

Prediction of Performance for Sony in Financial Market

Guanpeng Pi *

Shanghai Pinghe School, Shanghai, China

* Corresponding Author Email: Piguanpeng22@shphschool.com

Abstract. Sony Corporation has an enormous impact on society these days. It's a company majoring in technological innovation, with products like game consoles, cameras, headsets, and televisions. Most of them are the best in the business. With an income of 8,994 trillion yen in a single year, the massive company remains competitive around the globe. It would be essential to predict the future trend of a company that is still making contributions to the world. Expectations on the project is to predict Sony Stock Market. To achieve this goal, Long Short-Term Memory, known as LSTM and Linear Regression are implemented in the project. By first importing the data, dividing it into the training and testing set, and then creating LSTM and Linear Regression model, the result will be provided by the program. Using two models to predict the stock market made comparisons possible. According to the MSE (Mean Square Error), it's safe to make the conclusion that LSTM is a more reliable way when predicting the stock market for Sony Corporation.

Keywords: Sony; trading volume; price; forecast.

1. Introduction

Starting from 2012, Sony Corporation's stock market has been growing rapidly, reaching its peak in November 2021. Despite the pandemic sweeping over the continents, Sony's stock market seems undisturbed and remained increasing throughout the years. With an average volume of 818,533, it's safe to say that Sony Corporation had enormous market potential.

Sony's variety of effective products can be one of the reasons why the performance in the stock market is going well. In 2013, publish of ps4 game console (Play Station 4), marked a new generation of game consoles. PlayStation 4 provided a brand-new way for players to enjoy the game. This product benefited many gamers, and some of their Play Station 4 controllers remain impactful even today. Many games are monopolized only on Play Station 4 consoles, thus it's a main factor that caused the Sony stock market to go up. Also, Sony's headsets published in 2019, and 2021 are both very useful products for people. The products are set at an affordable price for consumers and the superior quality is making it outperform their competitors. The entertainment and game industry is becoming a trend that people follow these years. With the fast development of technology, and reduced digital divide, internet surfing is more available for more and more people. Entertainment and games have huge potential. This industry is entering a mature phase. The predicted gaming market size is estimated at 245.10 billion USD in 2023, with an upward trend that may reach 376.08 USD by 2028. Therefore, accurately predicting Sony's performance in the stock market is crucial for certain investors [1].

In fact, there are already many predictions about the performance of the stock market. Yang did the experiment based on Linear Regression about stock prediction [2]. The result is not convincing. Lin and Zheng on the other hand, predicted the stock price of 5G using an improved Linear Regression Method [3]. The result is too simple and not useful. Hu used the method of Random Forest to predict the stock price, the result is somewhat convincing due to the complexity of the method. Li's essay on the research of neural networks works decently in predicting the stock market. The result shows a positive trend and is convincing [4]. However, there is still limited research on predicting the performance of Sony, a specific company, in the stock market. Therefore, this article selects the LSTM and linear regression models to try to make up for the shortcomings of current research [5].

2. Methods

Linear Regression and LSTM are the models to predict of the future growth of Sony's stock market. The data is imported from Yahoo Finance, and the data of the stock market's recent year performance is imported into the code to make the predictions. Starting from 7/29/2022 to 7/28/2023. There's a big reduction in the stock market's volume at the end of year 2021, so adding that part of the data may cause the prediction to vary. Only the recent year of the stock market's performance is included to increase accuracy.

2.1. Linear Regression

Machine Learning focuses algorithms to export models used for predictions. Linear regression is a machine-learning algorithm uses datasets and the points collected from the data are used to make a map for making an optimized linear function.

The following is the basic formula for Linear Regression:

$$Y = MX + B \quad (1)$$

There are multiple elements in the formula. The dependent and independent variables are y and x. The degree of incline or slope is demonstrated by m and b is intercepted.

In the code of linear regression prediction, first import NumPy, pandas, and Linear Regression from sci-kit-learn, mse (mean squared error) and matplotlib. The data is downloaded from Yahoo Finance and stored on the device executing the code. Saved in file named Sony.csv. The data is loaded, and data cleaning must be done. Since not all the data are valid when doing the prediction, such changes include extracting the Close column from the data. Prediction is made about the data which is divided into training and testing set. By using linear regression models, the stock price and volume are predicted. After that, the MSE is computed. The data must be visualized next; the graph is plotted for a better understanding of the result.

2.2. LSTM

LSTM is basically a form of RNN [6]. LSTM have special connections that makes them outstand among all the traditional neural networks. Those connections makes LSTM models process multiple data on various points independently. They are able to process data and produce useful information. As a result, LSTM is very advantageous in data processing and prediction.

