**Stock Market Prediction by Using LSTM and GRU Models and Comparison**

Seongjin Yang

Woosong University, Daejeon, Republic of Korea

[hyysj0103@gmail.com](mailto:firstname.secondname@springernature.com)

**Abstract.** From 20180101 to 20210423, the closing price of all stocks of KOSPI, the Korean stock market, was estimated by LSTM and GRU models. Twenty-four daily closing prices were required to predict the closing price of one next day. The error between prediction and actual prices are calculated by Root Mean Square Error. By comparing each model with RMSE, GRUs showed a distinct tendency to predict relatively closer to actual values than LSTM.

# Introduction

A stock market is a market where you can buy shares of a listed company. As a result, a company can sell its shares to get the money it needs to operate immediately, and shareholders can receive dividends of the profits or sell the rights to other people for capital gains. The stock graph is ever-changing, and it would certainly help investors if they could predict these shares close to their actual value, even when it is predicted not perfectly.

For this reason, the author tries to predict companies in the KOSPI stock market in Korea with LSTM and GRU, which are types of artificial neural network models.

By the definition from Sachin Tiwari[1], “LSTM is a specialized category of RNN with a wide variety of applications, including text labeling, time series analysis, voice recognition, and speech recognition.” In this case, the author will be focusing on time series analysis application since the topic is stock market.

And GRU model does the same application with LSTM, because GRU has similar design base on LSTM but one less activation function.

Based on the proposed environment(dataset), we can compare which is good at Time Series Analysis among similar models, and if the comparison results are clear, we can use the dominant model when we are given similar data in the future.

# Proposed Models

# Common Inputs:

# input\_dim = 1

# hidden\_dim = 32

# num\_layers = 2

# output\_dim = 1

## Long Short Term Memory

**Model Structure:**

torch.Size([128, 1])

torch.Size([128, 32])

torch.Size([128])

torch.Size([128])

torch.Size([128, 32])

torch.Size([128, 32])

torch.Size([128])

torch.Size([128])

torch.Size([1, 32])

torch.Size([1])

**Model Code:**

**텍스트이(가) 표시된 사진

자동 생성된 설명**

Fig. . LSTM Code

## Gated Recurrent Unit

## Model Structure:

torch.Size([96, 1])

torch.Size([96, 32])

torch.Size([96])

torch.Size([96])

torch.Size([96, 32])

torch.Size([96, 32])

torch.Size([96])

torch.Size([96])

torch.Size([1, 32])

torch.Size([1])

**Model Code:**

**텍스트이(가) 표시된 사진

자동 생성된 설명**

Fig. . GRU Code

# Experimental Setup

## Dataset

The dataset was created manually by using “pykrx”[2], a Python library related to the Korean stock market, as a tool. In the form of Pandas DataFrame, the daily closing prices from 20180101 to 20210423 were selected and stored. Each row was dates, and each column was ticker numbers to identify certain companies and the DataFrame was 814 rows x 845 columns.

# Result Analysis

It is a little too much to calculate certain accuracy about the experiment. This is because predictions are not divided between right and wrong, but only show how close the predicted value is to the actual value. Therefore, rather than obtaining accuracy, the author obtained Root Mean Square Error (RMSE) values, counted the smaller error values of the two models one by one, compared the counts.

|  |  |  |
| --- | --- | --- |
|  | LSTM | GRU |
| Samsung Electronics |  |  |
| Hyundai Motors |  |  |
| Hanhwa |  |  |

Table. . Visual comparison: Red line for actual, blue line for predicted.

Those are three samples from 845 populations. But, to compare exactly, the author will calculate RMSE for both models per each company. After the calculation, counts each companies’ better performance model by choosing smaller RMSEs.

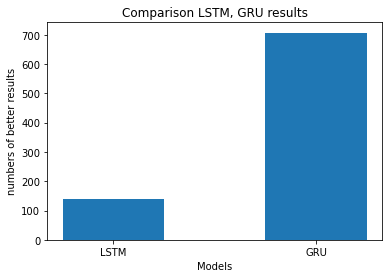


Fig. . Comparison LSTM, GRU results counts.

The result of LSTM better case was 138, while GRU better case was 707. It showed palpable difference between two models. GRU showed more smaller errors than LSTM.

# Conclusion

Although it is difficult to say that GRU outperforms LSTM with this result alone because it is a relative comparison rather than an absolute comparison, the conclusion of this report is that using GRU can achieve relatively better results than LSTM given such an environment.

# References

1. Tiwari S, Chaturvedi A K (2021) A survey on LSTM-based stock market prediction. Ilkogretim Online; 2021, Vol. 20 Issue 5, p1671-1677, 7p. doi: 10.17051/ilkonline.2021.05.182
2. Pykrx. https://github.com/sharebook-kr/pykrx