COMP40370 Practical 4

ADVANCED BTC PRICE PREDICTION (Part B)

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Assignment Files

- ./Practical-04-B.pdf — Assignment questions (this file).
- ./requirements.txt — Python environment requirements
- ./*BTCUSDT-1m.zip* — Data file for the question.
  - ./training/
  - ./validation/
  - ./test/

Expected output files

- ./Practical-04-report.pdf — The final academic report in PDF format.

Overview

This practical is a mandatory, graded assignment that builds upon the optional work from Practical 3. The objective is twofold: (Part A) to implement and thoroughly compare a selection of advanced machine learning and deep learning models to enhance the baseline BTC price trend prediction task; (Part B) to communicate your methodology, results, and findings in a formal academic report.

In this part, you will write a formal academic report detailing the work you conducted in Part A. The report should be written as if for a scientific conference.

Dataset Description

The dataset contains BTCUSDT (Bitcoin/Tether) 1-minute candlestick data:

Features

`open_time`:	Opening timestamp in milliseconds
`open`:	Opening price
`high`:	Highest price during the interval
`low`:	Lowest price during the interval
`close`:	Closing price
`volume`:	Trading volume
`close_time`:	Closing timestamp in milliseconds

Data Split

Training:	2024 (Jan-Dec)	~527,000 rows
Validation:	2025-01	~44,000 rows
Test:	2025-02 to 2025-04	~128,000 rows

Your Tasks

1. **Content Requirements:**

The report must be a self-contained document that clearly presents your project. It should follow a standard academic structure, including (but not limited to):

- Abstract
- Introduction: Introduce the problem, its significance, your approach, and contributions.
- Related Work: Briefly review existing literature on using ML/DL for financial forecasting.
- Methodology / Experiments: Detail the dataset, your feature engineering process, and the architectures of all models you implemented (especially your custom model).
- Results: Present the performance results of your models, using tables and figures. Focus on the test set performance.
- Discussion / Analysis: Critically analyse the results. Compare the models, explain why certain models performed better than others, and discuss any potential signs of overfitting or other limitations.
- Conclusion: Summarise your findings and suggest potential directions for future work.
- References

2. **Formatting and Submission:**

You must use the provided IEEE conference template:
https://www.ieee.org/conferences/publishing/templates.html

The report must be between 4 and 8 pages in length. This page limit excludes the bibliography/references and any appendices. An ideal submission is around 5 pages; 8 pages is a hard limit, not a target.

You are permitted to use AI tools for assistance, but you are fully responsible for the factual accuracy and integrity of all submitted content. Plagiarism will not be tolerated. All the external content must be cited (including AI-generated content).

The final report must be submitted as a single PDF file (Practical-4-report.pdf).

3. **Grading Dimensions:**

In Part B, grading will be based on the following five dimensions:

- **Requirement Complete:** Submission compliance requirements, such as the correct template, length, and structure conform to academic paper standards, with proper citation of references.
- **Literature**: Review whether there is a comprehensive and professional review of relevant literature, and clarify its relationship to this study.

- **Presentation**: Review writing style and clarity, presentation of figures and diagrams. This also includes the presentation quality of sections such as experimental setup, dataset metadata, and experimental methods.
- **Analysis**: Review the analysis of experimental results, including whether it incorporates error analysis, feature importance analysis, model improvement ablation experiments, limitations of the current study, and reflections.

HELPFUL RESOURCES

TensorFlow Documentation: https://www.tensorflow.org/api_docs

PyTorch Documentation: https://pytorch.org/docs/stable/index.html

Scikit-learn Documentation: https://scikit-learn.org/stable/

The final deadline for the submission of Practical 4 (Part A and B) is Sunday, 30th of November at 23:59. Part A submissions should be in a single file with FirstName_LastName-P4.zip (or tar.gz) format. Part B submissions should be in a single PDF file. All submissions must be done in Brightspace.