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Effective Stock Prediction Model Using MACD Method

Hamzah[1], Sugeng Winardi[2], Poly Endrayanto Eko Chrismawan [3], Firgina Paskalia Lakoy [4]

Abstract

Stock market predictions help investors to optimize benefits in the financial markets. Various papers have proposed different techniques in stock market forecasting, but no model can provide accurate predictions. In this study, we discuss how to predict stock prices using a MACD (Moving Average Convergence/Divergence Oscillator) method. We collect the dataset, preprocess it, extract features, evaluate the model, and then deploy the MACD method to develop a stock price prediction model. In this study, we collect several features, including date, open, high, low, close, and volume, to conduct the training and testing process. The results of the experiments reveal good accuracy and a low error rate. As a result, it has the potential to be a promising solution for dealing with accurate and dynamic prices. Based on the experimental result, our proposed model can obtain a transaction profit rate of 40.00% and an average profit per transaction of 1.42%.

Keywords:
Stocks, Prediction, MACD, Technical Analysis

1. Introduction

Stock is one of the most popular financial market instruments. Issuing shares is one of the company's choices when deciding to fund a company. On the other hand, stocks are an investment instrument that many investors choose because they can provide an attractive profit level. Shares can be defined as a sign of capital participation of a person or party (business entity) in a company or limited liability company. The stock price is the highest amount a buyer is willing to pay for a stock or the lowest amount a seller accepts. Supply and demand are the two most important factors that impact stock prices. If many individuals want to buy a stock, the demand will be high, and the stock price will rise, and if a large number of people want to sell the stock, the demand will be low, and the stock price will fall [1]. Stock predictions play an important role in predicting general or specific stock market movements. Due to the complexity of multivariate time series features and the volume of financial data, stock price forecasting has been considered one of the most challenging problems in financial markets [2][8].

Trading activity is one of the activities to predict the movement of stock prices to make a profit. To avoid making a mistake in investing in stocks, stock analysis is needed to be more confident in choosing stocks. One type of stock analysis that you can use is technical analysis. Technical Analysis interprets the price action of the company's underlying stock (or tradable financial instrument). Technical analysis can be described in charts and

Corresponding Author: Hamzah[1] (hamzah@respati.ac.id), Universitas Respati Yogyakarta
1. Sugeng Winardi, Universitas Respati Yogyakarta
2. Poly Endrayanto Eko Chrismawan, Universitas Respati Yogyakarta
3. Firgina Paskalia Lakoy, Universitas Respati Yogyakarta

statistical indicators to determine support/resistance, range, and price trends in the stock market. One of the most critical and complex problems is predicting stock market returns. According to several financial analyses, the stock market is predictable [7].

For investors, the stock market is a challenging issue [10]. More models used in stock market forecasting cannot provide accurate predictions [9]. Investors find it difficult to control price swings in the stock market correctly. As a result, it's critical to develop models with high predictive precision to effectively comprehend the principles of stock market volatility and assist investors in avoiding risk and increasing profits. Stock prices reflect all available information for a market economy with perfect laws and regulations. The relationship between historical and current stock prices can be used to forecast future stock trends [10].

Current methods propose intelligence techniques for developing a stock prediction system self-learning approach. Machine Learning is meaningless without data, meaning that all Machine Learning applications require data as learning material before producing an output. With Machine Learning technology, patterns from various other business data can be obtained, processed, and used to find future business trends or market behavior based on demographics, periods, seasons, temperature and weather, or other factors. From there, we can "predict" or "forecast" the results that will be obtained by the business so that the right decision maker is called predictive analytics. From the activities of investment actors in the form of stocks, trading, which is an action in determining stock investments, and the use of machine learning technology in the financial sector, the researchers will conduct research related to stock market trend predictions with technical analysis methods using machine learning. The relationship between historical and current stock prices can be used to forecast future stock trends [11].

2. Related Works

Shares are proof of ownership of the value of a company or evidence of equity participation. Shareholders also have the right to receive dividends according to the number of shares they own. Individuals and entities can claim ownership in a public company by holding shares. This means that, regardless of the number of shares owned, shareholders are entitled to attend the General Meeting of Shareholders (GMS). One way to own a company's shares is to buy them in the capital market [5]. Trading is a transaction process in the financial market where the system often works to sell and buy assets quickly. Traders benefit by selling the asset for a higher price than when they purchased shares. Trading involves the buying and selling of goods and services. So, the seller can benefit from the compensation provided by the seller. This compensation can also be generated from exchanging goods and services between the parties [6][18].

