Time series Assignment 3 Report

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Introduction:

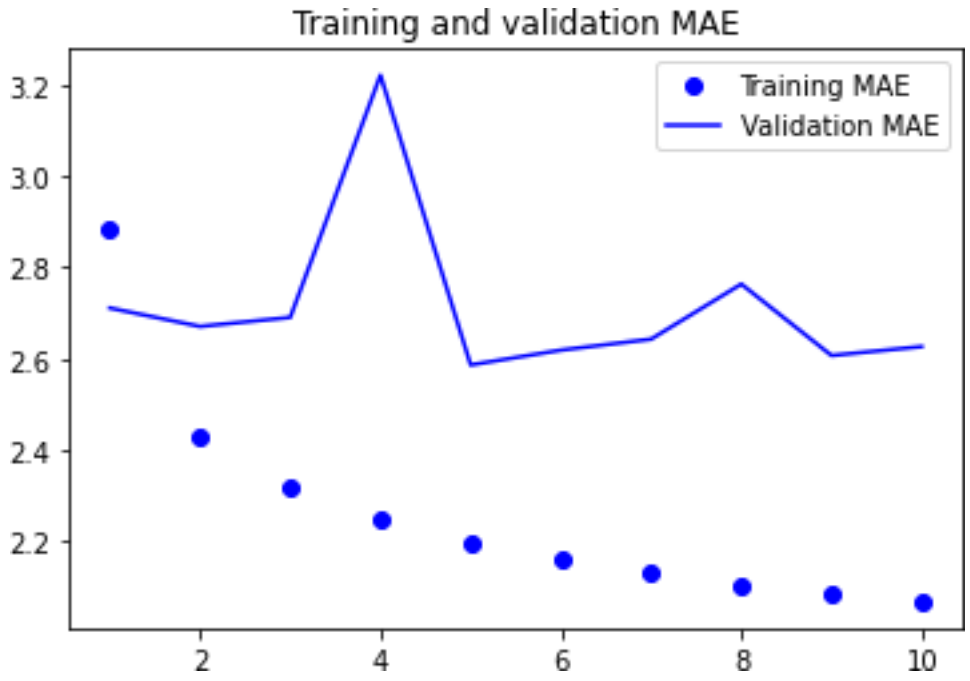
This assignment explores the use of various deep learning models to forecast temperature using the Jena weather dataset, which includes 420,451 samples and 15 weather-related factors. The main goal is to investigate and compare the effectiveness of different neural network architectures for the time series data forecasting problem.

Data Preprocessing:

Normalization is applied to the data by subtracting the mean and dividing by the training set's standard deviation. After that, it is divided into several sets for testing, validation, and training.

Results:

Basic Dense model: A densely connected neural network model obtains a validation MAE of 2.62 and a test MAE of 2.70.



Convolutional model: The validation MAE of a 1D convolutional neural network model is 3.17, and the test MAE is 3.21.

