercise 1: Heart Rate Estimation

The goal of this exercise is to estimate heart rate from PPG and tri-axis acceleration signals with a convolutional neural network (CNN). The signals are collected during two activities, sitting and waking, and the reference heart rate is extracted from ECG data.

1. Open the `hr_estimation.ipynb` notebook in the `notebooks` directory.
2. Run the cells one at a time and answer questions included in the notebook.

Exercise 2: ECG Rhythm Classification

In this exercise, the goal is to train and evaluate a neural network to classify five cardiac rhythms from a single-lead ECG signal with a convolutional neural network (CNN). You will also have the opportunity to build your own network architecture for this task.

1. Open the `ecg_rhythm_classification.ipynb` notebook in the `notebooks` directory.
2. Run the cells one at a time and answer questions included in the notebook.