IL2233 - Embedded Intelligence

Project presentation

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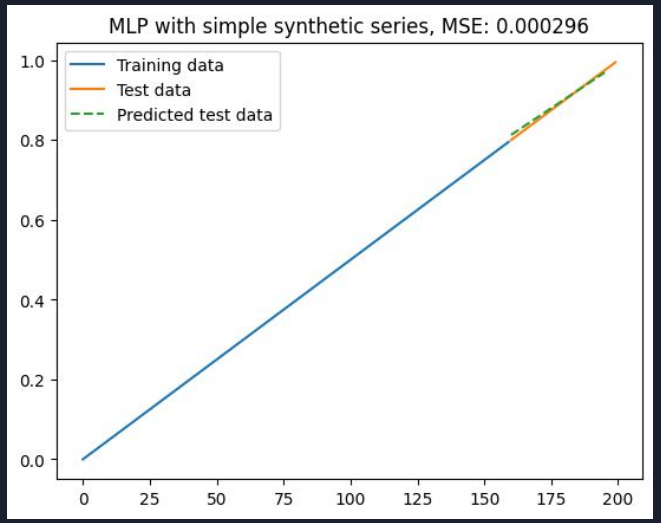
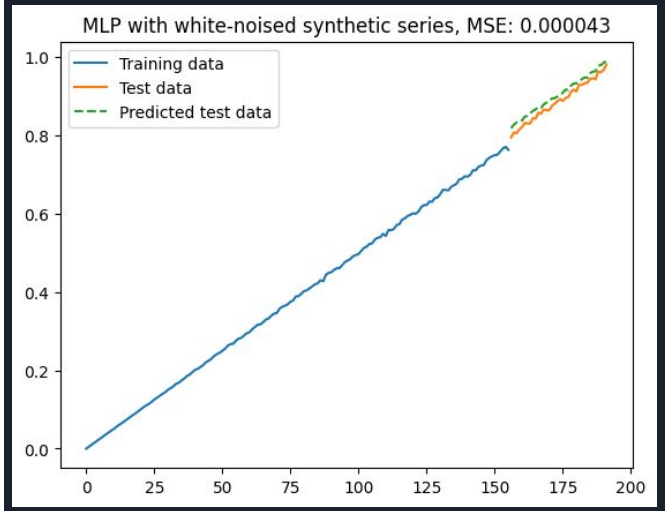
Introduction

- Background
  - Anomaly Detection
- Purpose
  - Learn how to detect anomalies
- Setup
  - Python : Programming language
  - PyTorch, Keras : Neural Network modules
  - Statstools, Scipy, Numpy, Pandas : Various tools for data handling, metrics, etc.
  - Matplotlib : Plotting
  - VSCode, Github : Workflow
- Methods
  - Time-series prediction with neural networks and ARIMA-process
  - Decomposition-based anomaly detection
  - Prediction-based anomaly detection
  - Clustering-based anomaly detection

Task 1.1

Prediction with MLP, RNN, LSTM, using synthetic series





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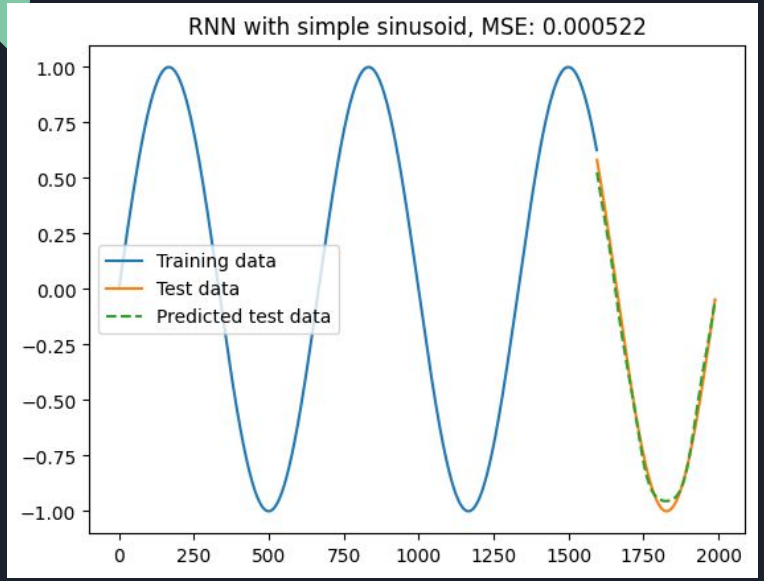

