Time series Assignment 3 Report

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Introduction:

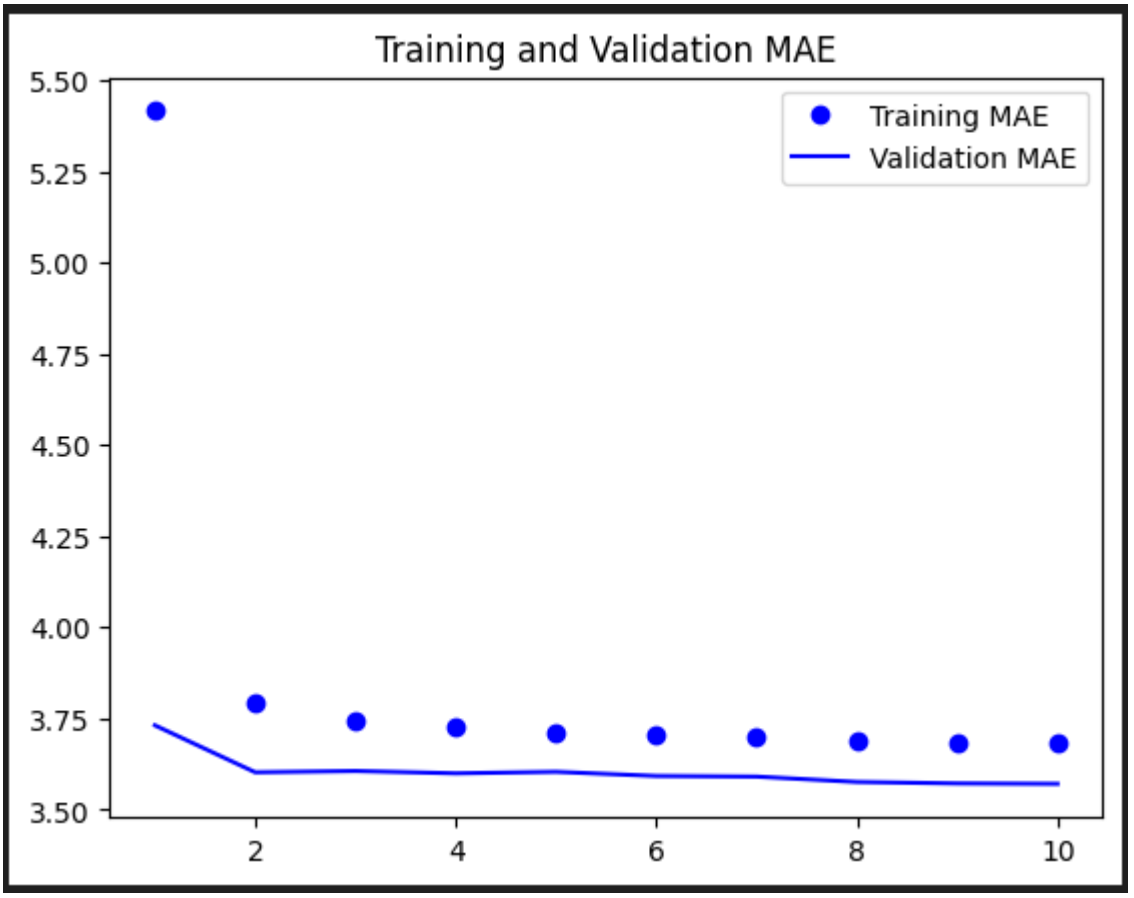
This assignment examines the application of various deep learning models to predict temperature using the Jena weather dataset, consisting of 420,451 samples and 15 weather-related variables. The primary objective is to explore and evaluate the performance of different neural network architectures for time series forecasting.

Data Preprocessing:

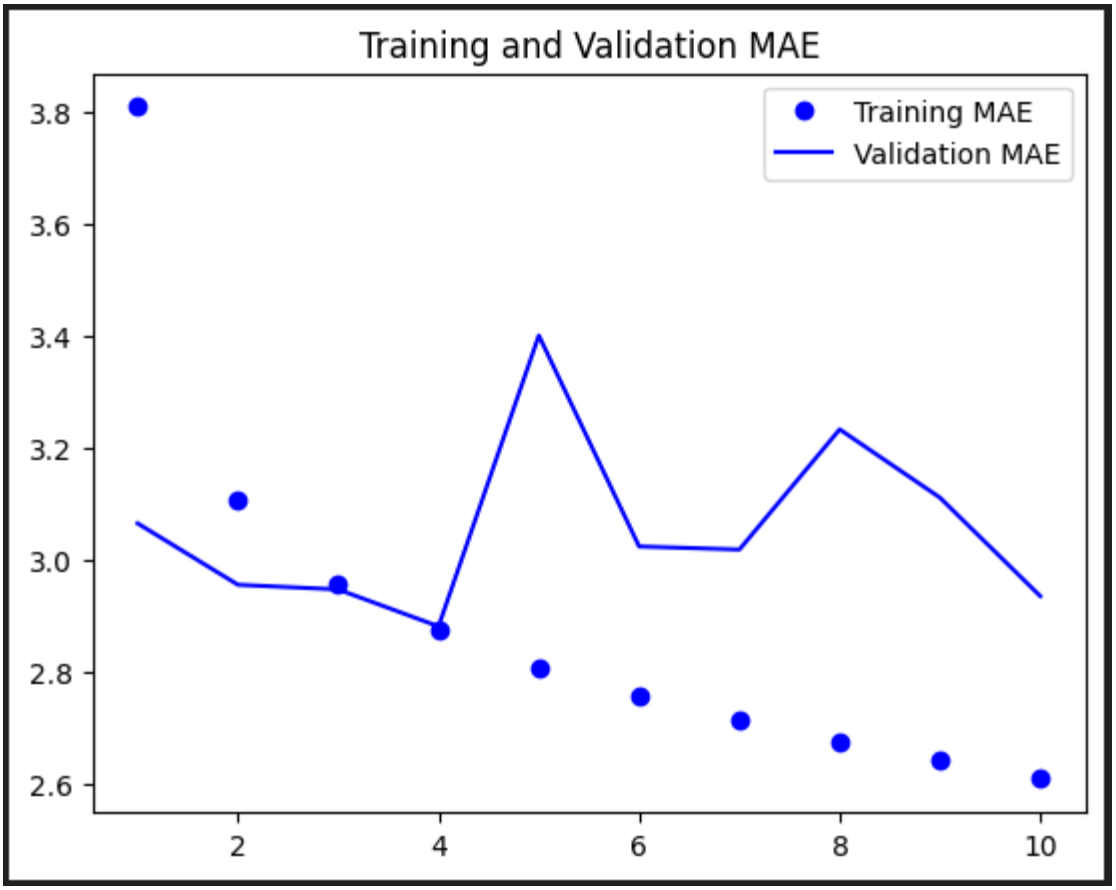
The data is normalized by subtracting the mean and dividing it by the standard deviation of the set. It is then split into separate sets for training, validation, and testing.

Results:

Basic Dense model: A densely connected neural network model obtains a validation MAE of 3.79 and a test MAE of 3.80.