The following is the formula for LSTM:

The input for Long Short-Term Memory is $x(t)$. The output is $o(t)$. In the code of Long Short-Term Memory prediction, NumPy, pandas, Minmax Scaler from sci-kit learn, Sequential, LSTM, and Dense are imported from TensorFlow. keras, as well as matplotlib and mean square error. The data is downloaded from Yahoo Finance and stored on the device executing the code. Saved in a file named Sony.csv. The Close volume and stock price in the data are extracted, followed by the normalization of the target variable. Then data is split into a testing set and a training set. They are converted into sequences for better data processing. Long Short-Term memory is built next, and inverse transforms the predictions. In the end, compute the Mean Squared Error then visualize the results. Details can be found in previous literature [7-10].

3. Result

3.1. Forecasts of trading volume

Fig.1 and Fig. 2 report the forecasts of trading volume by Long Short-Term Memory and linear regression, respectively.

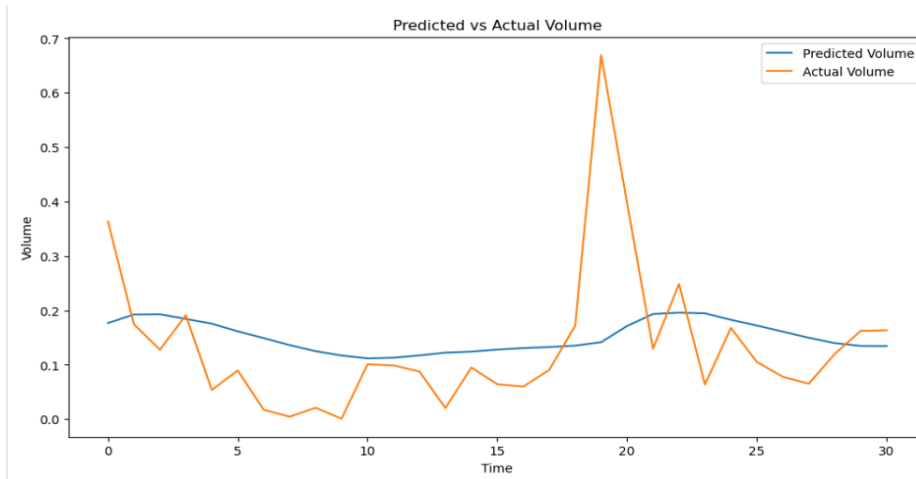


Fig. 1 Forecast of trading volume by Long Short-Term Memory.

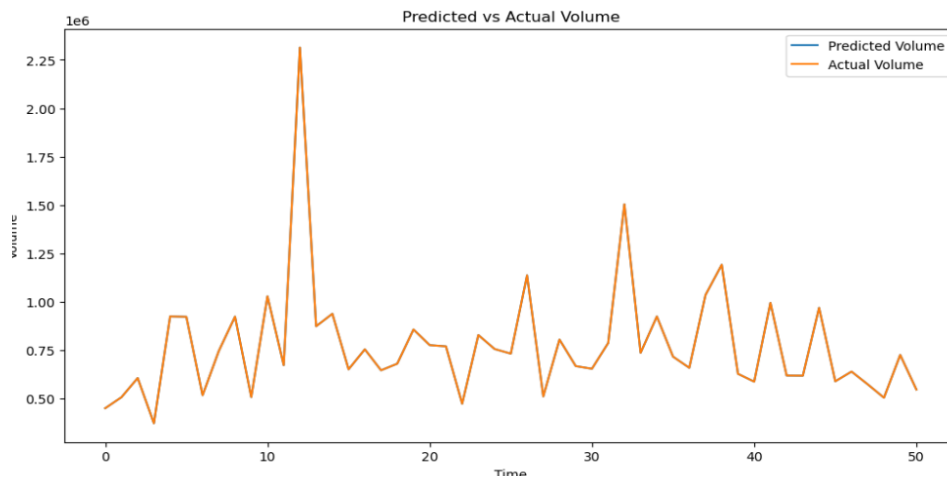


Fig. 2 Forecast of trading volume by Linear Regression.

The final MSEs are Predicted Price of Sony Stock Market and Predicted Volume Sony Stock Market for LSTM and linear regression models, respectively. Therefore, when investors are trying to forecast the trading volume, Long Short-Term Memory model is preferred.

3.2. Price Forecast by Linear Regression

This paper further forecasts the prices of the asset. Showing in Fig. 3, MSE of Training set is 42.9. Testing set's MSE is 16.9.

