Time Series Forecasting using LSTM Networks

In this project, a time series forecasting model based on LSTM networks has been implemented to predict daily maximum temperature in Melbourne. The experimental results indicate that the LSTM approach is performing well in one-step and multi-step ahead predictions. The implemented model has a good prospect in the prediction of different time series problems. The data analysis pipeline and the prediction models has been implemented in Python. I used libraries such as Pandas and Scikit-learn for data pre-processing, Matplotlib for visualization and Keras API for implementing the prediction models.

Motivation:

The motivation of this work was to learn behavior of time series forecasting models and ultimately employ the knowledge to real-world engineering problems.

Data Pre-processing:

The dataset (maximum temperature in Melbourne) is publicly available online, which contains 3651 data points in timeseries format.

A comprehensive pipeline for data cleaning and pre-processing has been implemented. Data cleaning includes removing Null values. Then, normalizing and scaling the data in range of (0,1) using minmaxscaler. Finally, using a generator script, I generated a timeseries training dataset.

Train and Test:

I implemented three different models, LSTM, Bidirectional LSTM and a regression model, to compare and evaluate the performances. The last layer of LSTM models is a layer of dense network (neural network). I used mean_squared_error as the loss function with ADAM optimizer. The regression model consists of two dense layers with 4 and 1 neurons. The models have been trained for 10 epochs with batch size 1.