

TIME SERIES SUMMARY

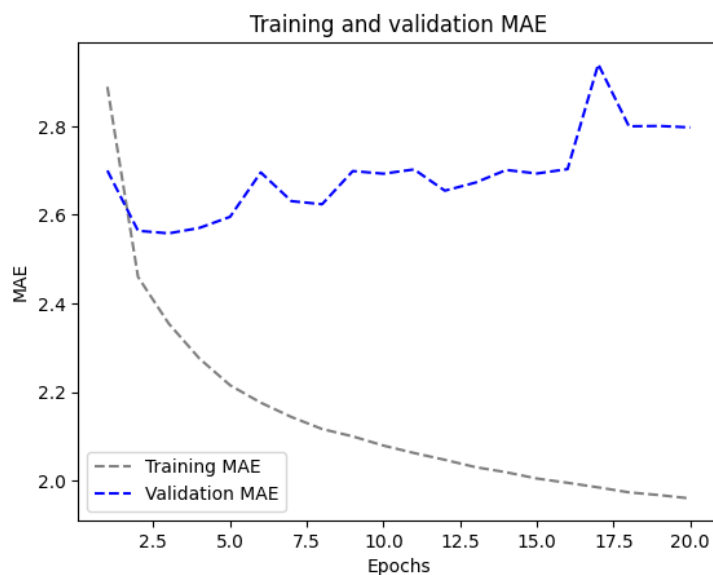
Recurrent Neural Networks (RNNs) are applied to time-series data in the current study, with special focus on weather forecasting issues. The goal of the assignment is to investigate several approaches for enhancing RNN models' performance in weather pattern predicting. Examining and comparing the effectiveness of different neural network patterns for the task of time series data forecasting is the main goal.

Normalizing Data:

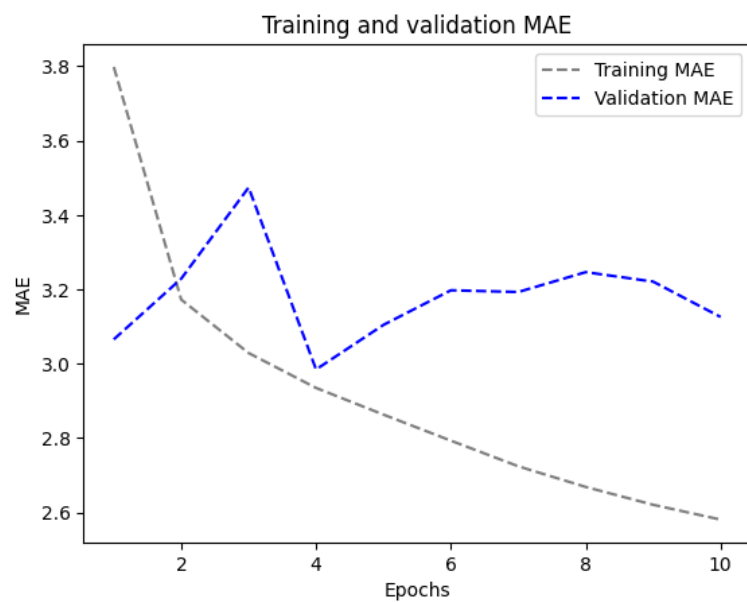
Vectorization is unnecessary because the data is already represented numerically. Nonetheless, because the data scales differ—temperature ranges from -20 to +30, and pressure is measured in millibars—it is prudent to normalize all variables. Then , data is divided into training, validation and testing data.

Models and their Results :

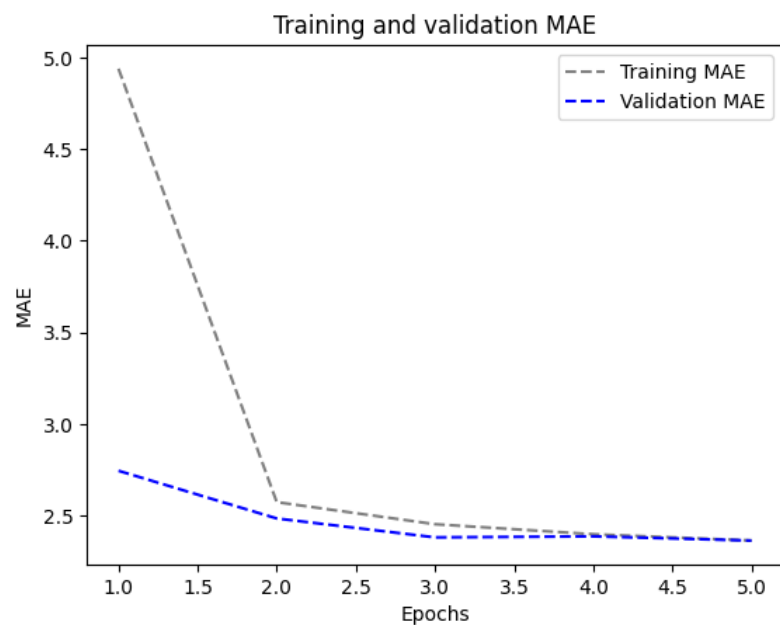
Dense Model :