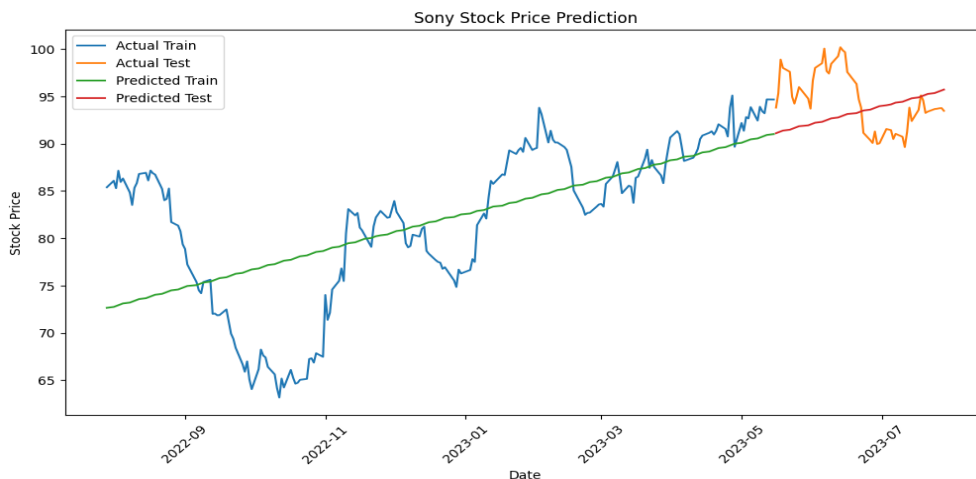


Fig. 3 Forecast of prices by linear regression.

3.3. Price Forecast by LSTM

LSTM for price forecasts was also implemented and was shown in Fig. 4, MSE of Training set is 12.5. The computed MSE of Testing set is 5.2.

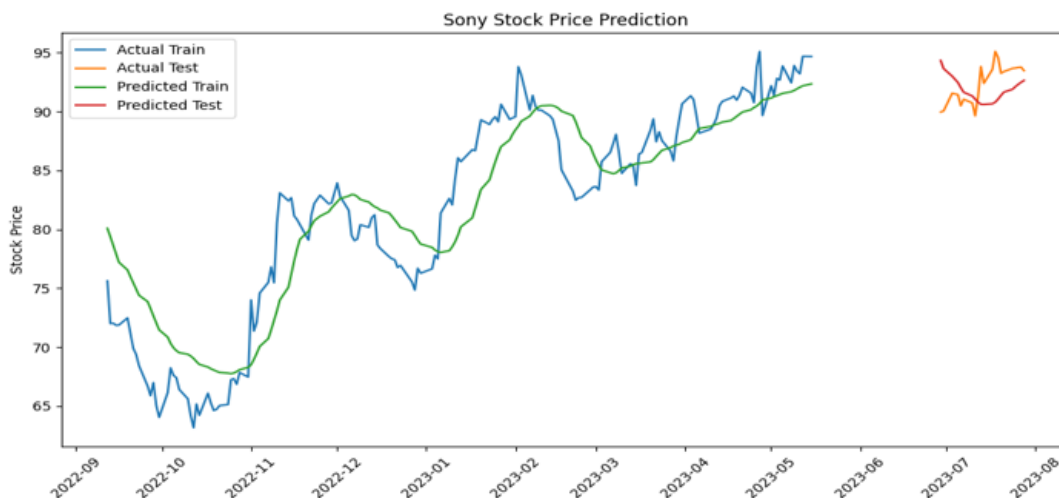


Fig. 4 Forecast of prices by LSTM.

4. Conclusion

The Uniqueness of the project is that it uses two methods in statistical learning, Long Short-Term Memory, and Linear Regression. Showing that both prediction of trading volume and price, the result provided convincing evidence. LSTM is superior to linear regression However, there are still some shortcomings in this study, so it is better to only consider two simple models. In future research, more complex models can be considered and compared with current research results.

References

- [1] Yu Mengmeng & Yang Ziyang. Domestic game market revenue in the first half of the year reached 144.263 billion yuan. *China Securities Journal*, 2023, A07.
- [2] Yang Guangyu. Comparative analysis of linear regression methods for five stock predictions based on stock correlation. *Modern Business*, 2022, (29): 42-45.
- [3] Lin Linrong, Zheng Wenzhen, Liu Mengru, Peng Peihao & Zhou Yan. Analysis of factors affecting the stock market risk of 5G concept from the perspective of multiple linear regression model. *Chinese Market*, 2020, (35): 44+51.
- [4] Hu Song. Research on multi-factor stock selection model based on random forest algorithm. Thesis for master's degree, Harbin Institute of Technology, 2022.
- [5] Li Jingqi. Research on stock price index prediction based on improved recurrent neural network. Thesis for master's degree, Shandong Technology and Business University, 2023.
- [6] Liu Siqi. Research on stock influencing factors based on linear regression model. *National Circulation Economics*, 2020, (05): 162-164.
- [7] Fan Yuhan. Empirical research on factors affecting stock returns based on multiple linear regression models. *National Circulation Economics*, 2019, (06): 101-103.
- [8] Wang Xiaoneng. Empirical study on factors affecting MSCI stock return rate based on multiple linear regression. *Communications World*, 2018, (08): 222-223.
- [9] Cong Jingqi, Cheng Pengfei & Zhao Zhenjun. Stock index integrated prediction model based on CEEMD-CNN-LSTM. *Systems Engineering*, 2023, (04): 104-116.
- [10] Wu, S., Liu, Y., Zou, Z., & Weng, T. H. S_I_LSTM: stock price prediction based on multiple data sources and sentiment analysis. *Connection Science*, 2022, 34(1): 44-62.