Cryptocurrency automatic trading research by using facebook deep learning algorithm

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페이스북 딥러닝 알고리즘을 이용한 암호화폐 자동 매매 연구

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Abstract Recently, research on predictive systems using deep learning and machine learning of artificial intelligence is being actively conducted. Due to the development of artificial intelligence, the role of the investment manager is being replaced by artificial intelligence, and due to the higher rate of return than the investment manager, algorithmic trading using artificial intelligence is becoming more common. Algorithmic trading excludes human emotions and trades mechanically according to conditions, so it comes out higher than human trading yields when approached in the long term. The deep learning technique of artificial intelligence learns past time series data and predicts the future, so it learns like a human and can respond to changing strategies. In particular, the LSTM technique is used to predict the future by increasing the weight of recent data by remembering or forgetting part of past data. fbprophet, an artificial intelligence algorithm recently developed by Facebook, boasts high prediction accuracy and is used to predict stock prices and cryptocurrency prices. Therefore, this study intends to establish a sound investment culture by providing a new algorithm for automatic cryptocurrency trading by analyzing the actual value and difference using fbprophet and presenting conditions for accurate prediction.

Key Words : Artificial intelligence, prediction system, fbprophet, deep learning, machine learning

요 약 최근 인공지능의 딥러닝과 머신러닝을 이용한 예측시스템에 관한 연구가 활발히 진행되고 있다. 인공지능의 발전으로 인해 투자관리자의 역할을 인공지능을 대신하고 있으며, 투자관리자보다 높은 수익률로 인해 점차 인공지능으로 거래를 하는 알고리즘 거래가 보편화하고 있다. 알고리즘 매매는 인간의 감정을 배제하고 조건에 따라 기계적으로 매매를 진행하기 때문에 장기적으로 접근했을 때 인간의 매매 수익률보다 높게 나온다. 인공지능의 딥러닝 기법은 과거의 시계열 데이터를 학습하고 미래를 예측하여 인간처럼 학습하게 되고, 변화하는 전략에 대응할 수 있어 활용도가 증가하고 있다. 특히 LSTM기법은 과거의 데이터 일부를 기억하거나 잊어버리는 형태로 최근의 데이터의 비중으로 높여 미래 예측에 사용하고 있다. 최근 facebook에서 개발한 인공지능 알고리즘인 fbprophet은 높은 예측 정확도를 자랑하며 주가나 암호화폐 시세 예측에 사용되고 있다. 따라서 본 연구는 fbprophet을 활용하여 실제 값과 차이를 분석하고 정확한 예측을 위한 조건들을 제시하여 암호화폐 자동매매를 하기 위한 새로운 알고리즘을 제공하여 건전한 투자 문화를 정착시키는 데 이바지하고자 한다.

주제어 : 인공지능, 예측 시스템, fbprophet, 딥러닝, 기계학습

1. Introduction

Recently, neural network algorithms such as CNN (Convolutional Neural Networks) have been used in various fields such as images, natural language processing, and robotics by enabling atypical data analysis that was difficult to learn in the past due to the development of hardware and the advent of big data processing techniques. Deep learning is a technique that is widely used among machine learning methods. Since it generates and analyzes data itself without providing prior knowledge, a lot of research is being conducted recently. In particular, stock investment in the financial field is the field of interest in artificial intelligence, and if it is possible to predict stock prices using artificial intelligence, huge profits can be expected. Recently, as the trading volume of cryptocurrency exchanges has surpassed that of securities companies, many studies have been conducted on automatic cryptocurrency trading and prediction of cryptocurrency prices using artificial intelligence [1-2].