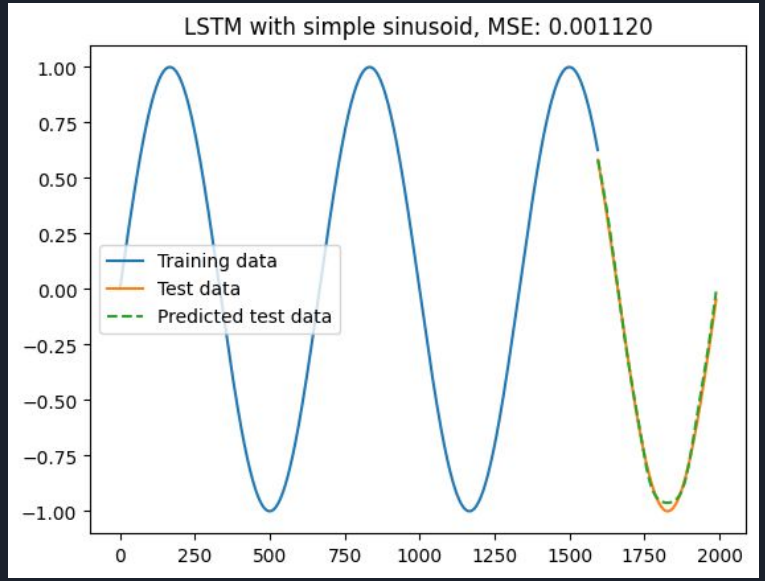

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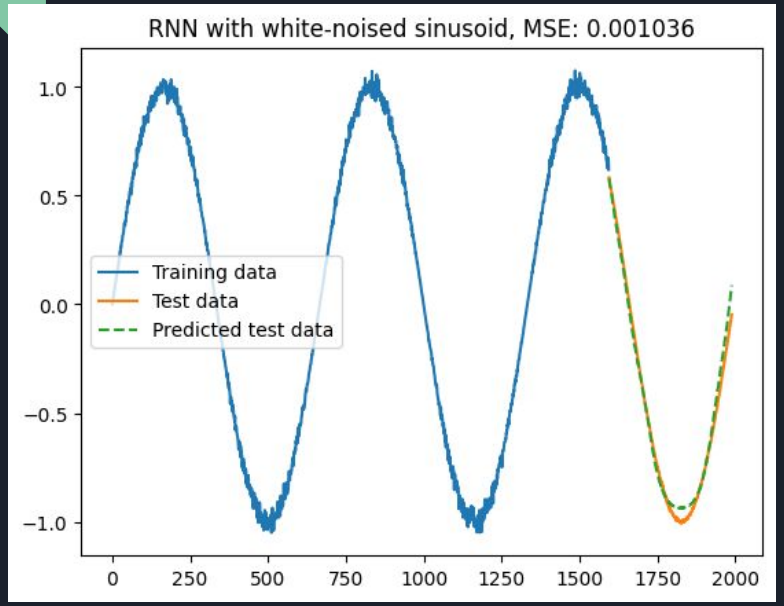
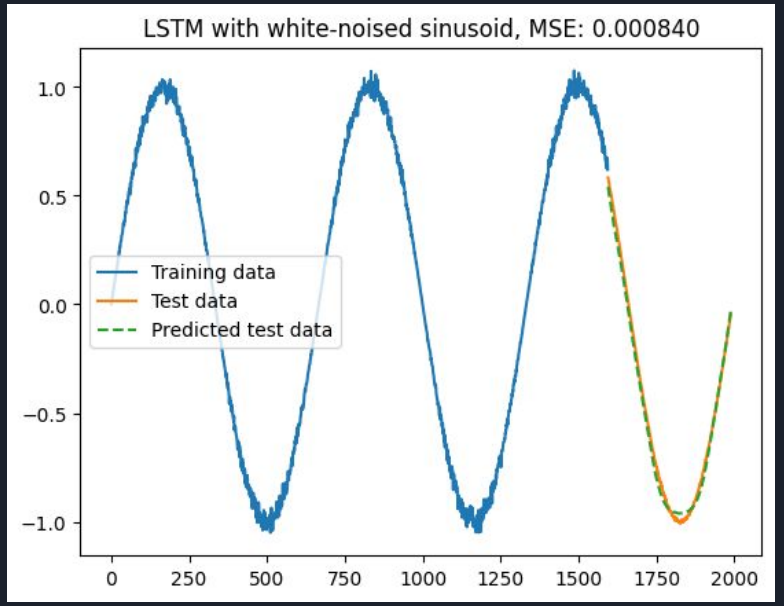