A paper proposes using Complex Networks and Machine Learning to anticipate stock price patterns in a research topic. In this investigation, they developed a novel pattern network design method for multivariate stock time series. In addition, each combination of symbolic patterns' topological characteristic variables is employed as input variables. To anticipate the next day's volatility pattern from one inventory, KNN and SVM models are utilized. Cross-validation and search approaches can find the best model that suits both algorithms based on the research findings. The three indexes have a prediction accuracy rating of more than 70%. The SVM algorithm generally outperforms the KNN method in prediction ability [15].

Other researchers offered clustering algorithms such as MSD and K-Means clustering to mine related equities. Also known as C-HTM, HTM is an online learning model used to analyze trends of comparable stocks and generate forecasts. The model has shown that C-HTM has superior prediction accuracy and performance than all the basic models based on experimental results on price prediction [16]. Another article uses Elman's network to predict stock prices using historical data on the Shanghai Composite index's closing price and the Shenzhen Composite index's opening price for building the next trading day prediction [14].

The current paper proposes an LSTM to learn from time-series data and predict future trends [19]. However, most existing research focuses only on individual stock information and stock market information, such as correlations between stocks. LSTM is a well-known method for extracting knowledge from time-series data and forecasting future trends [13]. Unfortunately, the learning approach can be a new solution for predicting dynamic stock prices. For example, a paper proposes using a Deep Q-Network with the CNN function approximator to make global stock market forecasts using stock chart images as input. It shows that future stock values can be forecasted even when the model is trained and evaluated on data from various places. The model can be trained on extensive, liquid market data (for example, in the United States) and tested on tiny market data. The findings suggest that artificial intelligence-based stock price forecasting models can be employed in small markets (developing nations), even though small markets lack sufficient data for training [12].

3. Proposed Method

MACD is one of the simplest momentum indicators ever. This indicator can help traders spot trends and apply the best technical analysis to all assets. This indicator determines the current direction, strength, and probability of its reversal. MACD shows the correlation between two Moving Averages for asset prices. Several essential components make this indicator such a powerful tool: The MACD line (blue) shows the difference between two EMA lines of different periods: 12 and 26. When this line crosses the zero line, there is no difference between the EMAs at that time. The more significant the difference, the farther the MACD line is from the zero line [17].

The signal line (orange) is a smooth MACD line. By default, the average of the previous nine periods is used for calculation. This line acts as a slow-moving average, intersecting with the fast MACD line, generating a signal that we will see. The histogram shows the distance between the signal line and the MACD line. This line changes position concerning the zero-line depending on the direction of the asset trend. If the price is directed upwards, the bar is above the baseline. If the movement is down, the bar will be below the line. The color of the bar indicates whether there will be a bullish or bearish momentum. [4]

Technical analysis is an analytical technique used to analyze price fluctuations within a certain period. From this analysis, investors can see patterns of stock price movements, market data, and stock transaction volumes to determine when to buy or sell. Unlike fundamental analysis, technical analysis does not look at things related to economic conditions. Technical analysis has a function to detect trends and give signals to buy or sell. Technical analysis is used to analyze prices based on past price data. With the help of this data, analysts try to spot trends or price patterns that are developing. This is a factor where transaction actors can determine the time to buy and sell.

In technical analysis, charts and graphs are essential components. Charts can display stock price movements through a graphic display, while a candle stick shows the daily activity of stock prices. The MACD line is calculated by subtracting the 26-period exponential moving average (EMA) from the 12-period EMA. The signal line is a nine-period EMA of the MACD line [3]

4. Experimental Setup

The basic idea of our research is to create a predictive model based on closing price data features that use trading algorithms to forecast stock prices using the TA-lib library in python. Trading algorithms are often used to overcome stock price forecasting problems based on technical analysis. In this study, we use MACD technical analysis. In an experiment in this study, we collected a stock price dataset obtained from yahoo finance which utilizes the closing stock price dataset of the public company PT. Bank Syariah Indonesia Tbk. We fetch stock prices from December 27 May 2021, to July 17, 2022, time series table with some features.