2. Related Work

2.1 LSTM

LSTM is an abbreviation of Long Short Term Memory, and is mainly used for past time series processing. It predicts the future by learning past data of stock prices, and compares it with actual data to make predictions by reflecting the flow of the past. LSTM is a structure in which when an input value is entered, it is cycled several times to calculate an output value. In the middle, it acts as a bridge with a value of h. It is called a hidden state, and the role is to remember some and erase some, so using only some of the past data is the key. The advantage and characteristic of LSTM is that historical data are not equally used for future forecasting because the distant

past does not affect the present price and the recent past affects the present price. Fig 1. is the basic configuration diagram of LSTM [3].
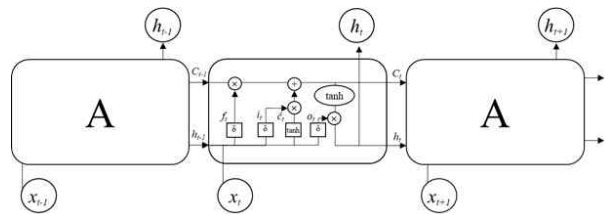

Fig. 1. Configuration of LSTM

2.2 BLSTM

LSTM goes in one direction by making predictions from the past to the present. However, BLSTM is an abbreviation of Bidirectional LSTM and can maintain more accuracy than LSTM by predicting in the opposite direction. The characteristic of BLSTM is that it complements each other by looking at the result of LSTM and predicting the past with BLSTM [4]. Fig. 1 is a BLSTM configuration diagram, characterized by dividing the LSTM into forward and backward and verifying it once more, and it plays a role of memorizing only some of the indicators in the past in the h state.
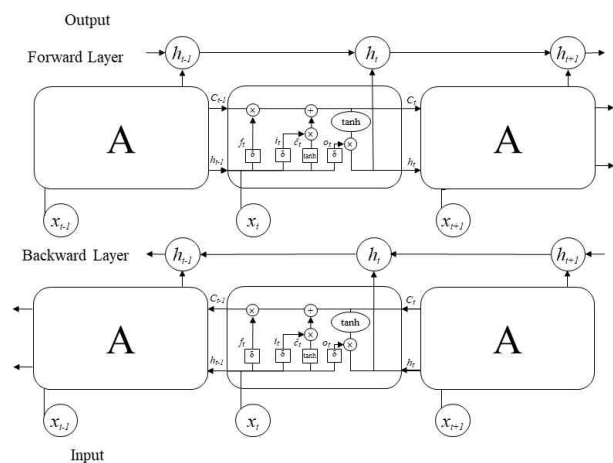

Fig. 2. Configuration of BLSTM

2.3 fbprophet

fbprophet is a time series prediction library created by Facebook that accepts time series data as input and trains it to predict the future.

It has the advantage of being able to adjust the model through intuitive parameters without statistical knowledge. In general, it shows high performance even if only the default value is used, so it will be used a lot in recent cryptocurrency predictions, and like other AI algorithms, there is no need to worry about how the inside works. The exact algorithm cannot be known because the internal algorithm is not disclosed, but it is characterized by analyzing time series data and analyzing the flow to make a prediction, and the accuracy can be known by comparing it with the actual value. Therefore, in this study, we predict the price of cryptocurrency using fbprophet and analyze the accuracy [5]. To use fbprophet, python language was used, Anaconda was used as a development platform, and target price for automatic trading was predicted using Colab. Anaconda is a development platform that collects open sources necessary for Python-based data analysis. Because it provides a virtual environment manager function and a package manager function, you can maximize the efficiency of Python and configure the development environment for each project [7]. Colab is an abbreviation of Colaboratory. It is a Python execution environment that can run Python in a browser, does not require any configuration, can use GPU, and can be easily shared [6]. Colab can make the most of its popular Python library, analyze and visualize data. You can generate arbitrary data using numpy and graph it using mathplotlib [8-9].

3. How to predict the price of fbprophet cryptocurrency

3.1 fbprophet overview

fbprophet is a time series prediction library released by Facebook. There is the advantage of high performance, accuracy, and easy model modification with intuitive parameters. The main components of the fbprophet model are Trend, Seasonality, and Holiday. Combining those can be expressed by the below formula (1).

$$y(t)=g(t)+s(t)+h(t)+\epsilon i \qquad (1)$$

$g(t)$: logistic growth curve on modeling non-periodic changes in time series

$s(t)$: periodictional changes (ex. weekly/yearly seasonality)

$h(t)$: affects of holidays with unpredictable schedules

ϵi errors accounts for any irregular changes not accommodated by this mode [16].

fbprophet is open source software released by Facebook's Core Data Science team. Prophet is an artificial intelligence algorithm that predicts time-series data based on models with non-linear trends suitable for year, week, and day. Therefore, it is an artificial intelligence algorithm optimized for time series data analysis. In addition, Prophet is resistant to missing data and trend changes, and is generally known to handle exceptional values well [10-11].