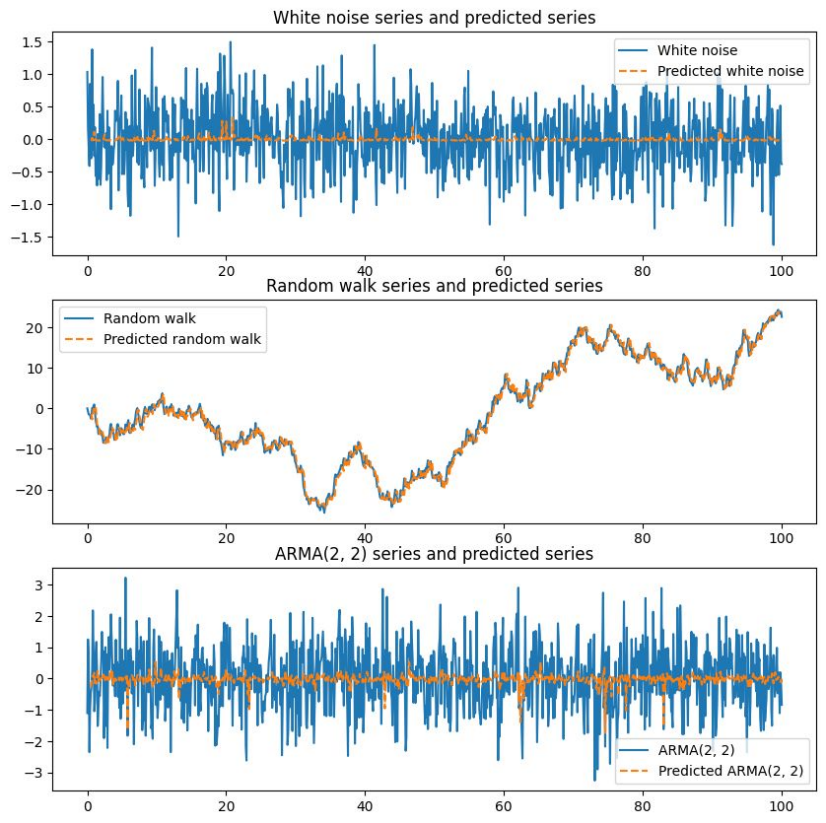
Task 1.2

Predict white noise, random walk, and ARMA process using NN

Series	MSE
White Noise	0.2285
Random Walk	1.3837
ARMA(2, 2)	0.9802

Task 1.2

Predict white noise, random walk, and ARMA process using NN



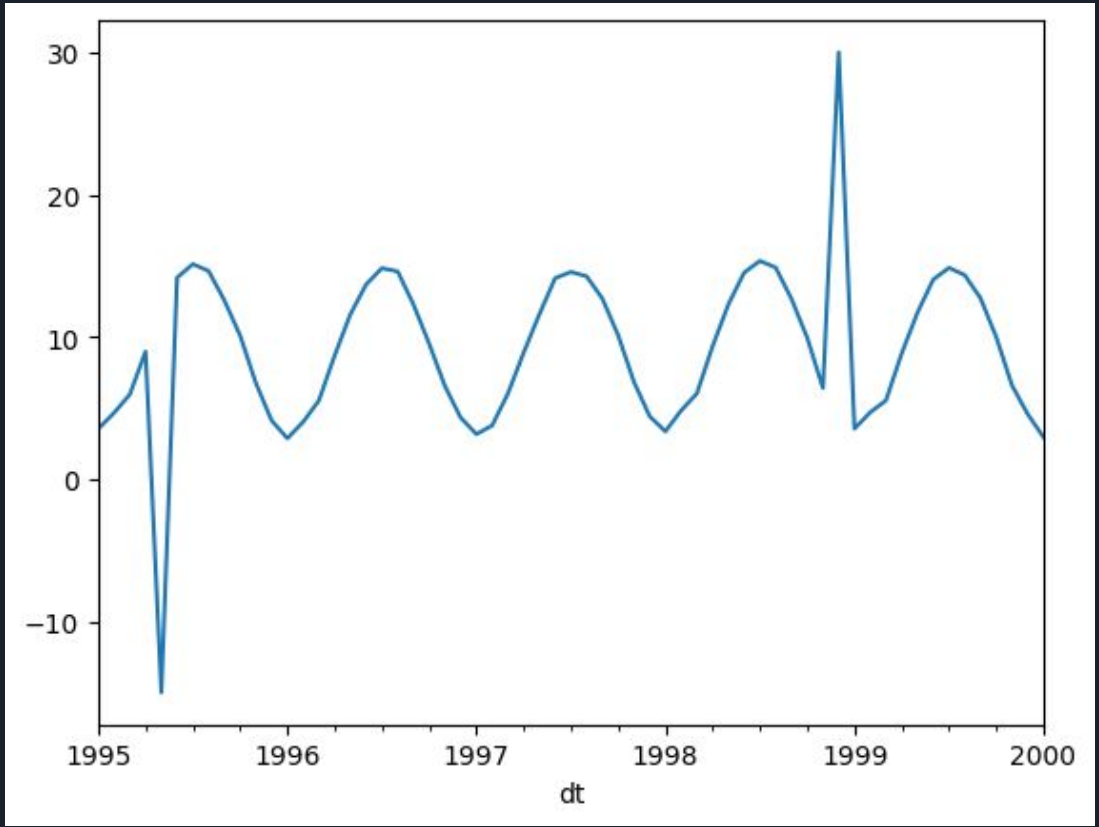
Task 1.3

Comparison with ARIMA-based modeling and prediction

	MLP	RNN	LSTM	ARIMA
MSE	27168008400014944	13383429941157064704	1383429928908566528	0.0015
MAE	128959329	2987257672	2987257670	0.0308
MAPE	0.0525	1.0000	1.0000	0.0667