5. Result & Analysis

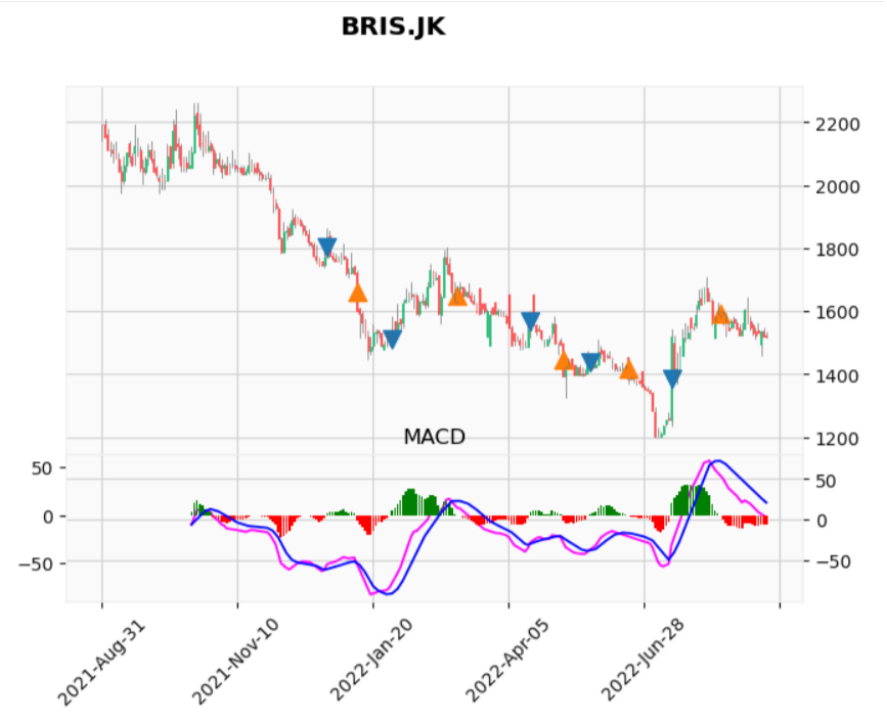

Fig.1: MACD stock prediction chart

Based on the experimental result, the MACD can obtain the best trend and momentum using the dataset. The MACD fluctuates above and below the zero line as the moving averages converge, cross and diverge. Hence, traders can look for signal line crossovers, centerline crossovers, and divergences to generate signals. Because the MACD is unbounded, it is not particularly useful for identifying overbought and oversold levels.

Table 1: MACD Analytic Chart Output

Buy Date	Duration	Profit	Percentage
2021-12-27	16	-143.171937	-7.93%
2022-01-31	37	138.235033	9.14%
2022-04-18	24	-120.955627	-7.72%
2022-05-30	21	-16.656424	-1.16%
2022-07-12	24	205.000000	14.77%

Based on the experimental result, the process of collecting and processing historical price data using MACD obtained the following result:

a. There are five transactions (sell/buy) in 1 (one) year
b. Using the MACD method can predict about 40% of profitable trade
c. The average profit per trade was 1.42%, with the most profitable trade making 14.77%, while the worst loss was - 7.93%.

6. Conclusion

Stock market predictions help investors benefit in the financial markets. Various papers have proposed different techniques in stock market forecasting, but no model can provide accurate predictions. In this study, we developed a stock price prediction model using a Moving Average Convergence/Divergence Oscillator (MACD). To create a stock price prediction model, we collect the dataset, preprocess it, extract features, evaluate the model, and then deploy the MACD method to predict stock prices in real-time.

In this paper, we propose MACD as one of the most popular technical indicators in trading to predict stock prices. The MACD is appreciated by traders worldwide for its simplicity and flexibility. It can be used as a trend or momentum indicator and signal opportunities to enter and exit positions. We gather a dataset from Yahoo Finance or other stock exchanges to conduct our experiment. Based on the experimental result, we obtained a transaction profit rate of 40.00% and an average profit per transaction of 1.42%. Based on the experimental result, our proposed method can achieve a promising gain and be a candidate for practical implementation in the stock market.