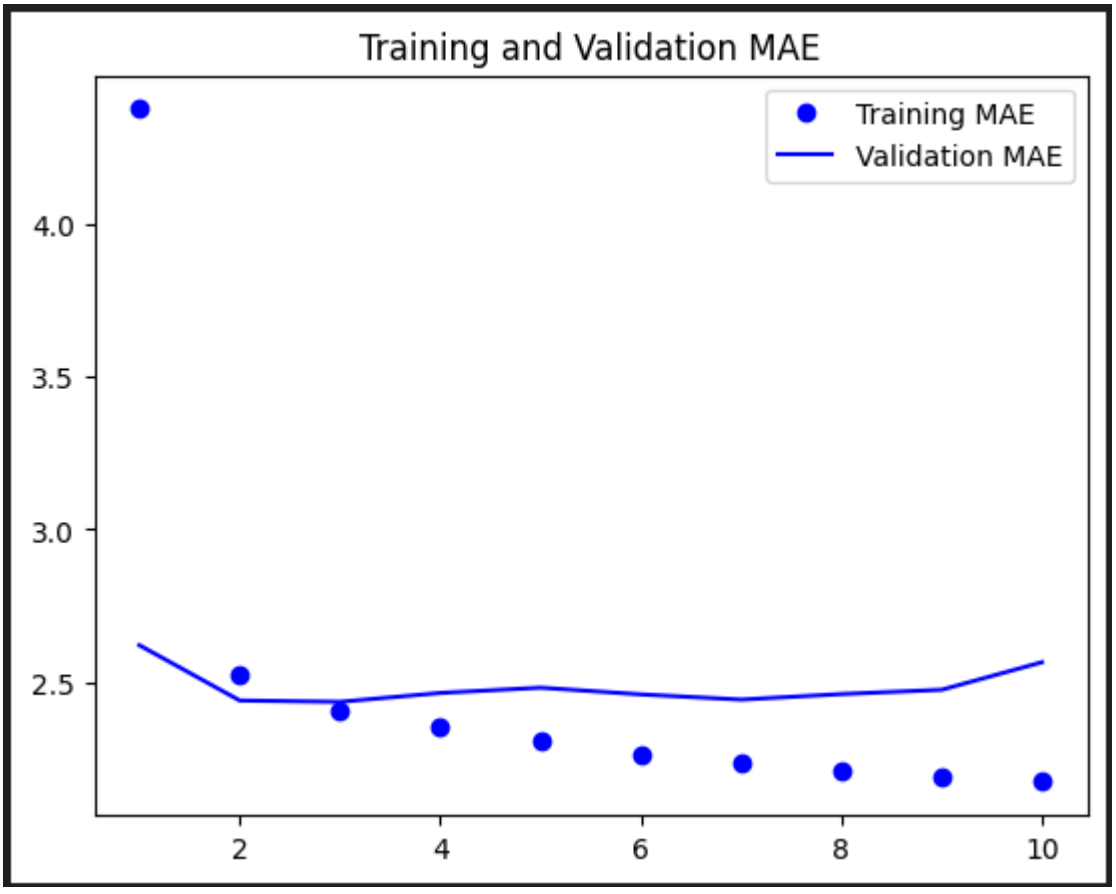


Convolutional model: The validation MAE of a 1D convolutional neural network model is 3.06, and the test MAE is 3.06.

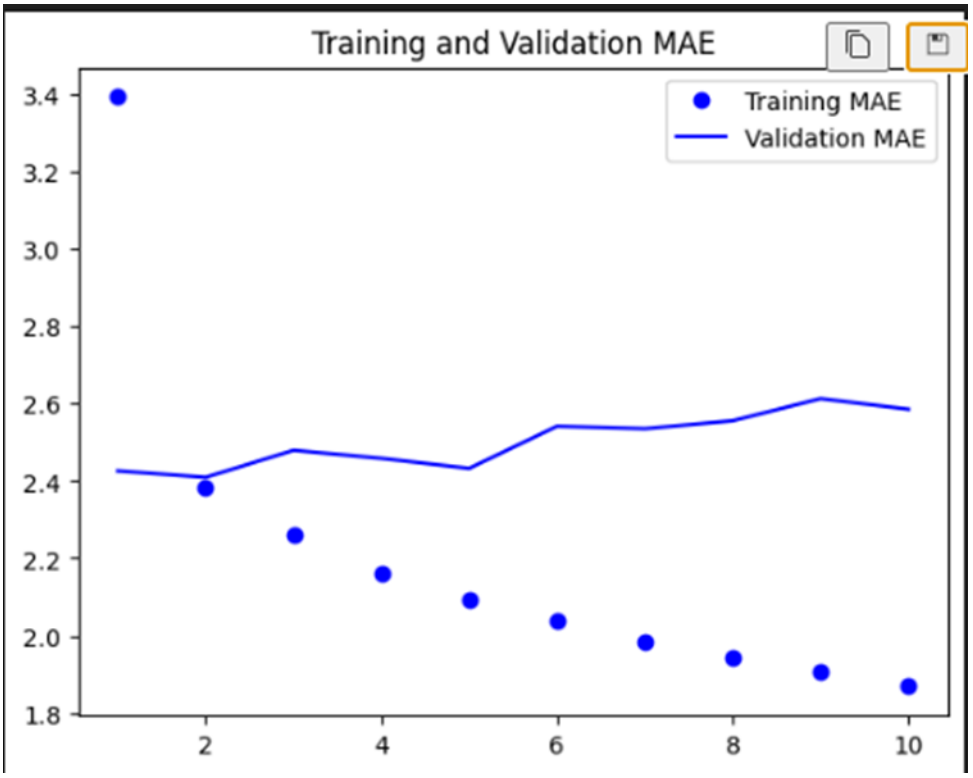


LSTM models:

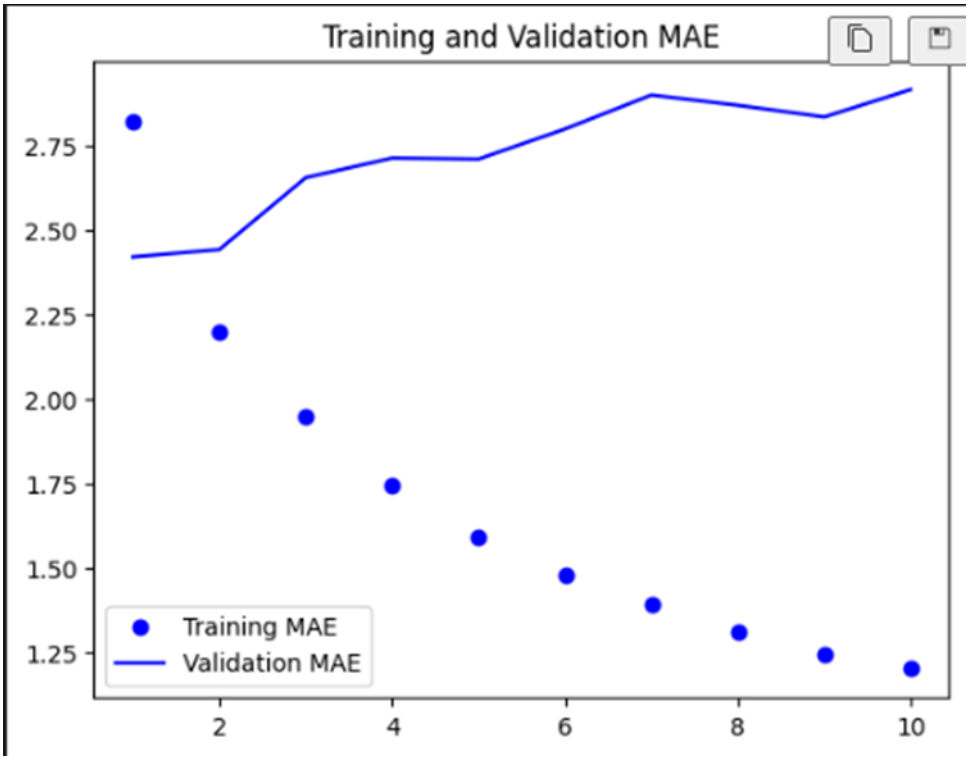
Simple LSTM with Dense 16: Validation MAE 2.5188, Test MAE 2.53