Task 2

Decomposition-based anomaly detection



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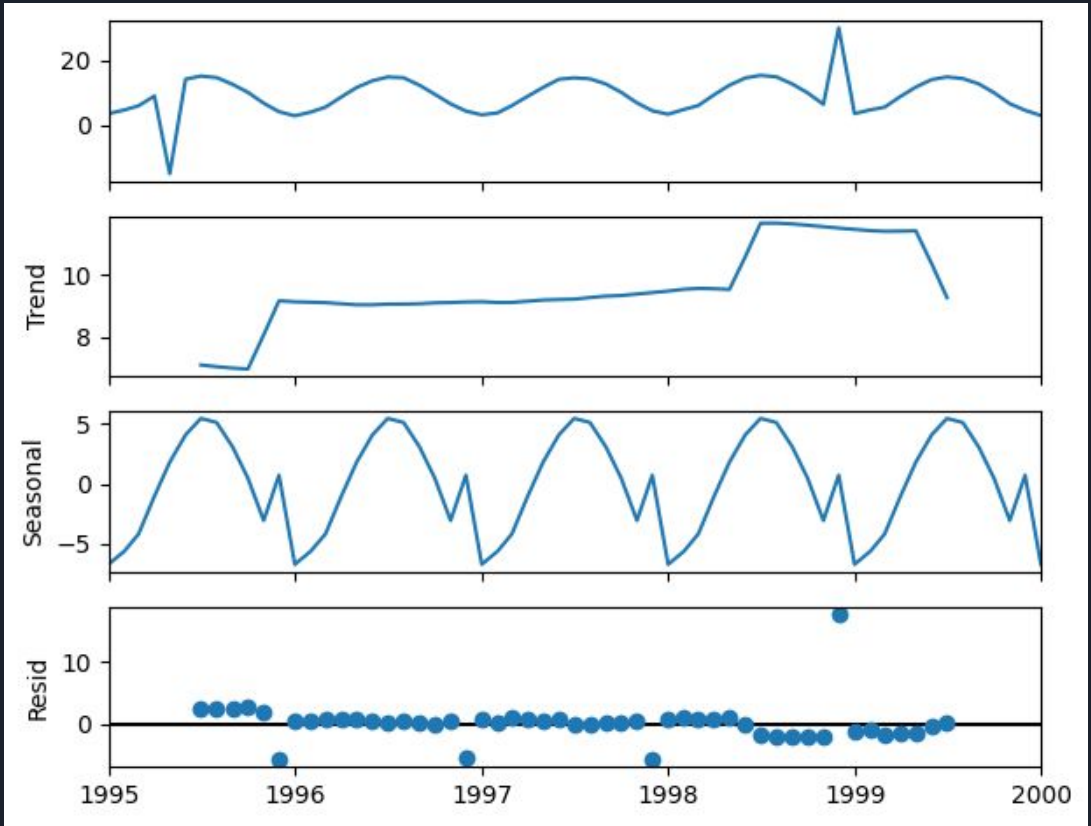

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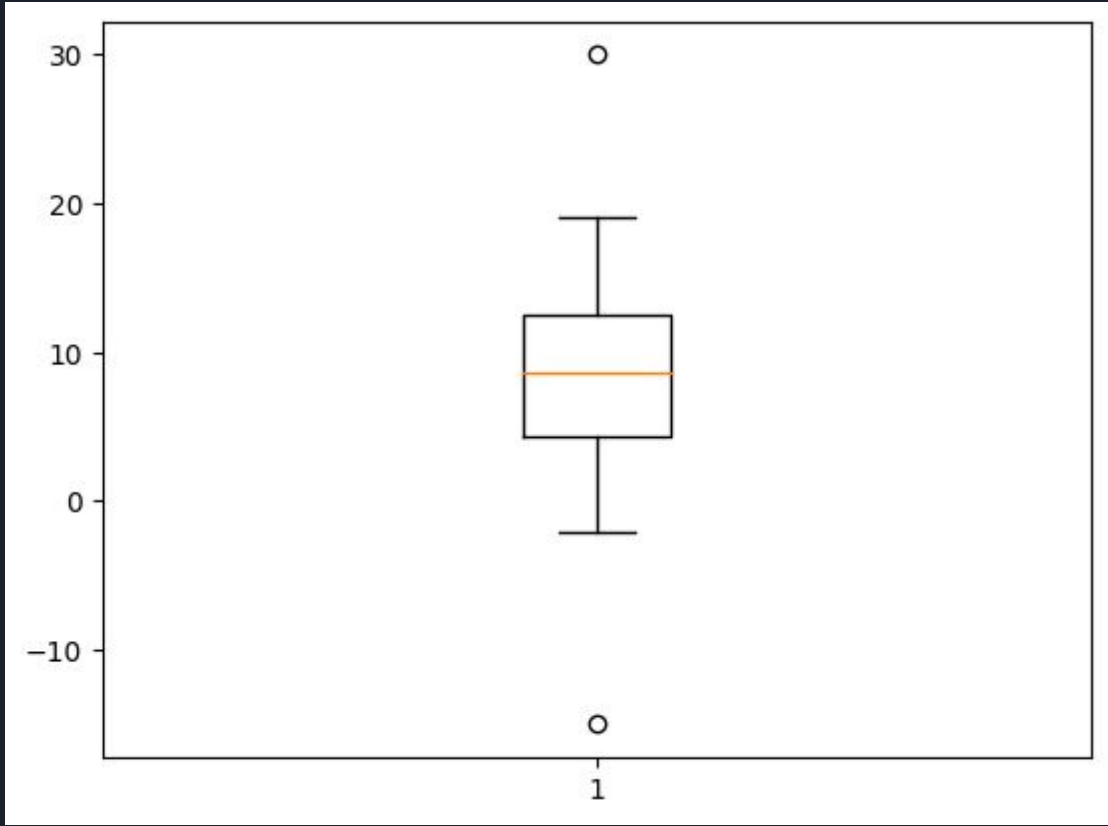
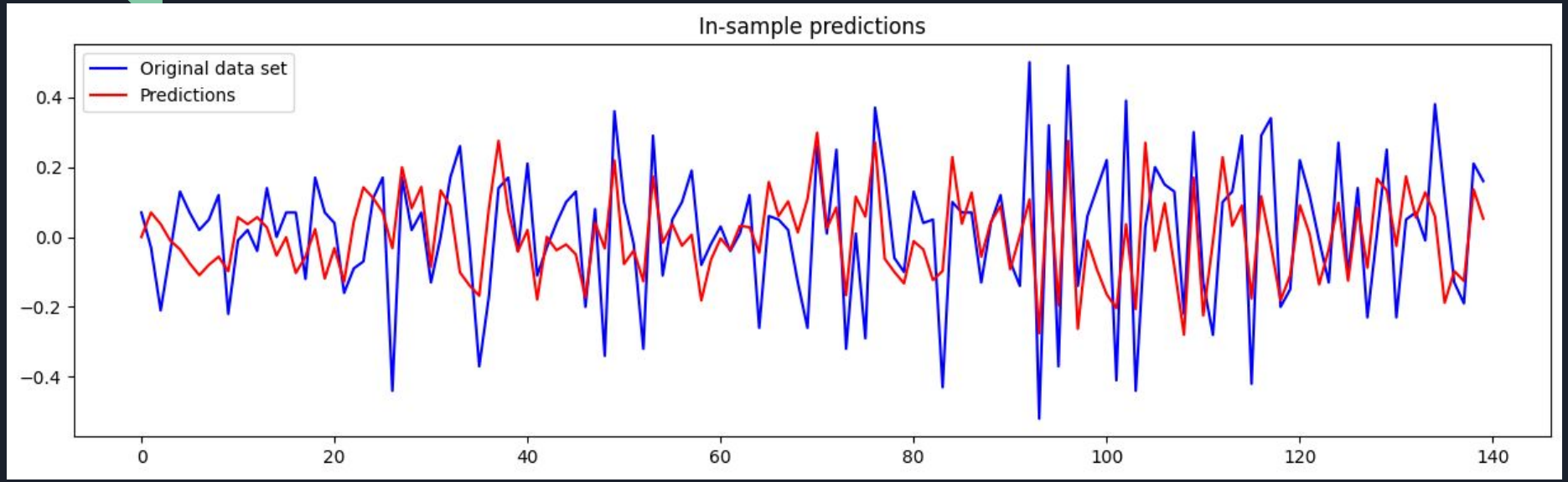


