

## Neural Network Lab 1

The first 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, evaluate their performance, and compare them.

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

### Setup

Due to computational time, we ask you to proceed locally with a virtual environment rather than using noto. The notebooks have been tested on python3.10, python3.11, and python3.12. Here are the steps to install the requirements and run the experiments:

1. Uncompress the compressed file with the experiments.
2. Open a terminal in the uncompressed directory.
3. Optionally create a Python virtual environment to avoid package conflicts.  
`python -m venv venv`  
Activate it.  
Linux: `source venv/bin/activate`  
Windows: `venv\Scripts\activate`
4. Install the requirements with pip.  
`python -m pip install --upgrade pip setuptools`  
`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: Atrial Fibrillation Classification

The goal of this exercise is to classify atrial fibrillation (AF) and normal sinus rhythm (NSR) from windows of interbeat intervals (IBIs) with neural networks. The following neural network architectures will be trained and evaluated: multi-layer perceptron (MLP), convolutional neural network (CNN), recurrent neural network (RNN).

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

### Exercise 2: Gait Classification

In this exercise, the goal is to apply neural networks to classify the following types of gaits from stride intervals (duration between steps when walking):

- Young healthy adults
- Old healthy adults
- Old adults with Parkinson's disease

This exercise also highlights the effect of different optimization algorithms.

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