

# Homework 1: Denoising 1D Brightness Data with MLPs

## Overview

In this task, you will implement and train a simple Multi-Layer Perceptron (MLP) to denoise 1D brightness data extracted from lunar images. The training data consists of 1,000 pairs of noisy and clean brightness profiles. Each profile is obtained by averaging pixel brightness values row-wise from 64x64 lunar images. Your goal is to learn a model that can effectively remove noise from these 1D signals. (See Figure 1 for an example output.)

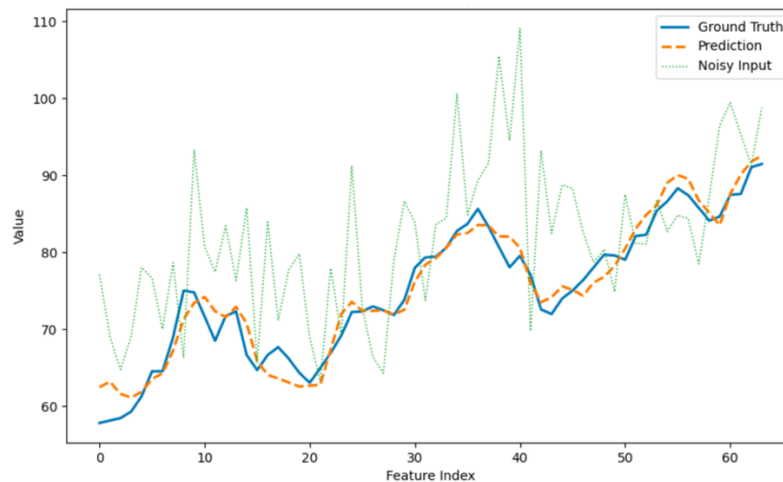


Figure 1) Example output of solution to the problem

**Training Data:** Provided in *noisy\_images\_small\_1k.npy* and *clean\_images\_small\_1k.npy*.

## Tasks

### 1. Model Implementation:

- Use the provided skeleton code (*MLP.py*) and complete the sections marked with #TODO.
- Train your MLP on the provided training dataset.
- Find suitable hyperparameters to obtain a good fit.

**Hint:** To avoid overfitting, consider applying the techniques discussed in Lecture 1.

### 2. Report (No need to hand it in):

- Describe any challenges you faced during implementation and how you addressed them.
- The plots described in Task 3.

### 3. Visualization and Analysis:

Generate two plots that compare the denoised output, the ground truth, and the noisy input (See Figure 1)

- **One plot** for a training sample used during training.
- **One plot** for a sample excluded during training.

Include these plots in your report, and comment on how the denoised results differ between these two samples, and what this difference reveals about your model's performance.