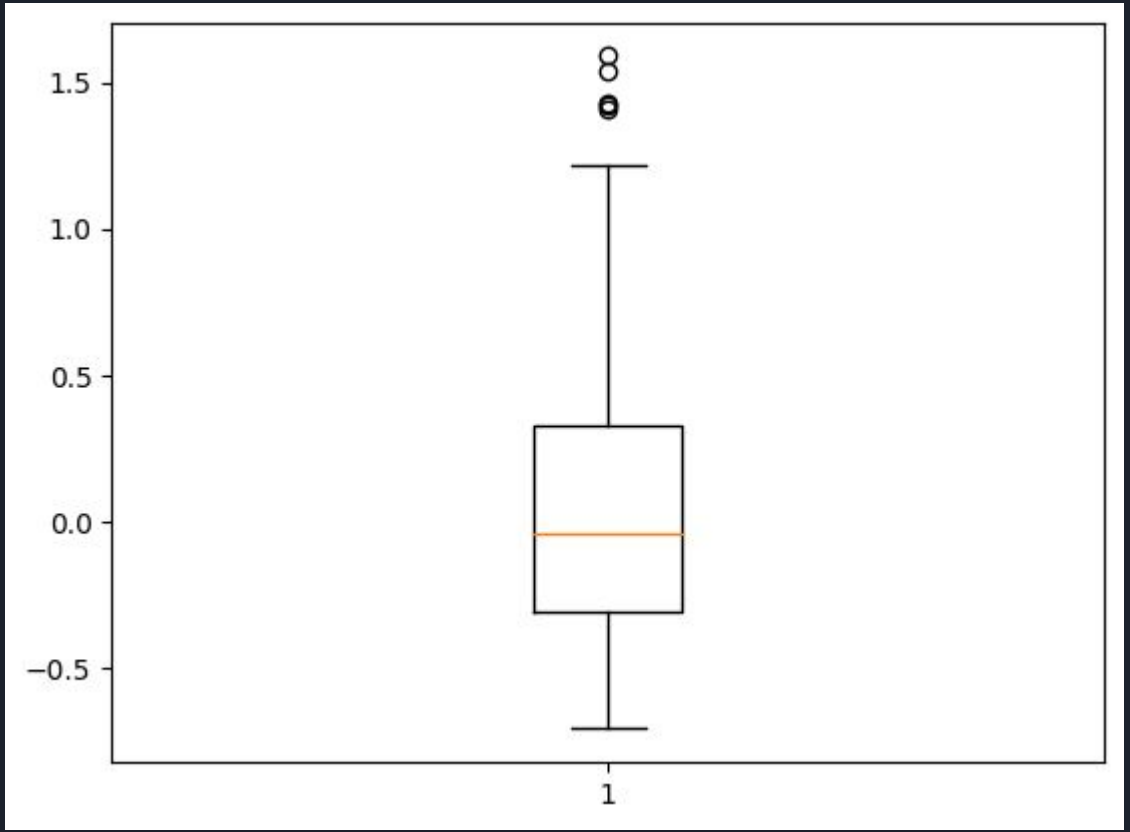
Task 3.1

Prediction-based anomaly detection



Task 3.1

Anomaly detection for uni-variate series with ARIMA



