Report on comparing results of my model with other models that have used LSTMs for prediction of stock prices .

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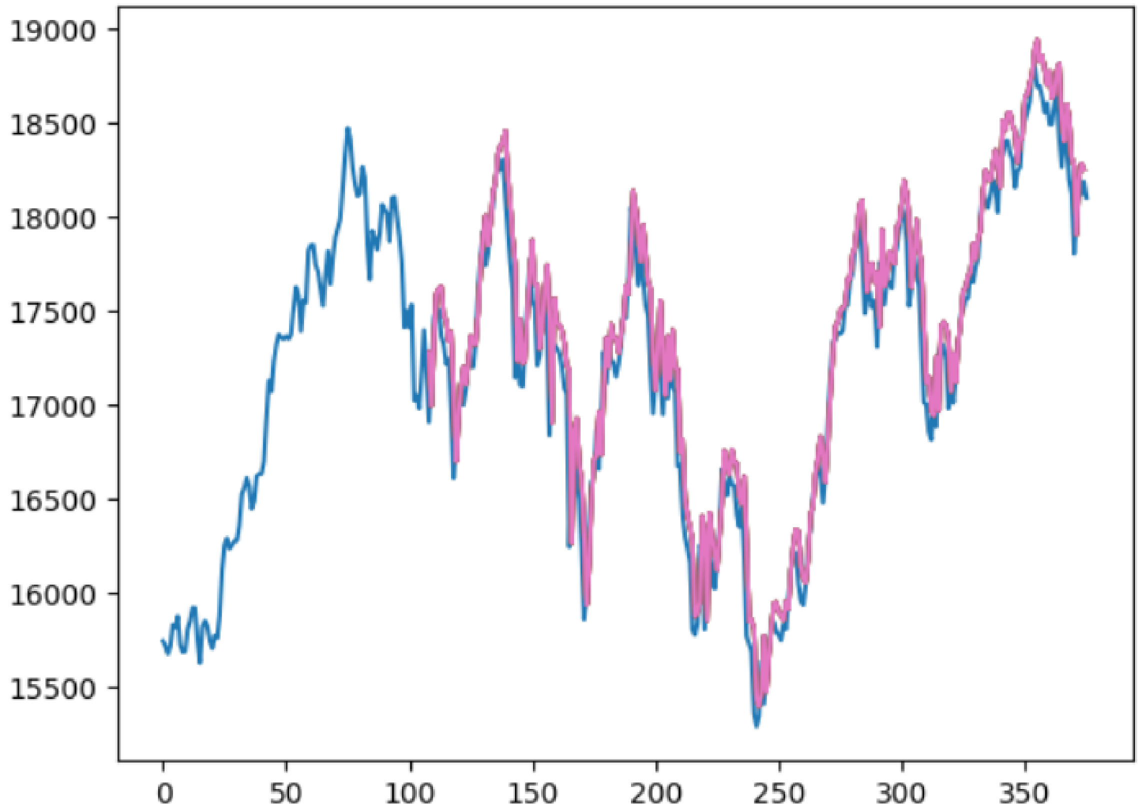
1) <u>Summarising the results of my model.</u>



The data i considered was the **NIFTY 50** index data from the date **Jan1,2008** to the date **Dec 31,2022** (i.e 15 years)

As seen in the figure for most of the times The original value of test data(represented by blue colour) and the values predicted by the LSTM model(represented by pink colour) are very close to each other. Which shows the effectiveness of the constructed model. Some slight deviations that could be seen can be attributed to the unexpected behaviour of markets during the covid period.(hence the actual value is lesser than the predicted value). But since we have considered the NIFTY 50 index and not an individual stock(which is relatively more stable, as covid has seen rise in some particular sector stocks that covered up the loss in other sectors and hence were not reflected in NIFTY 50) . Hence due to this stable nature of NIFTY 50 , covid didn't have any significant effect on the actual values of the index, making them close to the predicted values.

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MSE: 0.00018824363844745622
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The mean squared error of The model is in 1.8 * 10^(-4) terms which is very low , indicating the accuracy of our predicted values with the actual test data.

Most of the models that use LSTMs to predict time series data (such as stock prediction) , have their MSE in the range of 10^(-2) to 10^(-4) for the testing data. So we can say that our model has done a fair job.

2) **Comparing my results with few research papers that used similar models to estimate stock prediction.**

2.1) This article uses the LSTM model to predict the prices of the S&P 500 index.

Paper Link :
http://www.diva-portal.org/smash/get/diva2:1213449/FULLTEXT01.pdf

3.4.2 Layer

3.4.2.1 Hidden Layer

When constructing the LSTM model we have to take into consideration how many hidden layers the model will contain, the amount of LSTM cells that should be included in every layer and what the dropout should be. There is no right or wrong way of choosing the number of hidden layers or the number of cells within each layer, we have seen successful models where one model contained 4 layers and 1000 cells (Sutskever et al., 2014) and the other model contained 3 layers and 2 cells (Gers et al., 2000). These number depends on what application the LSTM model is going to be used on, so the number of cells and layers can differ but the layers are often from 1 to 5 and the cells in each layer should contain the same amount of cells for finding an optimal structure.

