Analysis of Stock Price Trend Prediction Using the Support Vector Machine (SVM) Method with the Moving Average Indicator at PT Bukit Asam Tbk

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Abstract

This study aims to analyze and predict stock price trends using the Support Vector Machine (SVM) method with the Moving Average indicator for PT Bukit Asam Tbk. The data used is historical stock price data consisting of open, high, low, adjusted close, volume, and technical moving average indicators (MA5 and MA10). The method used in this study is the Support Vector Machine algorithm implemented using the Weka application with a 10-fold cross-validation evaluation technique. The research process includes data collection, data preprocessing, calculation of moving average indicators, formation of trend variables, and the classification process using the SVM model. The test results indicate that the model is able to classify stock price trends with an accuracy level of 49.27%. This value indicates that the model still has limitations in optimally capturing patterns of stock price movement. Nevertheless, the use of the SVM method with the moving average indicator can be used as an approach in analyzing predictions of stock price trends. This study is expected to provide a reference for further research in developing models for predicting stock prices by adding other technical indicators or using different classification methods to increase the level of prediction accuracy.

Keywords: *Predicting Tren Saham; Support Vector Machine (SVM); Moving Average; Data Mining*

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Introduction

The development of information technology and data analysis has encouraged the use of computational methods in various fields, including stock market analysis. Stocks are an investment instrument with high profit potential but also carry a high level of risk due to dynamic price fluctuations. Therefore, an analytical method is needed that can help investors understand patterns of stock price movement and predict future stock price trends. The ability to accurately predict stock prices can provide a competitive advantage for investors and assist in making better investment decisions [1]. Recently, machine learning methods have been widely used in research on stock price prediction because they can process large amounts of historical data and discover hidden patterns in it. Research has shown that machine learning algorithms effectively model complex and non-linear stock price movements. This method allows for a more systematic analysis process by utilizing historical data to produce more accurate prediction models [2].

One of the machine learning algorithms frequently used in research on stock price prediction is the Support Vector Machine (SVM). This method has outstanding classification capabilities and is able to work effectively on high-dimensional data. Several studies have indicated that the SVM method can be used to predict the direction of stock price movements with a fairly satisfactory level of accuracy if supported by the selection of appropriate features and parameters [3]. In addition to the use of machine learning algorithms, technical indicators also play an important role in the process of analyzing stock price movements. The Moving Average (MA) is a common indicator. The moving average helps to find the direction of stock price movement trends and smooths out short-term changes in stock price data by calculating the average stock price over a certain period of time [4].

Several previous studies have indicated that a combination of machine learning algorithms and technical indicators can improve a model's ability to predict stock price movements. Research conducted on various stocks on the Indonesia Stock Exchange shows that historical stock price data, such as open, high, low, close, and volume, can be used as variables in building a model to predict stock prices using a machine learning approach [5].

Based on this background, this study aims to analyze and predict stock price trends using the Support Vector Machine (SVM) method with the Moving Average indicator on PT Bukit Asam Tbk shares. This study is expected to provide an overview of the SVM method's ability to classify stock price trends based on historical data and serve as a reference for further research in developing models for stock price prediction.

Literature Review

Extensive research on stock price prediction has been conducted using various data analysis and machine learning methods. Machine learning methods are considered capable of processing large amounts of historical data and discovering hidden patterns in the data, thus enabling them to predict future stock price movements. Based on a literature review, various machine learning algorithms have been applied in stock price prediction research, such as Artificial Neural Network, Decision Tree, and Support Vector Machine [1]. One of the AA method that is widely used in research on stock price prediction is Support Vector Machine (SVM). This method is known to have outstanding classification capabilities because it can build a hyperplane optimal for separating data based on specific classes. Previous research has indicated that the SVM algorithm has quite excellent performance in predicting the direction of stock price movements when supported by the selection of appropriate parameters and features [2]. Furthermore, other research has also shown that parameter optimization in the SVM algorithm can increase the model's accuracy in predicting stock prices [5].

In addition to the use of algorithms and machine learning, technical indicators also play an important role in analyzing stock price movements. Technical indicators help find patterns in price movement by looking at past data. One of the most commonly used technical indicators is the Moving Average (MA). Moving average is a way to determine the average stock price over a set amount of time. This helps to find the direction of stock price movement trends and smooths out short-term changes in stock price data [3]. Several studies have also shown that the combination of machine learning algorithms and technical indicators can improve the performance of models that predict stock prices. Research on banking sector stocks on the Indonesia Stock Exchange indicates that employing the SVM algorithm alongside technical indicators can enhance the model's efficacy in forecasting stock price movements [4].

Other studies also show that the use of historical variables such as open, high, low, close, and volume can serve as features in building models that predict stock prices using machine learning. These variables can be processed through preprocessing and modeling stages to produce a predictive model that is better at identifying trends in stock prices [6]. In addition, recent research indicates that the use of technical indicators such as Moving Average, Relative Strength Index (RSI), and Moving Average Convergence Divergence (MACD) can improve the quality of information used in predicting stock prices. These indicators help machine learning models recognize market trend patterns, thereby increasing the accuracy of the resulting predictions [7].

Based on various previous studies, it can be concluded that the use of the Support Vector Machine method combined with technical indicators such as moving averages has significant potential in predicting stock price trends. Therefore, this study was conducted to analyze the capabilities of this method. Support Vector Machine with Moving Average indicators is used to predict stock price trends at PT Bukit Asam Tbk by utilizing historical stock price data as a research variable.