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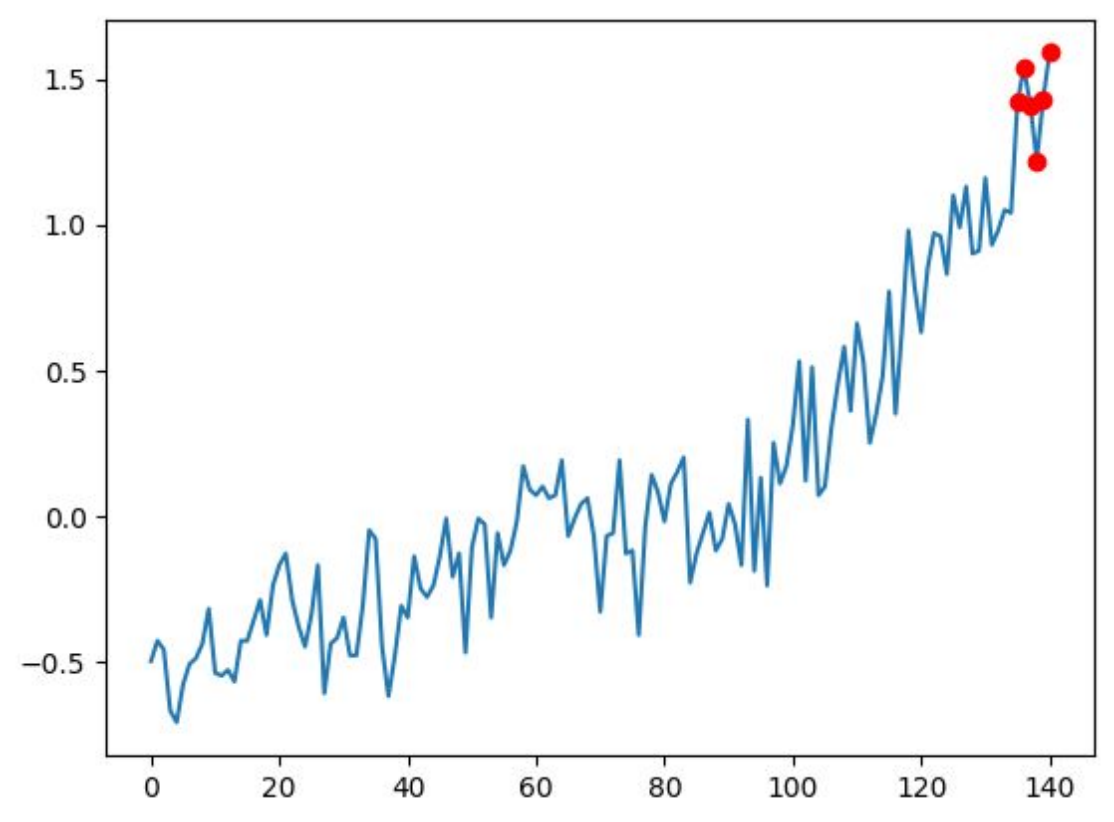
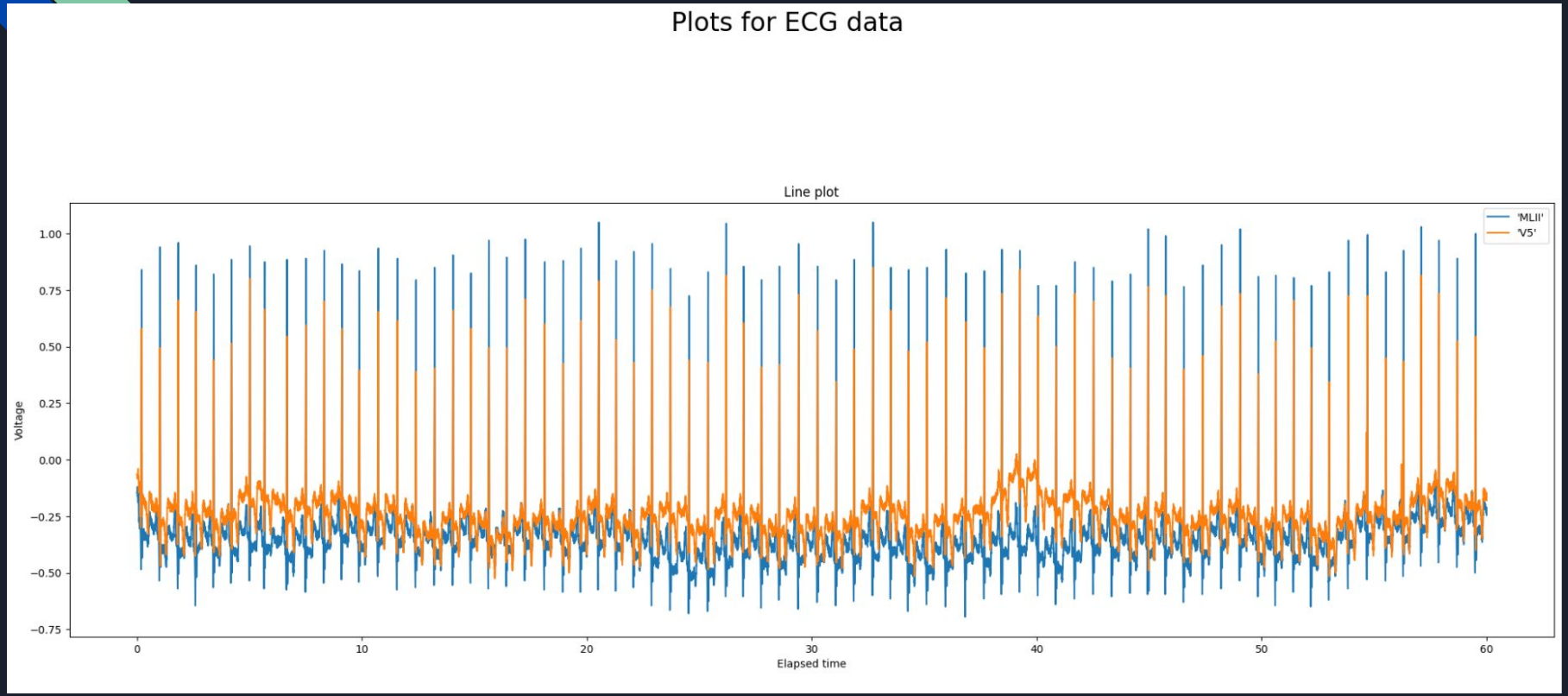