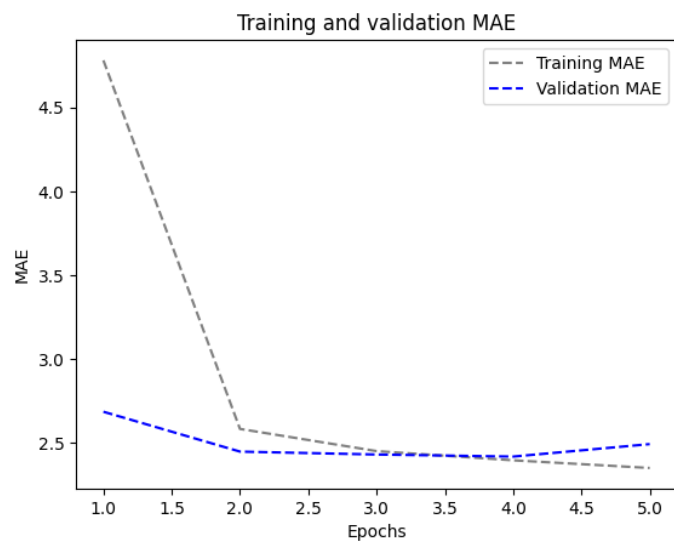
1D convolutional model:



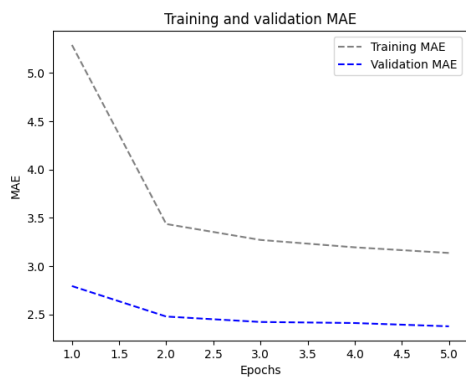
GRU model :



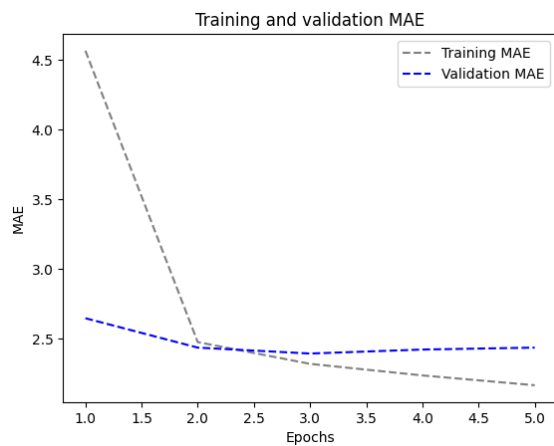
LSTM model :



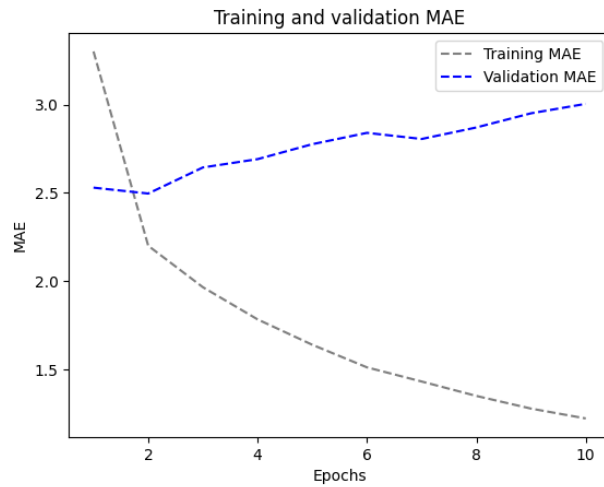
LSTM - dropout Regularization:



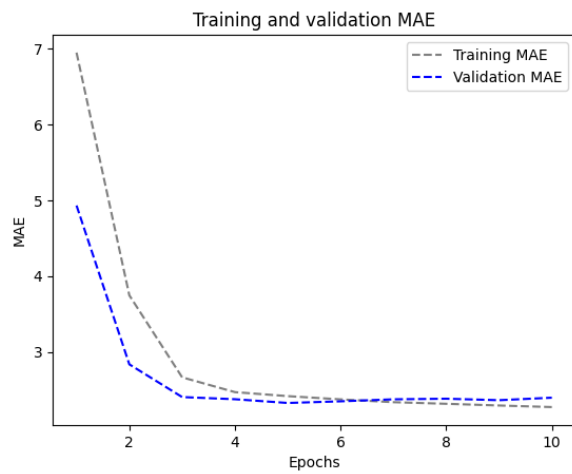
LSTM - Stacked setup with 16 units:



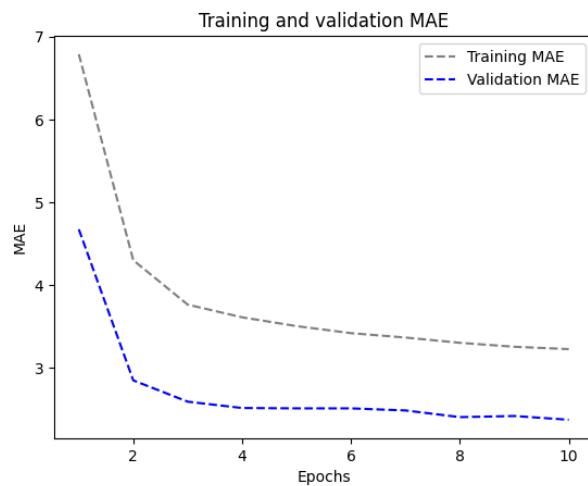
LSTM - Stacked setup with 32 units:



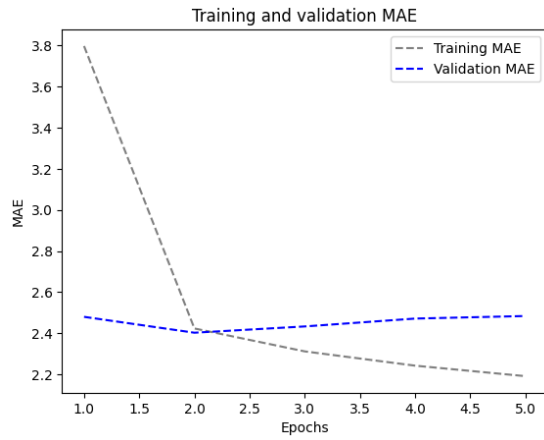
LSTM - Stacked setup with 8 units:



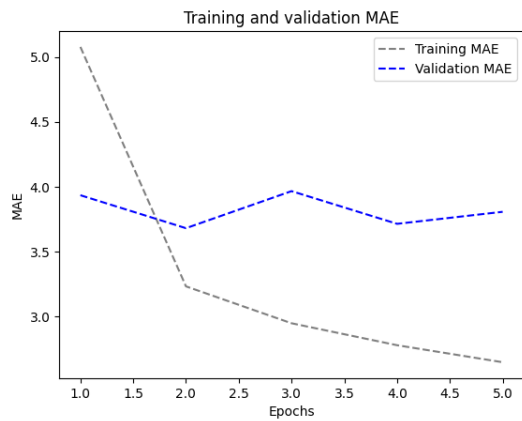
LSTM - dropout-regularized, stacked model:



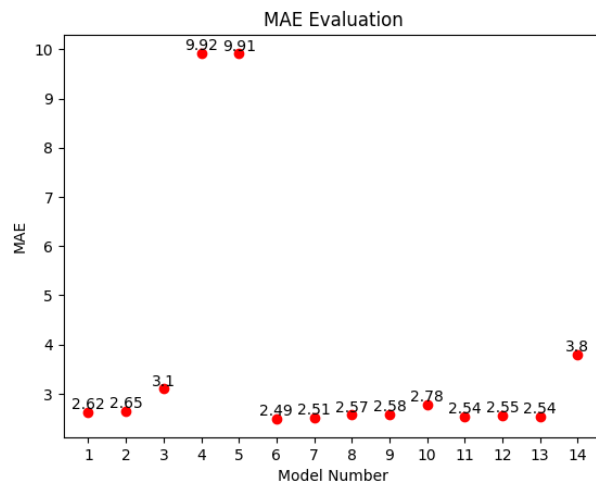
Bidirectional LSTM:



1D Convnets and LSTM together:



Models Test MAE:



Results :

Model	Validation MAE	Test MAE
Dense	2.79	2.65
1D convolutional	3.12	3.17
GRU	2.36	2.49
LSTM simple	2.49	2.51
LSTM (dropout Regularization)	2.37	2.57
LSTM Stacked – 16 units	2.43	2.58
LSTM Stacked – 32 units	3.00	2.78
LSTM Stacked – 8 units	2.39	2.54
LSTM - dropout- regularized, stacked model	2.36	2.55
Bidirectional LSTM	2.48	2.54
1D Convnets and LSTM together	3.80	3.80

- The results show that simple RNN and stacked SimpleRNN models outperform other models in terms of MAE on the test set. This shows that simple RNNs may not be suitable for time-series forecasting tasks.
- Conversely, GRU and LSTM models have superior performance. The Simple GRU and Bidirectional LSTM models are the most successful in capturing the temporal patterns in the data, as seen by their lowest test MAE values.
- Different configurations of LSTM models (dropout regularization, stacked setup with various units) also exhibit respectable performance, however they are not the best.
- Performance is lower when 1D Convolutional Neural Networks (CNNs) and LSTM are combined than when LSTM or GRU models are used alone.
- To enhance the model's capacity to identify pertinent patterns in the data, think about adding more features or designing brand-new features.
- Continually assess models on validation and test sets to make sure that gains in performance extend well beyond the training set.
- Look into additional deep learning strategies designed for time-series forecasting, like hybrid models that combine deep learning and conventional statistical techniques, or attention mechanisms.