Assignment-3

Time-Series Data

Summary:

The "Simple LSTM-Based Model" had the lowest MAE score of 2.57, outperforming all other models, including the more complex ones and the Naïve Method. This indicates that the model provides the most accurate predictions for the given dataset, making it the best performer among the models listed.

However, models with stacking RNN layers and combinations of convolutional layers with RNN show higher MAE values, indicating that they may not be suitable for the task. The choice of model architecture should be driven by the specific characteristics and requirements of the dataset and task. Further optimization and hyperparameter tuning may be necessary for improving model performance.

Introduction:

Recurrent neural networks can offer several advantages and uses when applied to time series data. Since RNNs can capture temporal dependencies, they are especially effective for analyzing and modelling time series data due to their capacity to handle sequential data.

I started doing assignment by uploading the dataset of temperature forecasting from amazon web services which is amazonaws.com. By using the code reads the file, extracts the file, and printed the number of variables and number of rows. Then I got the results as follows:

Based on the Analysis:

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| --- | --- | --- |
| MODELS | | TEST MAE |
| Naïve Method | | 2.62 |
| Densely Connected Network Model | | 2.68 |
| 1D Convolutional Model | | 3.25 |
| Model with sequence of any length Model | | 9.94 |
| Stacking RNN Layers | | 9.93 |
| Simple LSTM\_ Based Model | | 2.57 |
| Dropout Regularized LSTM Model | | 2.83 |
| Stacked LSTM- Based with 16 units | | 2.62 |
| Stacked LSTM- Based with 32 units | | 2.68 |
| Stacked LSTM- Based with 8 units | | 2.65 |
| Stacked LSTM- Based with 64 units | | 2.71 |
| LSTM-Dropout, Stacked Model | | 2.78 |
| Combined 1D Convolutional with RNN Model | | 3.85 |
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Based on the above observations:

Among all the models tested, this model achieved the highest accuracy in predictions with the lowest Mean Absolute Error (MAE) of 2.57. Several models have achieved competitive performance with low Mean Absolute Error (MAE) values, including the Naïve Method (MAE: 2.62), the Dropout Regularized LSTM Model (MAE: 2.83), and Stacked LSTM-Based Models with varying units (e.g. 16, 32, 8, 64) (MAE: various). While these models perform well, it is worth noting that they may not be as accurate as the best-performing model. Here are the Model Accuracy (MAE) results: - Densely Connected Network Model (2.68) - 1D Convolutional Model (3.25) - Combined 1D Convolutional with RNN Model (3.85) - Stacking RNN Layers (9.93) - Model with sequence of any length Model (9.94). It is worth nothing that the last two models have the highest MAE values, suggesting lower prediction accuracy in comparison to the top-performing models.

The below graph shows the graph between Model and Test MAE:

A graph with red dots

Description automatically generated

Conculsion:

The “Simple LSTM- Based Model” stands out as the top-performing model demonstrating the lowest MAE of 2.57. The optimal model for temperature forecasting is the "Simple LSTM-Based Model," but selecting the perfect model necessitates a thorough comprehension of the dataset, task prerequisites, and the delicate balance between model intricacy and predictive precision.