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References

[1] Saud, A. S., & Shakya, S. "Analysis of lookback period for stock price prediction with RNN variants. A case study on banking sector of NEPSE." Procedia Computer Science, Vol. 167, pp. 788-798. 2020.

[2] Ta, V.-D., Liu, C.-M., & Tadesse, D. A. "Portofolio Optimization-Based Stock Prediction Using Long-Short Term Memory Network in Quantitative Trading." Applied Sciences, Vol.10, No.2, pp. 437. 2020.

[3] Polamuri, S. R., Srinivas, D. K., & Krishna Mohan, D. A. "Multi-Model Generative Adversarial Network Hybrid Prediction Algorithm (MMGAN-HIPA) for stock market prices prediction." Journal of King Saud University – Computer and Information Sciences. 2021

[4] Feng, F., He, X., Wang, X., Luo, C., Liu, Y., Chua, T. -S. "Temporal Relational Ranking for Stock Prediction." ACM Transactions on Information Systems, Vol. 37 No. 2, pp. 1-30. 2019.

[5] Lin, H., Chen, C., Huang, G. & Jafari, A. "Stock price prediction using Generative Adversarial Networks." Journal of Computer Science, Vol. 17, No. 3, pp. 188-196. 2021.

[6] Nabipour, M., Nayyeri, P., Jabani, H., Mosavi, A., Salwana, E., & S., S. "Deep Learning for Stock Market Prediction." Entropy, Vol. 22 No. 8, pp. 840. 2020.

[7] Zhang, K., Zhong, G., Dong, J., Wang, S., & Wang, Y. "Stock Market Prediction Based on Generative Adversarial Network." Procedia Computer Science. Vol. 147, pp. 400-406. 2019.

[8] Usmani, S., & Shamsi, J. A. "News sensitive stock market prediction: Literature review and suggestions." PeerJ Computer Science, Vol. 7. 2021.

[9] Kelotra, A., & Pandey, P. "Stock Market Prediction Using Optimized Deep- ConvLSTM Model. Big Data, Vol. 8 No. 1, pp. 5–24. 2020.

[10] Sim, H. S., Kim, H. I., & Ahn, J. J. "Is Deep Learning for Image Recognition Applicable to Stock Market Prediction?" Complexity, Vol. 2019, pp. 1–10. 2019

[11] Wang, Y., Liu, H., Guo, Q., Xie, S., & Zhang, X. "Stock Volatility Prediction by Hybrid Neural Network." IEEE Access, 1–1, 2019.

[12] Lee, J., Kim, R., Koh, Y., & Kang, J. "Global Stock Market Prediction Based on Stock Chart Images Using Deep Q-Network." IEEE Access, 1–1. 2019

[13] Zhang, Y., Li, J., Wang, H., & Choi, S. C. T. "Sentiment-Guided Adversarial Learning for Stock Price Prediction." Frontiers in Applied Mathematics and Statistics, Vol. 7. 2021.

[14] Liu, B., Wu, Q., & Cao, Q. "An Improved Elman Network for Stock Price Prediction Service." Security and Communication Networks, Vol. 2020, pp. 1–9, 2020.

[15] Cao, H., Lin, T., Li, Y., & Zhang, H. "Stock Price Pattern Prediction Based on Complex Network and Machine Learning." Complexity, Vol. 2019, pp. 1–12, 2019

[16] Wang, X., Yang, K., & Liu, T. (2021). Stock Price Prediction Based on Morphological Similarity Clustering and Hierarchical Temporal Memory. IEEE Access, Vol. 9, pp. 67241–67248, 2021.

[17] Gabriel Dan I. Anghel, Stock Market Efficiency and the MACD. Evidence from Countries around the World, Procedia Economics and Finance, Vol. 32, , pp. 1414-1431, 2015

[18] Diqi, M., Hiswati, M.E. & Nur, A.S. StockGAN: robust stock price prediction using GAN algorithm. Int. j. inf. tecnol. 14, 2309–2315, 2022.

[19] Diqi, Mohammad. StockTM: Accurate Stock Price Prediction Model Using LSTM. International Journal of Informatics and Computation, [S.l.], Vol. 4, n. 1, pp. 1-10, oct. 2022.