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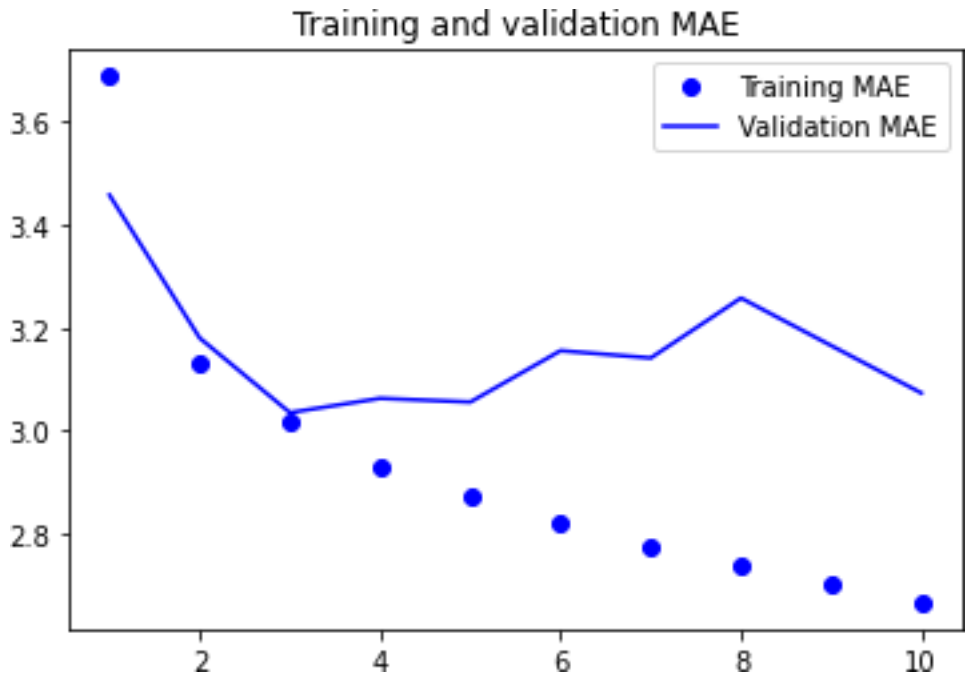
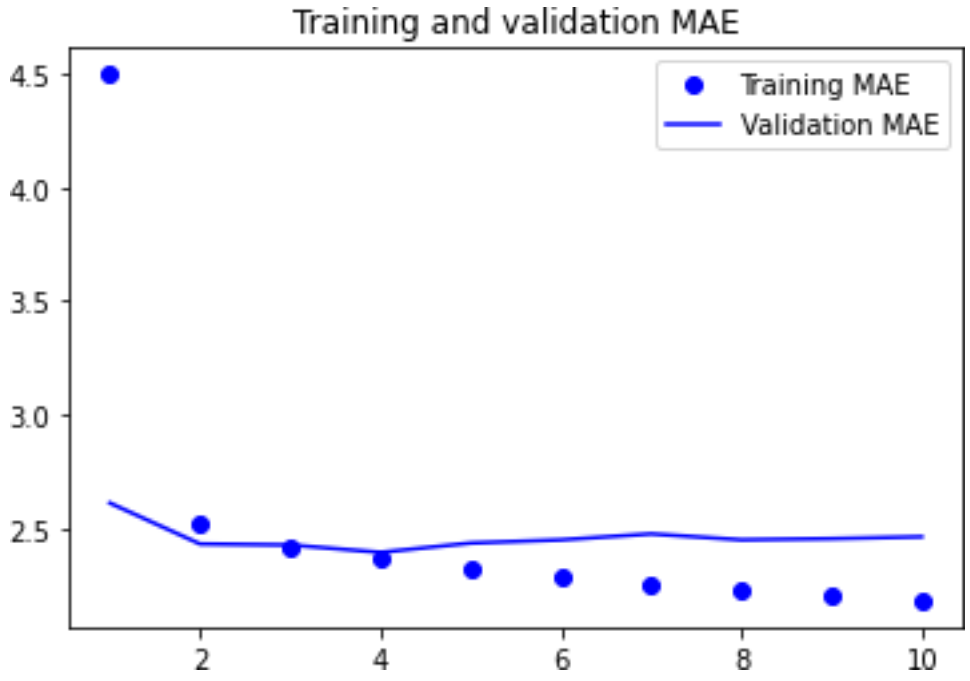
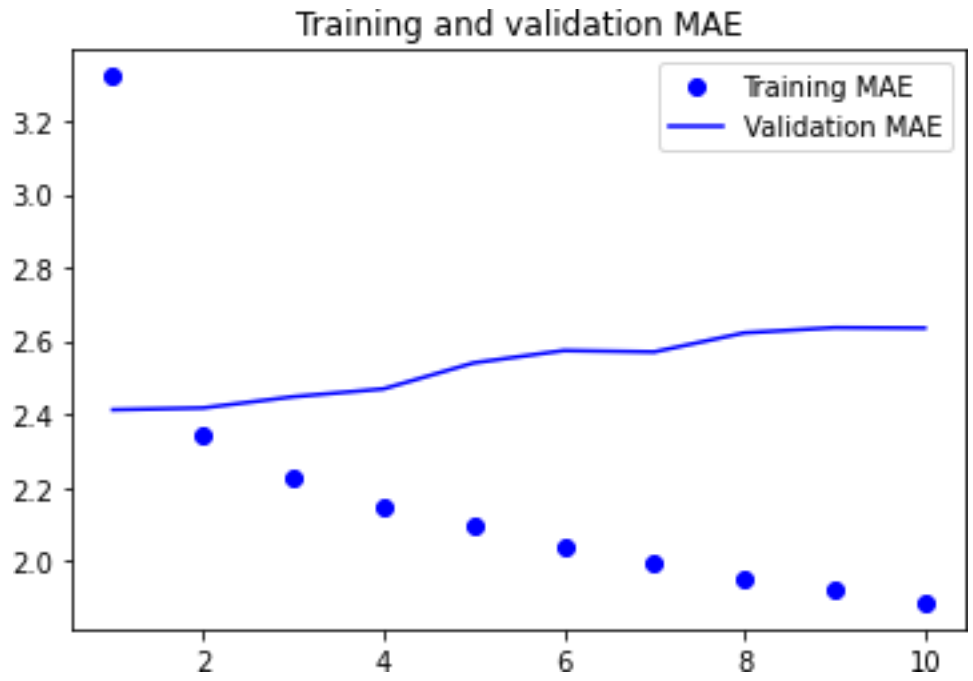