3.2 fbprophet installation guide

To install fbprophet, you must first run the following environment installation and update.

1. Step Anaconda installation
(https://www.anaconda.com/)
2. Step pip install pyupbit
3. Step pip install schedule
4. Step conda install -c conda-forge fbprophet
5. Step pip install pystan --upgrade

Step 1 is to download the Anaconda file and install the appropriate version for your OS. Step 2 thur Step 5 are installing additional libraries.

In this study, Python 3.9.0 and extension were installed, and the source code for prediction was executed in Visual Studio Code 1.56.2 and Colab. Google Colab is an open Jupyter Notebook

development environment based on distributed cloud. It consists of technology stacks of Colab, Google drive, docker, linux, and Google cloud. The advantage of Cob is that it is easy to set up the environment and prepare for operation, and multiple people can work at the same time, and if there is an Internet browser, it can be accessed anytime, anywhere. In addition, there is an advantage that can be implemented on mobile. It provides more convenient functions compared to Jupyter Notebook. In other words, there are table of contents function, preview function of Markdown, power level, cat mode, etc. It is easy to link with Git and it is a good environment to share knowledge with others. If you gather somewhere to conduct a study, everyone will waste time adjusting the laptop environment due to the Python-based nature, but there is no need for that. When an error occurs, click the [SEARCH STACK OVERFLOW] button to automatically display the results of the Stack Overflow site search. However, it should be noted that, since it is free, the maximum session duration is 12 hours, and when 12 hours have passed, it is safely stored in Google Drive with the *.ipynd extension. If the network is separated for security, such as in government or financial institutions, it cannot be used in the internal network [12-15].

To install fbprophet, run Anaconda terminal and enter the fbprophet installation command as shown in (1) below to install. When installing in colab, you can install it by executing !pip install fbprophet on the line of code.

conda install -c conda-forge fbprophet　(1)

Fig. 3 is a command to fetch the last 200 hours of data from Upbit. Fig. 4 is the result of Fig. 3.

```
df = pyupbit.get_ohlcv("KRW-ETH",
interval="minute60")
df
```

Fig. 3. Print Open, High, Low, Close price for ETH

	open	high	low	close	volume	value
2021-07-16 05:00:00	2271000.0	2288000.0	2271000.0	2283000.0	1041.032506	2.374257e+09
2021-07-16 06:00:00	2283000.0	2291000.0	2271000.0	2271000.0	1565.147439	3.569482e+09
2021-07-16 07:00:00	2271000.0	2289000.0	2266000.0	2277000.0	1713.303558	3.901905e+09
2021-07-16 08:00:00	2278000.0	2284000.0	2249000.0	2267000.0	3013.907867	6.830009e+09
2021-07-16 09:00:00	2268000.0	2274000.0	2242000.0	2253000.0	5548.841882	1.250988e+10
...	...	...	...	...	...	...
2021-07-24 08:00:00	2432000.0	2477000.0	2430000.0	2471000.0	8463.567916	2.076064e+10
2021-07-24 09:00:00	2472000.0	2486000.0	2454000.0	2465000.0	11567.016550	2.856901e+10
2021-07-24 10:00:00	2465000.0	2482000.0	2448000.0	2475000.0	5831.384548	1.435446e+10
2021-07-24 11:00:00	2475000.0	2484000.0	2470000.0	2476000.0	3049.504804	7.553553e+09
2021-07-24 12:00:00	2475000.0	2488000.0	2461000.0	2484000.0	2784.314581	6.879553e+09

Fig. 4. The Result of Fig. 3.

