Long Short-Term Memory Versus Gaussian Process Regressor on Stock Prediction

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I. Introduction

Forecasting stock market prices is an attractive topic for researchers and financial institutions. Attentions have been drawn to the accuracy of the forecasting, and the ability of correctly predicting a stock price can bring a considerable amount of profit. Over the past decade, Machine Learning algorithms such as *Gaussian Process Regression*(GPR) have demonstrated the capability of such forecasting. More recently, *Long Short-Term Memory*(LSTM) model, a deep-learning algorithm has shown an astounding, extraordinary capability for time-series prediction. However, it is observed that stock prediction models based on LSTM are not popular. In this research work, I survey the prediction power of GPR and LSTM, perform an investigation on the incentives and drawbacks of both models and conclude the result.

II. Experiment and results

In this experiment, comparision between GPR model and LSTM model is carried out. I acquired FTSE-100 index stock data ranges from September 2017 and November 2018 to serve as the training data-set. Evaluation of models will be based on the *Root Mean Square Error*(RMSE)and the interpretability.

To be more precise, the GPR model is set with *Matern* and *RadialBasisFunction* kernels, while the LSTM model is set to have two layers with cell states 16 and 32 respectively. These configurations have shown to be performing the best empirically by prior work. Both models are implemented in Python with Keras[1] and scikit-learn[2]. Code can be viewed via here. [3]

Results show that LSTM has a lower $RMSE$ score than GPR. In another words, the LSTM model exhibit a superior predictive power than the GPR model. However, it is crucial to note that $RMSE$ scores may include biases in this case, where predicted stock values match the trend but not mapping the absolute stock prices, which is an interesting phenomenon. With regards of interpretability, GPR models make prediction according to its internal estimators, which also means that the predicted outcome from GPR can be explained, while LSTM omits the weight matrix from states to states, indicating that it is less transparent and is extremely difficult to understand the model behaviour.

III. Conclusions

The experiment described above compares Guassian Process Regressor and Long Short-Term Memory. Although LSTM can predict stock more accurately, the model is difficult to understand. In contrast, GPR is less accurate in stock prediction, but the model is completely interpretable. In practice, utilizing LSTM for financial forecast might expose dealers at a greater risk since they cannot simply interpret the model, which might lead to the unpopularity of LSTM.

This work is the beginning of an exciting journey, which could leads to further research questions such as resolving the interpretablility problem for LSTM; Combining both methods to get the best algorithm for stock predictions.

[1] A deep learning library developed and maintain by Google

[2] A popular machine learning framework maintained by the community

[3] Source code can be explored from https://github.com/ringochuchudull/Stock-Price-Predictor