LSTM models:

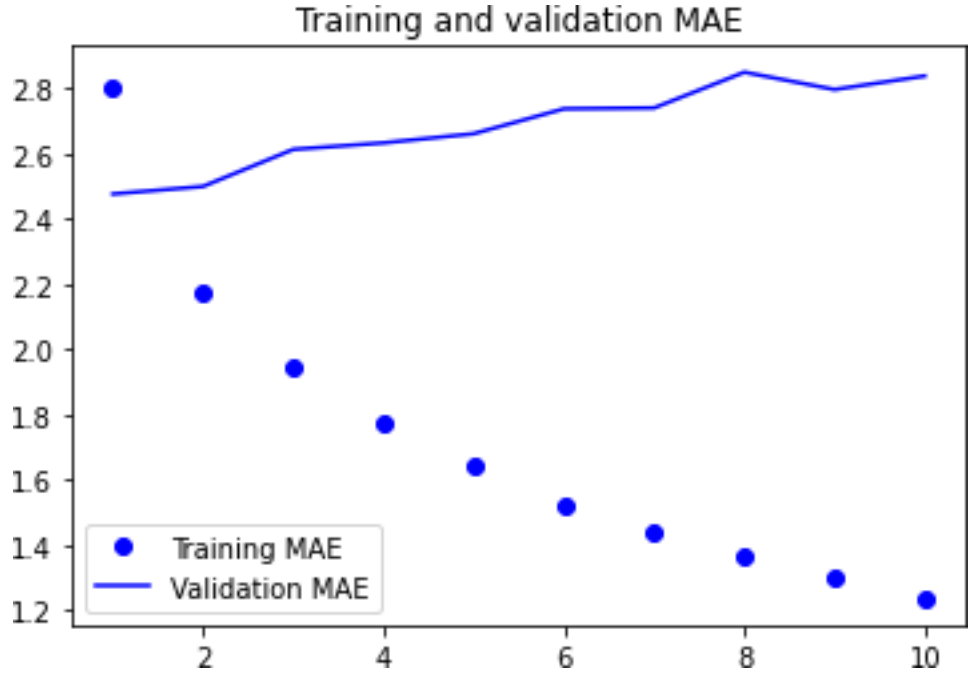
Simple LSTM with Dense 16: Validation MAE 2.47, Test MAE 2.58