It compares the price prediction and actual value of Ethereum from Upbit, the largest cryptocurrency exchange in Korea, and retrieves the latest 200 hours of data from July 16 to July 24, 2021. OHLC shows the opening price, high price, low price, and closing price. 4 Execute the command. Fig. 5 When the command is executed, Fig. As shown in 5, only the opening and closing prices are output.

```
df = df.reset_index()
df['ds'] = df['index']
df['y'] = df['close']
data = df[['ds','y']]
data
```

Fig. 5. Print Open and Close Price

Fig. 6 is a command to call fbprophet, train it, and predict for 24 hours. (2) is a command shown by a graph. (3) shows an additional graph, and the result of (3) is shown in Fig. 9 is output.

	ds	y
0	2021-07-16 06:00:00	2271000.0
1	2021-07-16 07:00:00	2277000.0
2	2021-07-16 08:00:00	2267000.0
3	2021-07-16 09:00:00	2253000.0
4	2021-07-16 10:00:00	2277000.0
...	...	...
195	2021-07-24 09:00:00	2465000.0
196	2021-07-24 10:00:00	2475000.0
197	2021-07-24 11:00:00	2476000.0
198	2021-07-24 12:00:00	2487000.0
199	2021-07-24 13:00:00	2485000.0

Fig. 6. Print of Open and Close price

```
from fbprophet import Prophet
model = Prophet()
model.fit(data)
future = model.make_future_dataframe
(periods=24, freq='H')
forecast = model.predict(future)
```

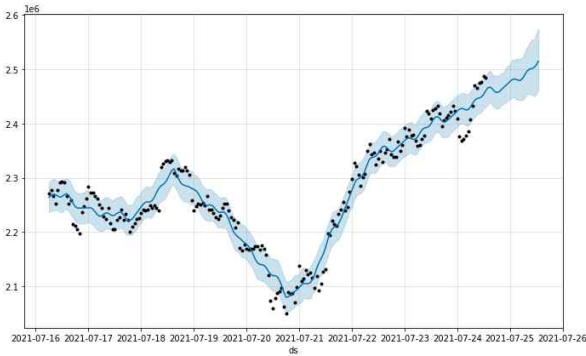Fig. 7. Import and Train Model

Fig. 8. The Result of (2)

```
fig1 = model.plot(forecast)                    (2)
```
```
fig2 = model.plot_components(forecast)   (3)
```

Fig. 8 shows the price trend by time period and the direction of the future graph. Using the indicating the price at the time of purchase, the price of Ethereum as of July 24 is 2,486,000 won, the predicted price on July 25 is 2,500,273, and the actual price on July 25 is 2,523,657, which is 0.93% error. did. fbprophet shows the trend well and predicts an increase in the price of Ethereum.
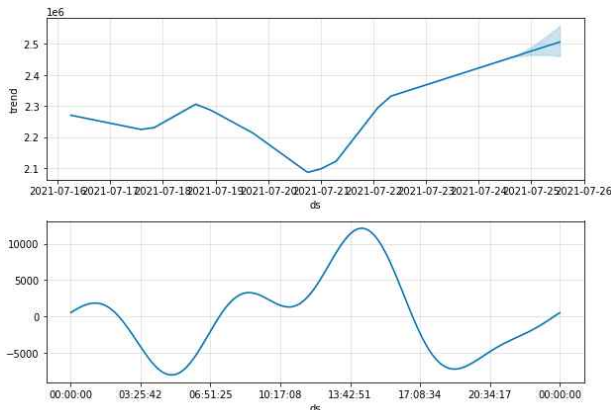

Fig. 9. The Result of (3)