Task 3.2 Anomaly detection with LSTM in ECG signals



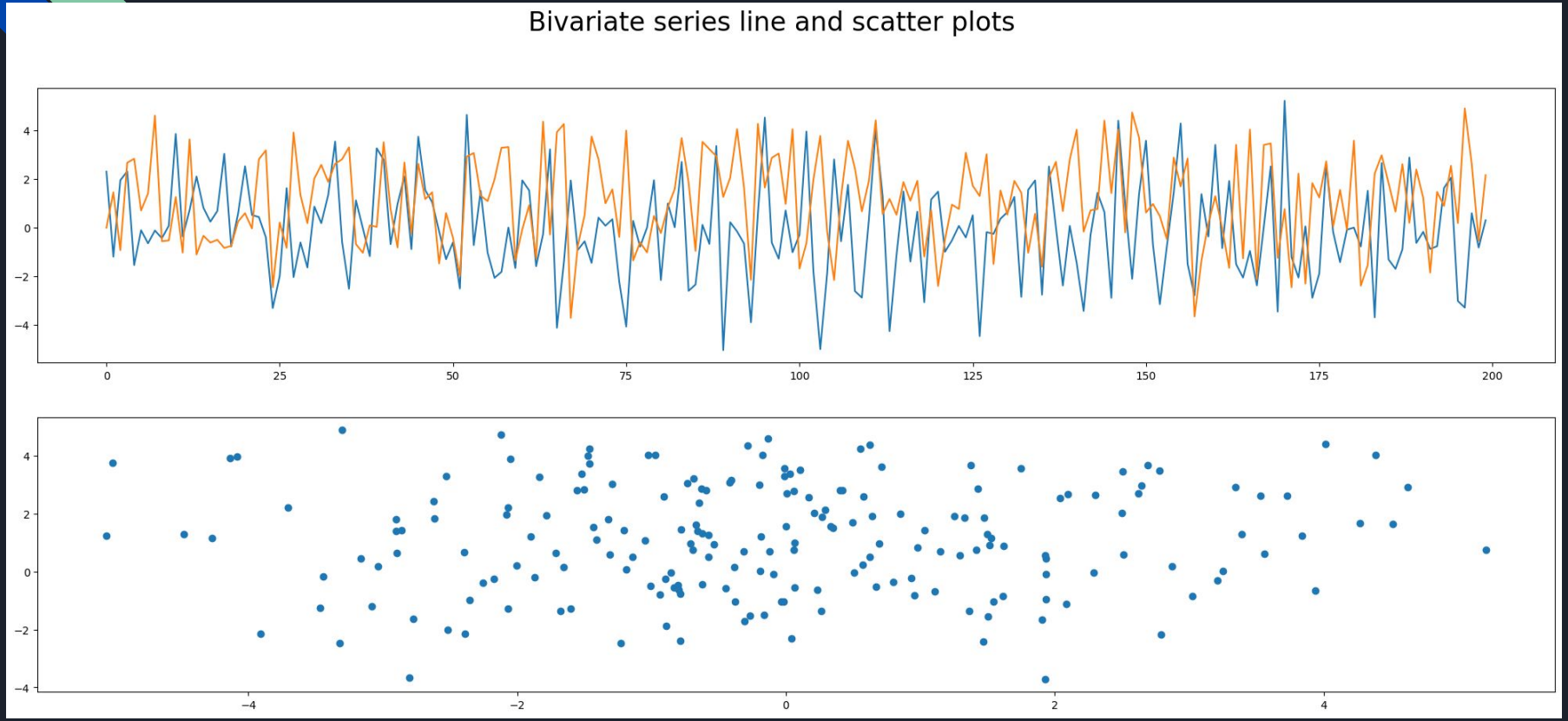
Task 3.2

Anomaly detection with LSTM in ECG signals

		MLII	V5
Input size	4		
MSE		0.0090	0.0090
MAE		0.2004	0.1831
MAPE		71.5060	107.9604