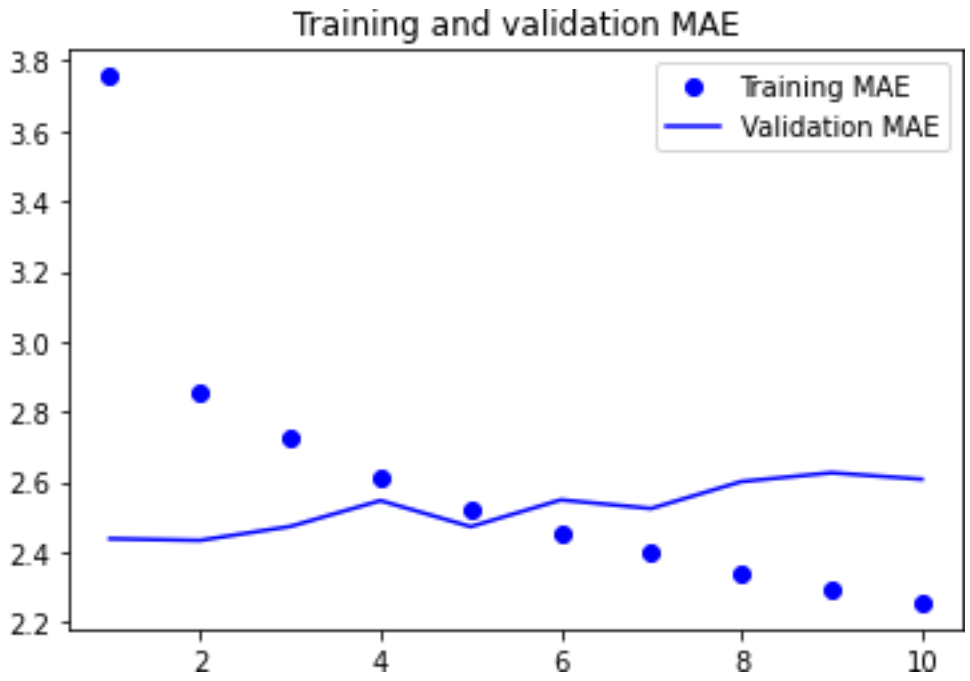
Simple LSTM with Dense 32: Validation MAE 2.63, Test MAE 2.58



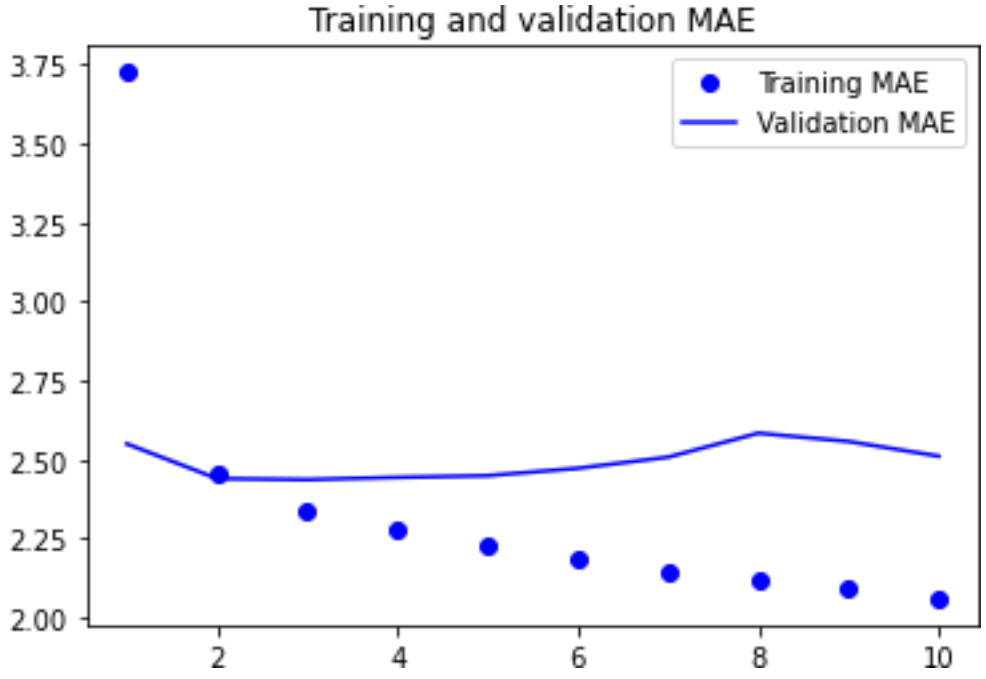
Simple LSTM with Dense 64: Validation MAE 2.83, Test MAE 2.70