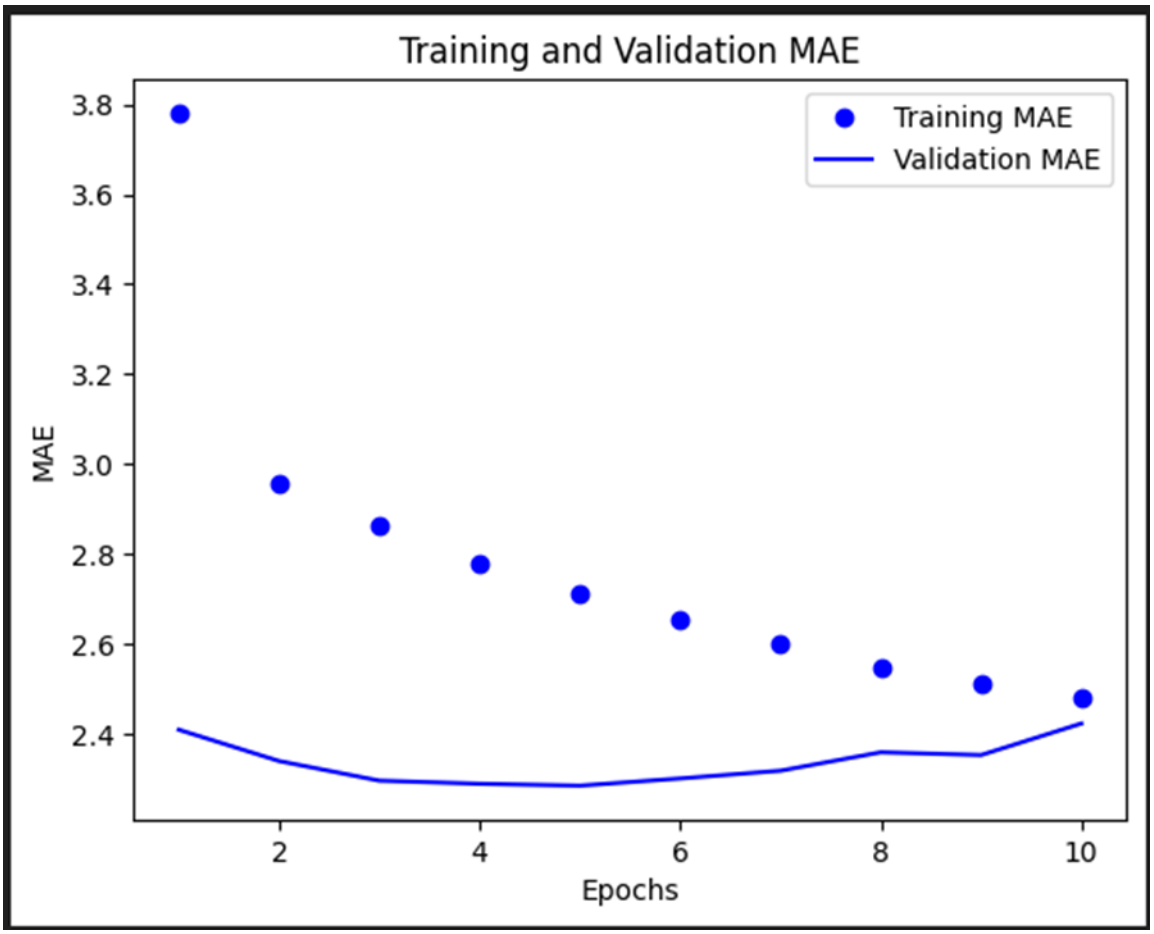
Simple LSTM with Dense 32: Validation MAE 2.5761, Test MAE 2.59



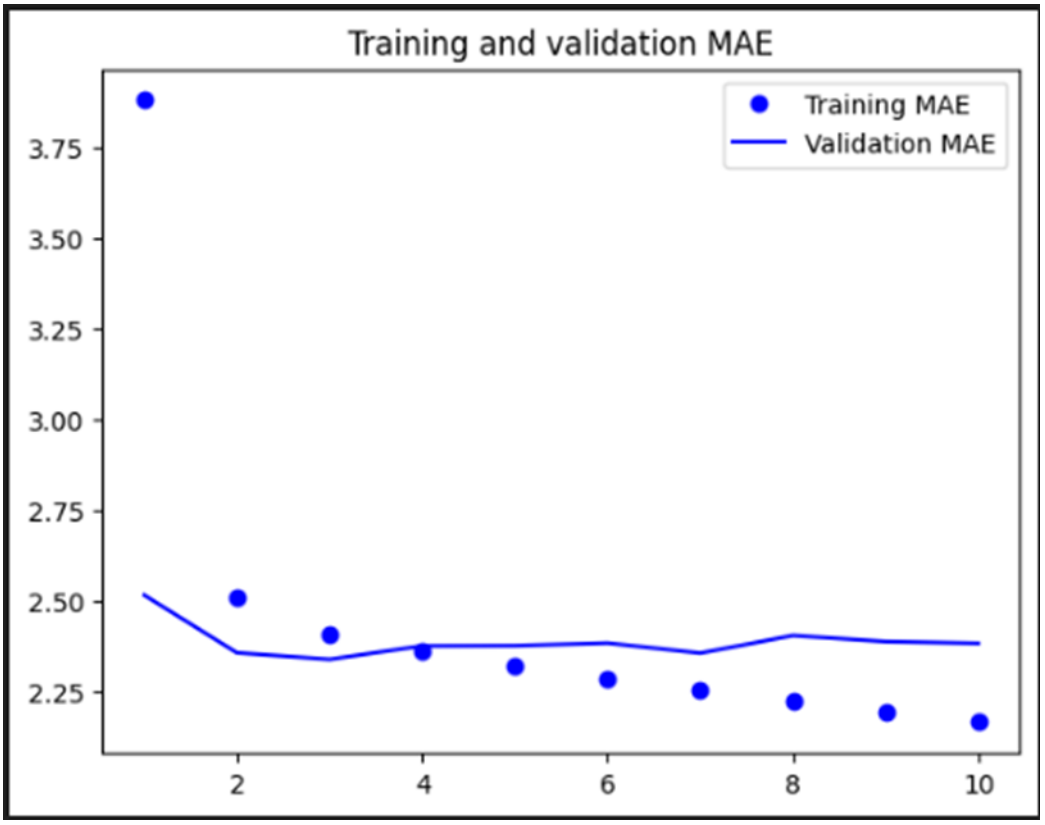
Simple LSTM with Dense 64: Validation MAE 2.5088, Test MAE 2.52



