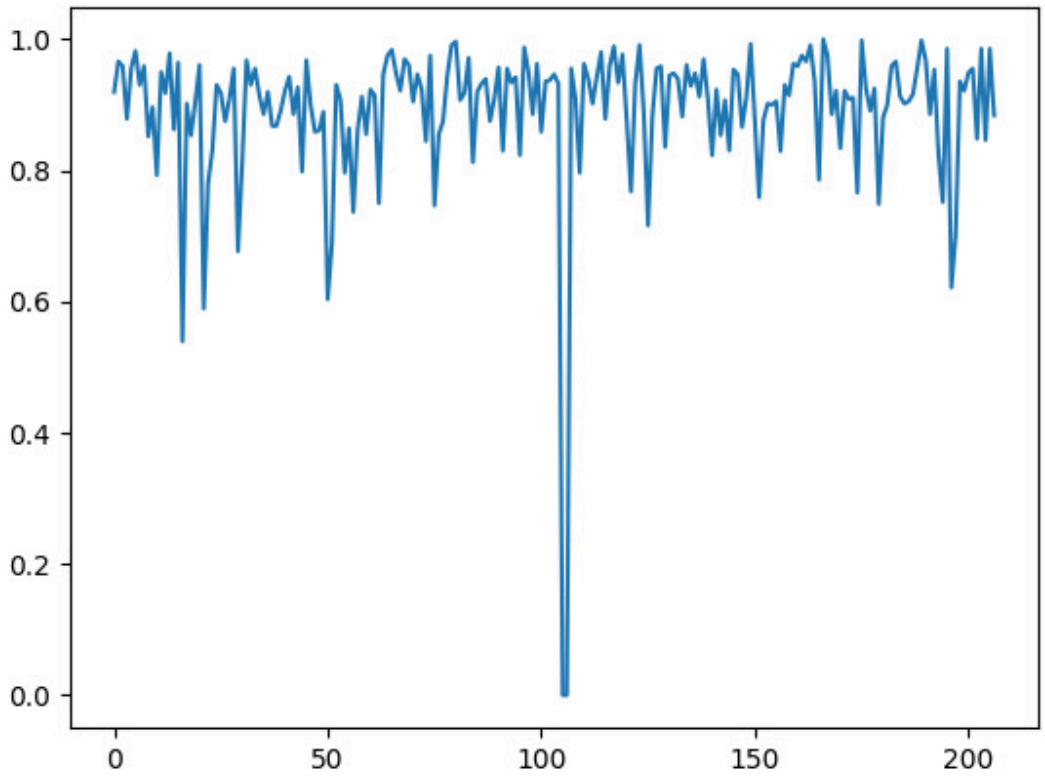
PR-Holistic Traffic Prediction for Smart Cities - Interim Report

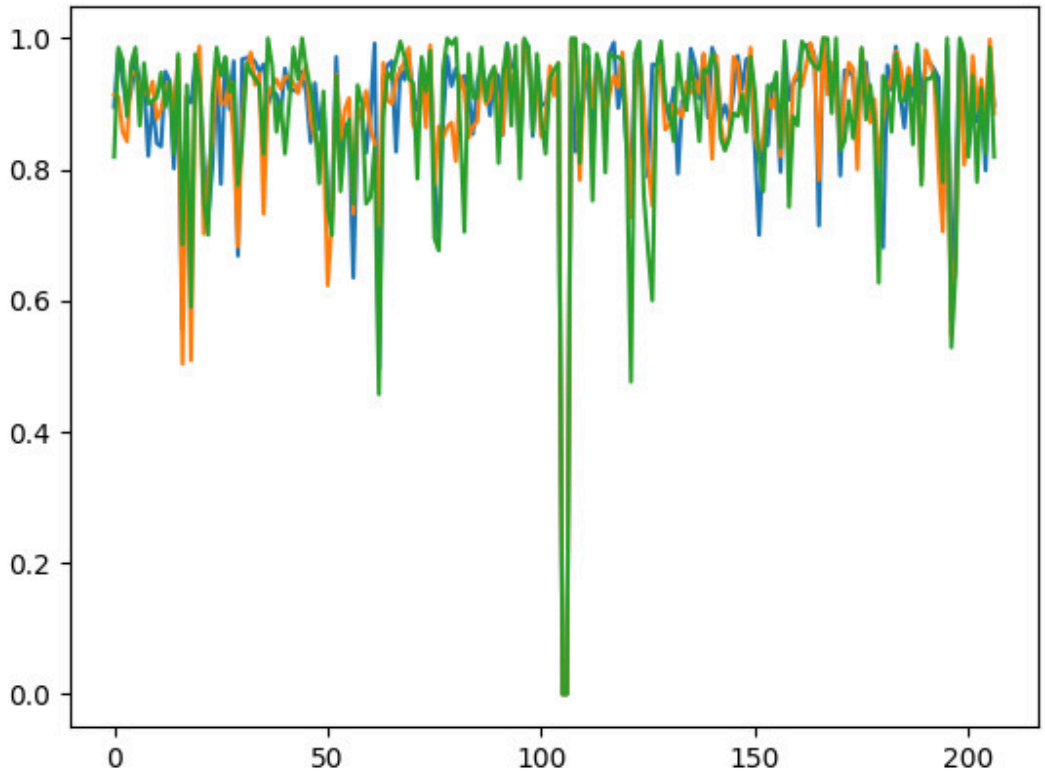
1. Introduction

This report compares the performance of two deep learning models, Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU), for predicting traffic flow using the METR-LA dataset.

a) Visualizations



We see a clear auto correlation



For multiple locations, traffic variation seems to be related as well.

2. Model Architectures

1. LSTM Model:

· Two LSTM layers (64 units and 32 units)

· One Dense layer (207 units)

· Total parameters: 266,639

2. GRU Model:

· Two GRU layers (64 units and 32 units)

· One Dense layer (207 units)

· Total parameters: 205,967

3. Performance Metrics:

Both models were evaluated using the following metrics:

- **Mean Absolute Error (MAE)**: Measures the average magnitude of errors in a set of predictions.
- **Root Mean Squared Error (RMSE)**: Measures the square root of the average of squared differences between predicted and observed values.
- **R-squared (R^2)**: Indicates how well the model explains the variability of the outcome data.

Model	Train RMSE	Test RMSE	Train MAE	Test MAE	Train R^2	Test R^2
LSTM	0.15404960	0.16678380				
GRU	0.15634858	0.16749414	<			

4. Analysis

1. Accuracy:
   - Both models show similar performance, with LSTM slightly outperforming GRU.
   - The LSTM model has a marginally lower RMSE for both training and test sets.
2. Generalization:
   - Both models demonstrate good generalization, with a small gap between training and test performance.

- LSTM: Train-Test RMSE difference of 0.01273420
- GRU: Train-Test RMSE difference of 0.01114556

3. Model Complexity:

- The LSTM model has more parameters (266,639) compared to the GRU model (205,967).
- Despite higher complexity, LSTM provides only a slight improvement in performance.

4. Training Efficiency:

- Specific training times were not provided, but GRU models are generally faster to train due to fewer parameters.

5. Conclusion

Both LSTM and GRU models demonstrate strong performance in predicting traffic flow using the METR-LA dataset. The LSTM model shows slightly better accuracy, but at the cost of increased model complexity. The GRU model, while marginally less accurate, offers a more lightweight architecture that may be beneficial for deployment in resource-constrained environments.