# AI 2024, Assignment 1B:

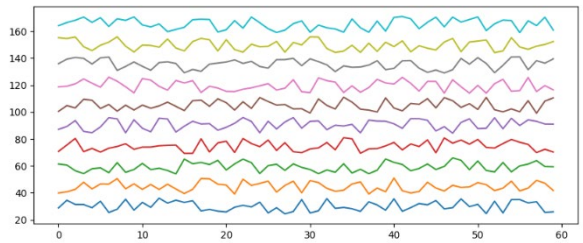
## 1 D Convolutional Neural Networks (1D CNNs) for Time Series Data

In this assignment, you will learn how to construct and apply a custom 1D convolutional neural network (1D CNN) to handle time series data. The dataset is the Synthetic Control Chart Time Series, a well-known time series classification problem from the UCI Machine Learning Repository.

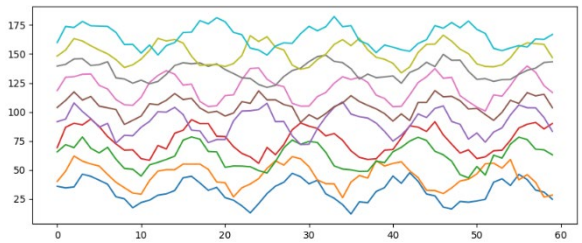
***UCI Machine Learning Repository: Synthetic Control Chart Time Series***

*https://archive.ics.uci.edu/dataset/139/synthetic+control+chart+time+series*

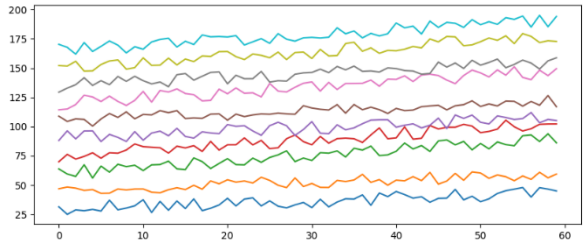
1. Normal



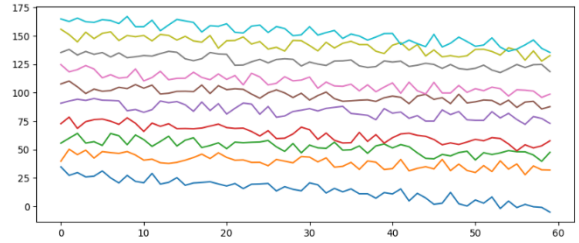
2. Cyclic



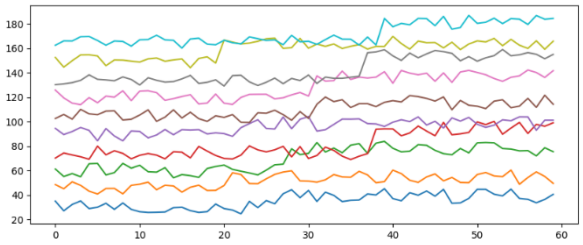
3. Increasing trend



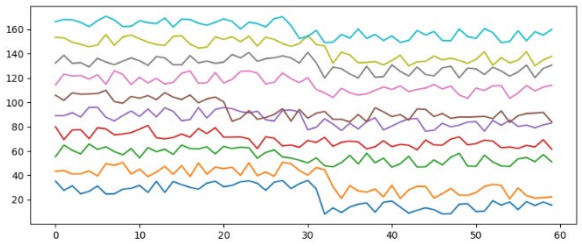
4. Decreasing trend



5. Upward shift



6. Downward shift



## Dataset Overview:

For assignment 1B, we consider all 6 signal types. The data is stored in an Excel file (SPC_data.csv), 600 rows (number of samples), 60 columns (length of a time-series signal), with a single SPC chart per line. For each SPC type, 60% is used for the training, and the remaining 40% is for the test. For the 360 training samples, they should be randomly shuffled.

## Task Requirements:

1. Model Construction: Design and implement a 1D CNN model, ensuring it is suitable for processing time series data.
2. Data Processing: Preprocess the dataset, including normalization and splitting it into training and test sets.
3. Train the Model: Train the 1D CNN on the dataset and adjust hyperparameters such as learning rate and batch size.
4. Performance Evaluation: Evaluate the performance of the model on the test set, reporting model accuracy and loss.
5. Results Visualization: Plot the accuracy and loss curves during training, and display examples of misclassified instances.

## Deliverables:

1. The code implementation with appropriate comments.
2. A detailed report on the results, including model accuracy, loss, and justification for your model design.
3. Relevant charts, such as training curves and misclassification examples.