Research Methodology

This study uses a quantitative approach with historical data analysis to predict stock price trends using a machine learning algorithm. The method used in this study is the Support Vector Machine (SVM) with the Moving Average technical indicator. The data used in this study is historical stock price data from PT Bukit Asam Tbk, consisting of several attributes. These include open, high, low, adjusted close, and volume. The historical data is then processed to build a classification model capable of predicting stock price trends. The data processing is carried out using Weka software, a data mining application frequently used for classification, clustering, and data analysis. The model evaluation method used in this study is 10-fold cross-validation to measure the accuracy of the resulting classification model. In this study, the Moving Average (MA) technical indicator is used to help identify trends in stock price movements. Moving Average is an indicator that calculates the average value of stock prices over a certain period of time, thereby helping to reduce short-term fluctuations in stock price data and simplifying the identification of market trend directions.

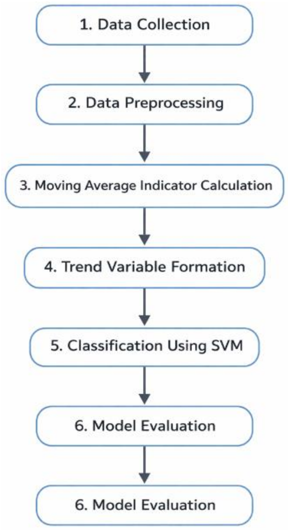

Figure 1. Research Stage

Results

This study aims to predict stock price trends using the Support Vector Machine (SVM) method with the Moving Average technical indicator. The dataset used is historical stock data from PT Bukit Asam Tbk consisting of several attributes, namely open, high, low, adjusted close, volume, MA5, and MA10. Data processing and classification were carried out using Weka software with a 10-fold cross-validation evaluation method. The number of datasets used in this study was 1373, with 9 attributes consisting of one class attribute, namely trend, which indicates the category of stock price movements. A classification model was then built using the Support Vector Machine algorithm to predict stock price trends based on available historical data.

a. Model Classification Results

The model evaluation results, based on the classification process using the SVM method, are shown in Table 1.

Table 1. Classification Model Evaluation Results

Parameter	Mark
Correctly Classified Instances	676
Incorrectly Classified Instances	696
Accuracy	49.27%
Kappa Statistic	-0.027
Mean Absolute Error	0.507
Root Mean Squared Error	0.712

Based on the model evaluation results in Table 1, the resulting classification model's accuracy level is 49.27%. This value indicates that the model is able to correctly classify approximately half of the total data. However, the negative Kappa statistic value (-0.027) indicates that the level of agreement between the model's predictions and the actual data is still relatively low.

b. Analysis of Confusion Matrix

A confusion matrix is used to determine how the model classifies data in each class. The confusion matrix results are shown in Table 2.

Table 2. Classification Model Evaluation Results

Actual / Predicted	Trend 0	Trend 1
Trend 0	421	316
Trend 1	380	255

Based on Table 2, it can be seen that 421 data were successfully classified correctly as class 0, while 255 data were successfully classified correctly as class 1. However, there were also a number of classification errors: 316 instances of class 0 were predicted as class 1, and 380 instances of class 1 were predicted as class 0. This shows that the model still has difficulty in accurately distinguishing stock price trends.

c. Model Performance Analysis

Based on the model testing results, the precision, recall, and F-measure values indicate relatively low performance. This could be due to several factors, including the limited number of features used in the classification process and the complexity of stock price movements, which are influenced by various external factors, such as economic conditions, government policies, and market sentiment. Furthermore, the limited use of technical indicators, such as Moving Averages (MA5 and MA10), can also affect the model's ability to recognize more complex patterns in stock price movements. Previous research has shown that using a combination of several technical indicators, such as the Relative Strength Index (RSI) or Moving Average Convergence Divergence (MACD), can improve the performance of models that predict stock prices.

d. Comparison with Previous Research
Several previous studies have shown that the Support Vector Machine method has quite satisfactory capabilities in predicting stock price trends when combined with various technical indicators and model parameter optimization. These studies indicate that selecting the right features and parameters can improve the accuracy of models that predict stock prices. In this study, the accuracy obtained was still relatively low, at 49.27%, indicating that the model used can still be further developed by adding other feature variables or technical indicators to improve the model's predictive capabilities.

e. Research Implications
This study's results suggest that historical stock data can effectively predict stock price trends using the Support Vector Machine method. However, the results of the model evaluation show that we still need to improve the accuracy of the model by adding additional features and optimizing its parameters. This research is expected to contribute to the development of machine learning-based stock price prediction methods and serve as a reference for future research seeking to develop more complex and accurate stock price trend prediction models.

Conclusion

Based on the results of the research that has been carried out, it can be concluded that the Support Vector Machine (SVM) method with the technical indicator Moving Average can be used to predict stock price trends using historical data. This study uses historical stock data from PT Bukit Asam Tbk, which consists of several attributes, such as open, high, low, adjusted close, volume, MA5, and MA10. The modeling process was carried out using Weka software with a 10-point evaluation method. fold cross validation. The results of the model testing show that the SVM algorithm is capable of producing a classification model with an accuracy rate of 49.27% in predicting stock price trends. In the confusion matrix, 676 data points were correctly classified, while 696 data points were misclassified. The low Kappa statistic value indicates that the model's ability to distinguish stock price trends is still limited.

The results of this study indicate that using the moving average technical indicator alone is insufficient to produce a predictive model with a high level of accuracy. Therefore, further research is recommended to add other technical indicators such as the Relative Strength Index (RSI) or Moving Average Convergence Divergence (MACD) and optimize parameters in the SVM algorithm to improve the model's performance in predicting stock price trends. The conclusions are formulated based on the results of the problem-solving analysis. The conclusion is presented in the form of paragraphs. At the end of the conclusion, it is necessary to write about the implications and development of the findings.

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