LSTM Neural Networks: COVID-19 Time Series Forecasting

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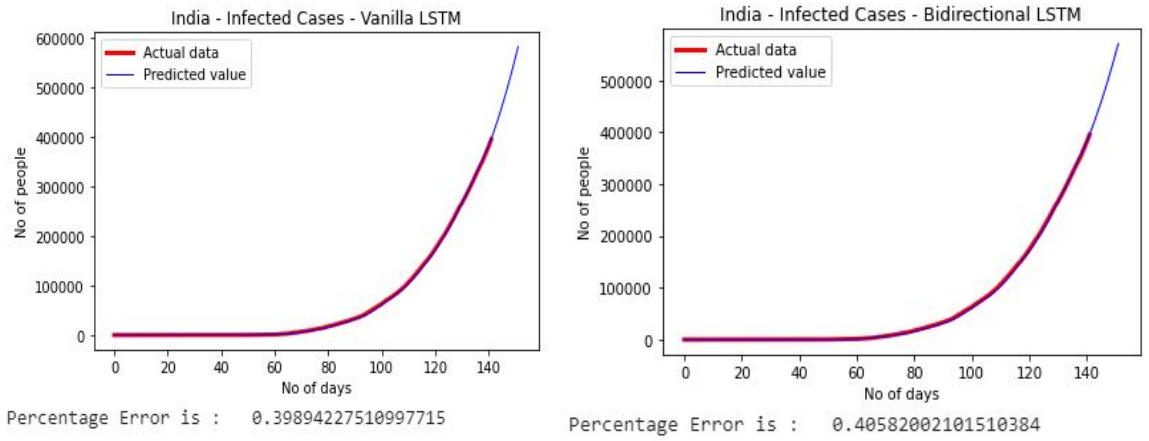
Long Short-Term Memory or LSTM Neural Networks have recently become popular as a mechanism for machine learning long- and short-term dependencies in datasets. LSTMs, unlike their simpler Recurrent Neural Network predecessors, are capable of retaining information not only from very recently learned information but also on longer terms. They follow unique mechanisms to achieve a high degree of accuracy in tasks pertaining to prediction, extrapolation of known information, and so on. Their most popular application is perhaps in Natural Language Processing tasks, where they are used to interpret large bodies of text and predict words and sentences. The other primary use of LSTM architectures is in time-series analysis, fitting and prediction.

The aim of this project is to examine in detail the structure and working of Vanilla LSTM Neural Networks and Bidirectional LSTM Neural Networks, and see them in action in an application to the time-series data of COVID-19 infection in India as well as some of its states.

Using the TensorFlow 2.0 Keras library and the Pandas and Numpy packages for efficient data manipulation, we have achieved a very close fit to the data available thus far, with the Bidirectional LSTM performing better on individual states, and the vanilla LSTM performing better on the national data.



(a) Using Vanilla LSTM

(b) Using Bidirectional LSTM

Figure 1: Number of Infections in India

We have attempted an extrapolation of the data in order to predict how the number of cases will rise in the upcoming days. It can be seen that the number of infections of COVID-19 follow an exponential trend, with individual states showing greater local fluctuations.