3.4.2.2 Dense Layer

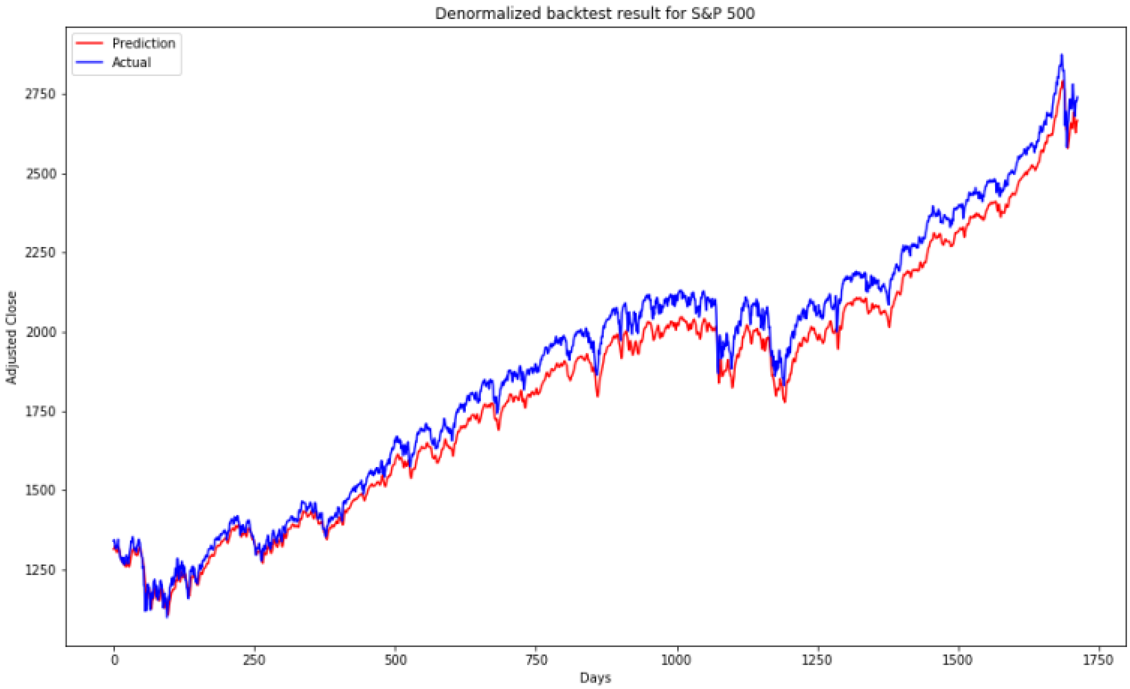
A dense layer is a densely connected NN layer (Keras, 2018b), where a dense layer connects each cell to another in the next layer. We have seen successful models using dense layer by building their model of hidden layers followed by multiple dense layer (Goodfellow et al., 2013).

3.4.2.3 Number Of Layers

We have decided that our LSTM model will contain four layers, two hidden layers and two dense layers. The output of the first hidden layer is connected to another hidden layer than that layer is connected to a dense layer and that dense layer is lastly connected to another dense layer, i.e. *hidden layer* $\rightarrow$ *hidden layer* $\rightarrow$ *dense layer* $\rightarrow$ *dense layer*, where $\rightarrow$ represent the connection between layers. Dropouts are used after each hidden layer for preventing the risk of overfitting (Reimers and Gurevych, 2017).

As we can see, the structure of the above model is quite similar to our model.

Graph of predicted values and the actual values.



Mean Squared Error.

4.3 Train And Test Score

Table 5 shows the obtained average MSE and RMSE values after evaluating the training and backtesting. We obtained the MAPE = 4.50574288% for our prediction accuracy of the model.

	MSE	RMSE
Train Score	2e-05	0.004
Test Score	0.00056	0.024

Table 5: Average MSE and RMSE Scores

As we can see the MSE of test data is very close to our value of 0.00018824

2.2) This paper uses a very complicated multi feature model(we use only a single feature model – that uses closing price to estimate stock prices) . but the core logic of the paper is using LSTMs with some hidden network layers , which matches with our models description.

Paper Link : [Forecasting directional movements of stock prices for intraday trading using LSTM and random forests - ScienceDirect]()

Table 3. Average performance metrics of daily returns after transaction cost.

Metric of daily returns	3-Feature IntraDay LSTM	3-Feature IntraDay RF	1-Feature NextDay LSTM	1-Feature NextDay RF	1-Feature IntraDay LSTM	1-Feature IntraDay RF	SP500 Index
Mean (long)	0.00232	0.00173	0.00157	0.00159	−0.0000	0.00004	0.00033
Mean (short)	0.00212	0.00166	0.00058	0.00030	0.00080	0.00087	0.00000
Mean return	0.00444	0.00339	0.00214	0.00189	0.00074	0.00090	0.00033
Standard error	0.00019	0.00020	0.00024	0.00023	0.00021	0.00021	0.00014

Here standard error implies the variation of Predicted values from the Testing data. Which is computed in the exact same manner as the mean squared error.

As seen in the above table The standard error of the S&P 500 (an US index stock) is 0.00014 which again is in power of 10^(-4) and our model has given us a MSE in the exact same range.

In This way by comparing with the Research papers that have used similar techniques as our model , we can confirm the accuracy and performance of our constructed model.