4. Conclusion

Recently, automatic trading is widely used by finding patterns in the financial market and excluding human emotions using machine learning, a field of artificial intelligence. Algorithms that have been proven to be profitable in the financial market are publicly available, and by combining them appropriately, you can create your own automated stock trading program. With a well-planned program, what an investor does can be as much as changing an investment from six months to once a year. Because of these advantages, these days, not only individual investors, but also traders and investors in financial institutions are jumping into coding. As the securities transaction tax is on the decline, algorithm trading is highly likely to become a trend in the domestic market. Algorithmic trading enables large-scale trading at a speed of 1/1000th of a second, which can have the side effect of increasing market volatility. Recently, fbprophet, an artificial intelligence algorithm developed by Facebook, boasts high prediction accuracy(0.93% difference) and is used for stock price or cryptocurrency price prediction. Therefore, we intend to contribute to establishing a sound investment culture by providing a new algorithm for automatic trading of cryptocurrency through more data and long-term analysis in the future. In addition, a comparative analysis thesis for each algorithm will be conducted in the future.

REFERENCES

[1] Nikou, M., Mansourfar, G., & Bagherzadeh, J. (2019). Stock price prediction using DEEP learning algorithm and its comparison with machine learning algorithms. Intelligent Systems in Accounting, Finance and Management, 26(4), 164-174.

[2] Kim, S. W. (2021). Profitability of Trading System for Cryptocurrency. Journal of Digital Contents Society, 22(3), 555-562.

[3] Hong, S. (2020). A study on stock price prediction system based on text mining method using LSTM and stock market news. Journal of Digital Convergence, 18(7), 223-228.

[4] Hong, S. (2020). Research on Stock price prediction system based on BLSTM. Journal of the Korea Convergence Society, 11(10), 19-24.

[5] Hoyos-Rivera, G. J., Gomes, R. L., Willrich, R., & Courtiat, J. P. (2006). Colab: A new paradigm and tool for collaboratively browsing the web. IEEE Transactions on Systems, Man, and Cybernetics, Part A: Systems and Humans, 36(6), 1074-1085.

[6] Phelps, R., Krasnicki, M., Rutenbar, R. A., Carley, L. R., & Hellums, J. R. (2000). Anaconda: simulation-based synthesis of analog circuits via stochastic pattern search. IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, 19(6), 703-717.

[7] Gaur, S. (2020). Global forecasting of covid-19 using ARIMA based FB-Prophet. International Journal of Engineering Applied Sciences and Technology, 5(2), 463-467.

[8] Van Der Walt, S., Colbert, S. C., & Varoquaux, G. (2011). The NumPy array: a structure for efficient numerical computation. Computing in science & engineering, 13(2), 22-30.

[9] Hunter, J. D. (2007). Matplotlib: A 2D graphics environment. IEEE Annals of the History of Computing, 9(03), 90-95.

[10] Chikkakrishna, N. K., Hardik, C., Deepika, K., & Sparsha, N. (2019, December). Short-term traffic prediction using sarima and FbPROPHET. In 2019 IEEE 16th India Council International Conference (INDICON) (pp. 1-4). IEEE.

[11] Carneiro, T., Da Nóbrega, R. V. M., Nepomuceno, T., Bian, G. B., De Albuquerque, V. H. C., & Reboucas Filho, P. P. (2018). Performance analysis of google colaboratory as a tool for accelerating deep learning applications. IEEE Access, 6, 61677-61685.

[12] Lahmiri, S., & Bekiros, S. (2019). Cryptocurrency forecasting with deep learning chaotic neural networks. Chaos, Solitons & Fractals, 118, 35-40.

[13] Patel, M. M., Tanwar, S., Gupta, R., & Kumar, N. (2020). A deep learning-based cryptocurrency price prediction scheme for financial institutions. Journal of Information Security and Applications, 55, 102583.

[14] Kumar, D., & Rath, S. K. (2020). Predicting the trends of price for ethereum using deep learning techniques. In Artificial Intelligence and Evolutionary Computations in Engineering Systems (pp. 103-114). Springer, Singapore.

[15] Zoumpekas, T., Houstis, E., & Vavalis, M. (2020). ETH analysis and predictions utilizing deep learning. Expert Systems with Applications, 162, 113866.

[16] Introduction to time series forecasting package Prophet. Hyper Connect Tech Blog[Website]. (2020.03.09.).
URL:https://hyperconnect.github.io/2020/03/09/prophet-package.html

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