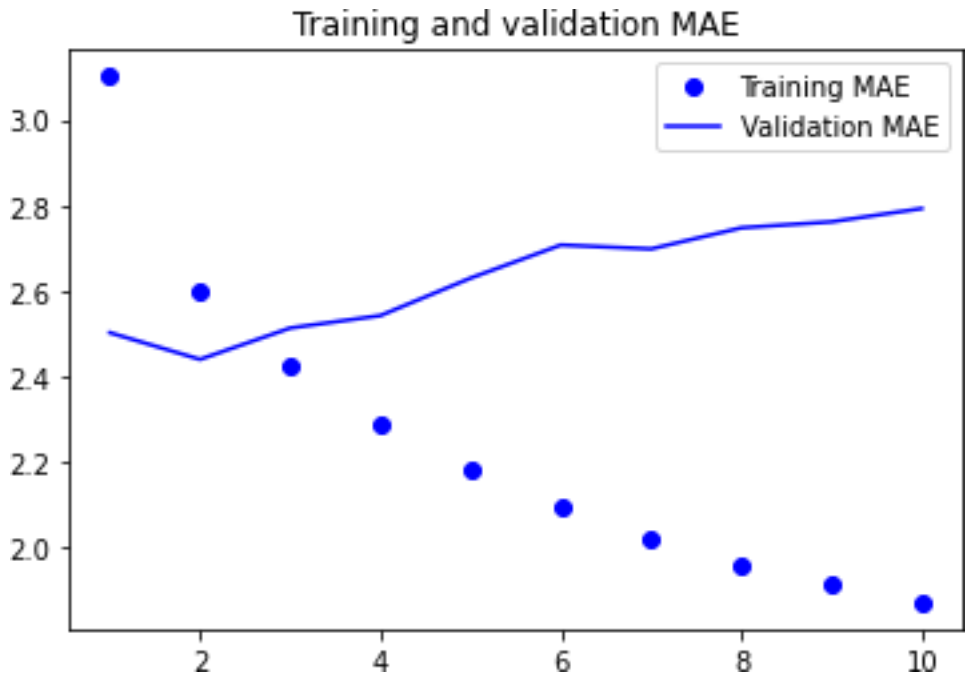
Stacked LSTM with dropout: Validation MAE 2.61, Test MAE 2.53



Bidirectional LSTM: Validation MAE 2.51



Combination of 1D_Convnet and LSTM: Validation MAE 2.80, Test MAE 2.62



Results Table:

Model	Validation MAE	Test MAE
Basic Dense	2.71	2.70
1D Convolutional	3.17	3.21
Simple LSTM (Dense 16)	2.47	2.58
Simple LSTM (Dense 32)	2.49	2.58
Simple LSTM (Dense 64)	2.64	2.70
Stacked LSTM with Dropout	2.61	2.53
Bidirectional LSTM	2.51	-
Combination of 1D_Convnet and LSTM	2.80	2.62

Conclusion:

In general, the more complex RNN models—such the bidirectional LSTM and the stacked LSTM with dropout—perform better than the more basic models, like the 1D convolutional network and the dense neural network. With a test MAE of 2.53 and a validation MAE of 2.51, the bidirectional LSTM performs the best. Recurrent neural networks and its different variations are shown to be successful for time series forecasting tasks in this assignment.