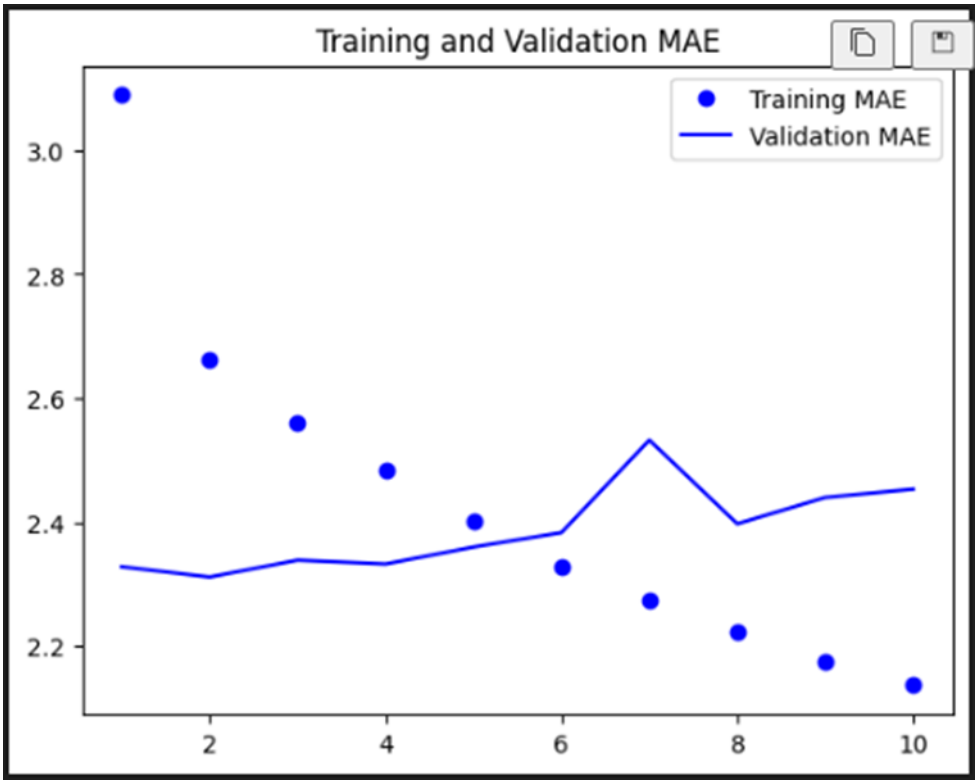
Stacked LSTM with dropout: Validation MAE 2.44, Test MAE 2.46



Bidirectional LSTM: Validation MAE 2.1692



Combination of 1D_Convnet and LSTM: Validation MAE 2.4938, Test MAE 2.50



Results Table:

Model	Validation MAE	Test MAE
Basic Dense	2.44	2.62
1D Convolutional	3.06	3.06
Simple LSTM (Dense 16)	2.51	2.53
Simple LSTM (Dense 32)	2.57	2.59
Simple LSTM (Dense 64)	2.50	2.52
Stacked LSTM with Dropout	2.44	2.46
Bidirectional LSTM	2.51	-
Combination of 1D_Convnet and LSTM	2.49	2.50

Conclusion:

The results demonstrate that more complex RNN models, such as the stacked LSTM with dropout and the bidirectional LSTM, generally outperform simpler models like the 1D convolutional network and the dense neural network.

- The stacked LSTM with dropout achieves the best performance overall, with a validation MAE of 2.44 and a test MAE of 2.46.
- The combination of 1D ConvNet and LSTM also performs well, with a validation MAE of 2.49 and a test MAE of 2.50.
- The bidirectional LSTM has the lowest validation MAE of 2.51, but its test performance is unavailable in the results.

This analysis highlights the effectiveness of recurrent neural networks and their variations for time series forecasting tasks, with the stacked LSTM with dropout emerging as the most successful model in this assignment.