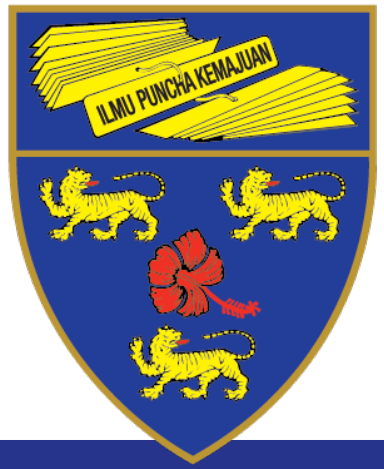

UNIVERSITI MALAYA

Utilizing Numerical Integration in Deep Learning for Forecasting in Time-Series Datasets

Group CSBS1

Supervisor: Dr Suzan J. Obaiys

Table of Contents

Group Member List

Group Member List

Name	Matrix Number
BELDON LIM KAI YI	22059390
CHONG JIA YING	U2102853
HUMYRA TASMIA	S2176677
MASYITAH HUMAIRA BINTI MOHD HAFIDZ	U2000518
MUHAMMAD BAKHTIAR BIN MOHAMAD HARUN KAMAL	U2100679
MUHAMMAD IKRAM BIN JAAFAR	U2100632

Introduction

Introduction

- The usual fields applying the tasks:
  - Healthcare
  - Weather
  - Traffic
- The challenges in forecasting
- What are similar models and their limitations:
  - ARIMA
  - SARIMA
  - Statistical Methods
- Add a brief overview of how numerical integration contributes to forecasting.

Problem Statement and Hypothesis

Problem Statement and Hypothesis

- Problem Statement
  - The problem addressed in this study is the accuracy and efficiency of forecasting time series data using hybrid numerical integration and deep learning models.

- Hypothesis
  - The hybrid model combining numerical integration and deep learning will provide more accurate and robust time-series forecasting than standalone methods.

Objective

Objective

Objective

- To develop and evaluate the deep learning model based on LSTM and numerical integration by comparison of the MAE, MSE, MSLE, R^2, IA, MAPE and SMAPE metrics comparison using a predefined time-series dataset to address gaps in forecasting by leveraging numerical and deep learning techniques.

Methodology

Methodology

1. **Dataset collection (prefer time-series)**
   - NYC taxi passengers
   - Why we choose this and why is it suitable:
     - Type
     - Properties
     - Relation to other course assignment
     - Anomaly
2. **Understanding the numerical Integration methods**
   - Define the methods you'll use (e.g., Trapezoidal Rule, Monte Carlo methods).
   - Explain how numerical integration results will be used to forecast or preprocess data for deep learning models:
     - Integration outputs:
     - Cumulative sums
     - Rate of change
     - Numerical integration is applied to calculate cumulative trends over time, which serve as additional features for the LSTM model.

Methodology (cont'd)

3. **Data preprocessing & preparation**
   - Time-series preprocessing:
     - Trend extraction
     - Seasonality Analysis
   - Describe the steps in more detail:
     - Handling missing values.
     - Normalizing/standardizing data.
     - Splitting into training and testing datasets.
4. **Understanding deep learning models structures**
   - LSTM:
     - Explain its capability.

Methodology (cont'd)

5. **Process of Hybrid Models**

- Specify how you'll combine numerical integration with deep learning:
  - Use integration results as features for the deep learning models.
  - Apply numerical integration to validate predictions or enhance training.
- Clarify the process of combining outputs from numerical integration with deep learning:
  - Are NI results used directly as input features?
  - Are they applied to preprocess or smooth the data?

6. **Performance Metrics / Error Analysis**

- Include error analysis methods:
  - MAE
  - MSE
  - MSLE
  - R^2
  - IA
  - MAPE and SMAPE

7. **Discuss about the whole procedure of the project**

Results and Discussion

Results and Discussion

- **Comparative Analysis**
  - Present a clear comparison of Numerical Integration (NI), Deep Learning (DL), and the Hybrid model.
  - Use:
    - Bar charts for metric comparison.
    - Line plots for actual and predicted.
    - Confidence intervals.
  - Explain Results
    - Discuss why the hybrid model performs better or worse in specific scenarios.
    - Relate findings to challenges mentioned in the Introduction.
  - Visualizations
    - Incorporate MATLAB visualizations as outlined earlier to enhance clarity.
    - Relate findings to challenges mentioned in the Introduction.

Results and Discussion (cont'd)

- **Ensure clear comparisons:**
  - Standalone numerical integration vs. standalone deep learning vs. hybrid.
  - Use line plots to highlight the difference between actual and predicted values.
  - Include confidence intervals to visualize prediction uncertainty.

Conclusion

Conclusion

- **Ensure the conclusion explicitly addresses the hypothesis:**
  - Did the hybrid approach improve forecasting accuracy?
  - Were there trade-offs, such as increased computational cost?

Future Work

Future Work

- Suggest exploring real-time forecasting applications or scaling the hybrid approach to larger datasets.
- Anomaly Detection

Bibliography

Bibliography

References

- Reference 1: ?
- Reference 2: ?
- Reference 3: ?
- Reference 4: ?

Appendix

Appendix

Appendix content.