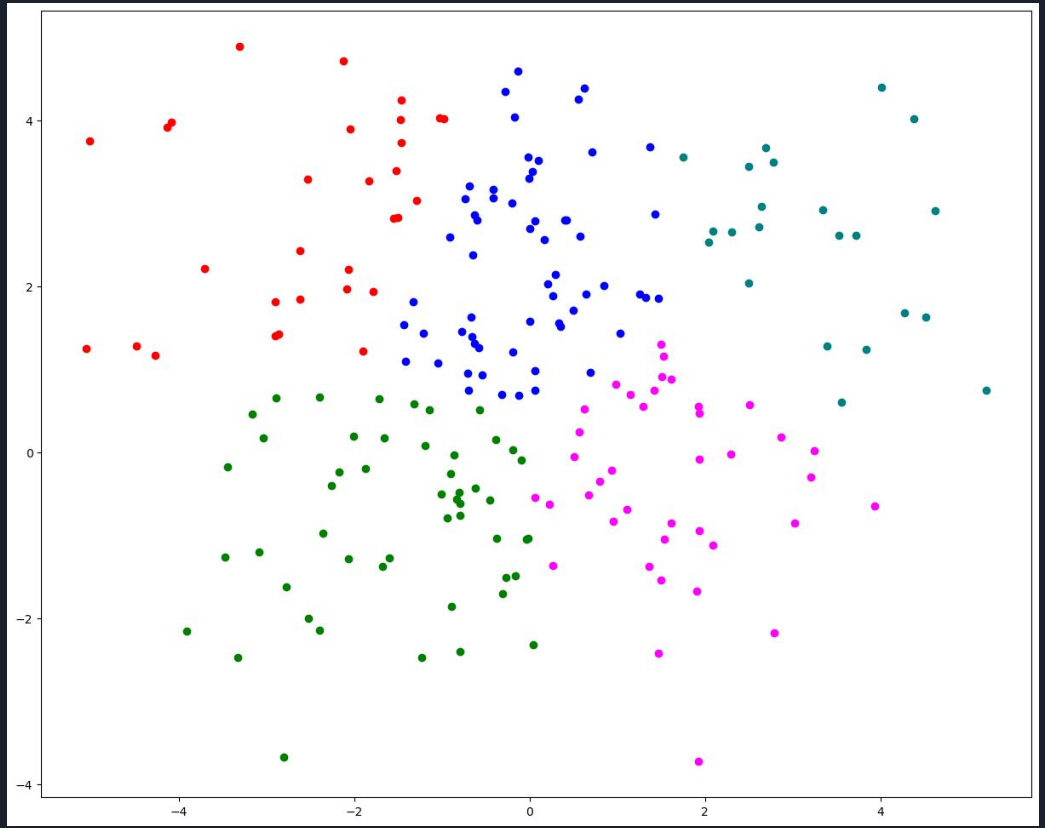
Task 4

Clustering-based anomaly detection



Task 4

K-Means Clustering



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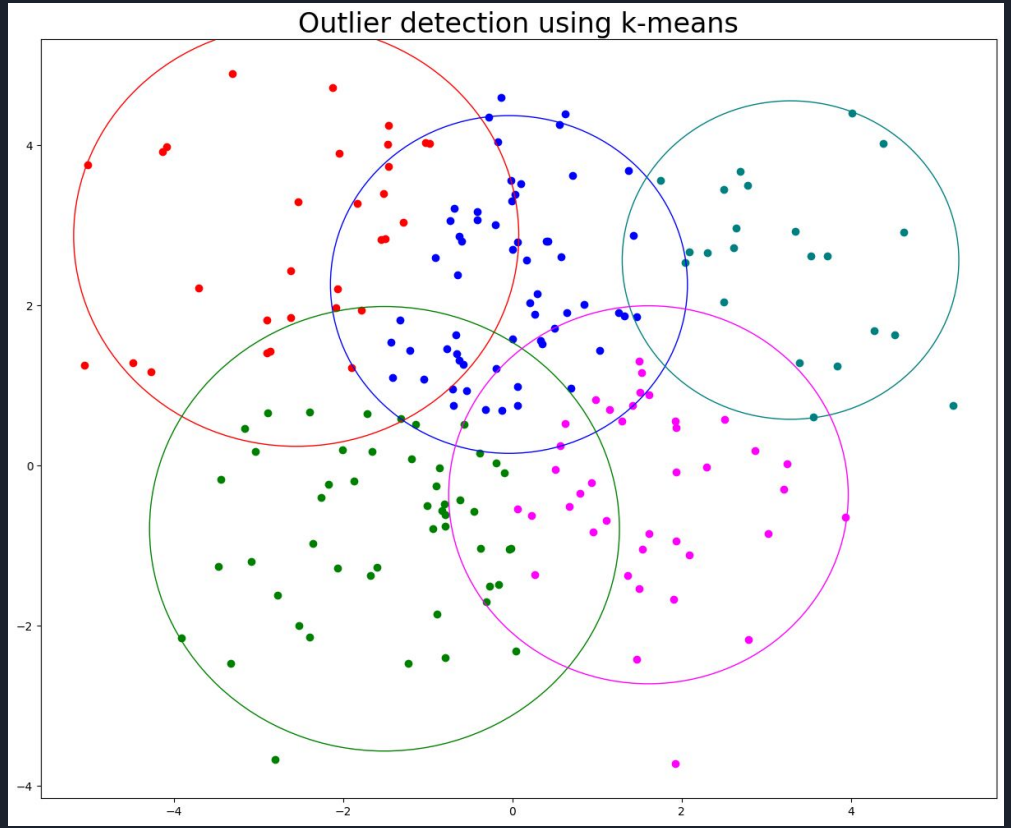

Summary

- Statistical approach: ARIMA
- Neural Networks: MLP, RNN, LSTM
- Clustering: K-Means, SOM

Thank you for your patience!