Engineering and Scientific International Journal (ESIJ)
Volume 11, Issue 4, October – December 2024
ISSN 2394-7187(Online)
ISSN 2394 - 7179 (Print)

Forecasting Cryptocurrency Trends using Web Application

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Abstract — Global currency values have been declining, stock markets have been having a bad run, and investors have been losing capital over the past two years due to growing geopolitical and economic concerns. As a result, interest in virtual currencies has increased. One of the most well-known digital currencies, cryptocurrency, has gained attention from investors hoping to get a piece of it and from businesses accepting it as payment because of its consistent performance over the past several years. The study proposes a system aimed at accurately predicting the prices of Bitcoin, Ethereum, and Litecoin by considering various parameters influencing their values. For the first phase of investigation, aim to understand and identify daily trends in the cryptocurrency market while gaining insight into optimal features surrounding cryptocurrency price. The data set consists of various features relating to the Bitcoin, Ethereum and Litecoin price and payment network over the course of five years, recorded daily. For the second phase of investigation, using the available information to predict the sign of the daily price change with highest possible accuracy. The overall goal of the project is to construct a machine learning model that can predict price trends with results superior to that of random selection.

Keywords: *Bitcoin; Ethereum; Litecoin; Cryptocurrency; Machine Learning; Price Prediction.*

1. Introduction

In recent years, cryptocurrencies have transformed the way people think about financial transactions and reshaped the traditional financial industry. The emergence of cryptocurrencies has given investors new opportunities to make successful investments [6]. Cryptocurrencies are virtual currencies that rely on blockchain technology, a distributed ledger system that enables safe and open exchanges without the need for a central authority [1]. Cryptocurrencies, including Bitcoin, Ethereum, and Litecoin, have become prominent digital assets in the global financial landscape, reshaping traditional concepts of currency and investment. Each cryptocurrency operates on a decentralized blockchain network, offering unique features and functionalities. Bitcoin, introduced in 2009 by an anonymous entity known as Satoshi Nakamoto, is the pioneering cryptocurrency and the most widely recognized digital currency to date. As the first cryptocurrency, Bitcoin holds a significant market share and is often considered a store of value or "digital gold" by investors. Ethereum, launched in 2015 by Vitalik Buterin and a group of developers, represents a decentralized platform that enables the creation of smart contracts and decentralized applications (DApps). Unlike Bitcoin, Ethereum's blockchain is programmable, allowing developers to build and deploy smart contracts that automate and enforce Agreements without intermediaries. The native cryptocurrency of the Ethereum platform is Ether ETH), which serves as both a digital currency and a means to facilitate transactions and incentivize network participants. Ethereum's versatility and support for DApps have contributed to its popularity and widespread adoption within the blockchain ecosystem.

Litecoin, created by Charlie Lee in 2011, is often referred to as the "silver to Bitcoin's gold" due to its similarities to Bitcoin in terms of codebase and functionality. However, Litecoin aims to offer faster transaction confirmation times and improved scalability compared to Bitcoin. Litecoin's primary objective is to serve as a peer-to-peer digital currency for everyday transactions, emphasizing speed and efficiency. Predicting the prices of Bitcoin, Ethereum, and Litecoin presents unique challenges due to their volatile nature and susceptibility to various market factors. However, advancements in machine learning and data analysis techniques have enabled researchers and traders to develop models and strategies for forecasting cryptocurrency prices with varying degrees of accuracy. In this study, the application of machine learning algorithms and data analysis methods to predict the price trends of Bitcoin, Ethereum, and Litecoin is explored, aiming to provide valuable insights for investors and market participants in the dynamic cryptocurrency market.

The study compared the predictive performance of several machine learning algorithms, such as Support Vector Regression, Random Forest, and Neural Networks, in forecasting Bitcoin prices. It incorporated diverse features including historical price data, market capitalization, and trading volume. Findings indicated that Random Forest and Neural Networks exhibited superior performance compared to other algorithms in predicting Bitcoin prices [2]. The study employed a range of machine

DOI: **10.30726/esij/v11.i4.2024.114009**

ISSN 2394-7187(Online)
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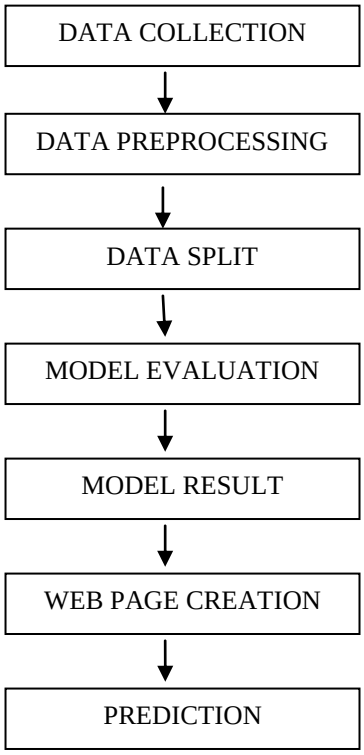
learning algorithms, encompassing linear regression, decision trees, and neural networks, to forecast Bitcoin prices. Through the exploration of diverse feature sets and assessment of algorithm performance across varying sample sizes, the research revealed that integrating historical price data, technical indicators, and social media sentiment enables accurate prediction of Bitcoin prices [10]. Various machine learning algorithms, such as decision trees, random forests, and gradient boosting machines, were utilized to forecast the price of Bitcoin. Diverse features, including historical price data, trading volume, and social media sentiment, were incorporated into the analysis. The results indicated that gradient boosting machines demonstrated superior performance compared to the other algorithms in predicting Bitcoin prices [4].

2. Process Flow



3. Data Collection

Data collection is very important because the quality and quantity of the data gathered will directly affect the level of the prediction model. The dataset contains approximately 5616 rows and 8 columns. The dataset includes different parameters Date, Closing price, Open, Close, High, Low, Volume, Change percent.

- Date: Referring to the historical price or market data of a cryptocurrency on a specific date
- Opening Price: The initial price of the cryptocurrency at the beginning of the day's trading session.
- Opening Price: The initial price of the cryptocurrency at the beginning of the day's trading session.
- Closing Price: The final price of the cryptocurrency at the end of the day's trading session.
- High Price: The highest price reached by the cryptocurrency during that specific day.
- Low Price: The lowest price reached by the cryptocurrency during that specific day.
- Volume: The total amount of the cryptocurrency traded within that day.
- Change Percent: The percentage change in price from the opening to the closing price during that day.

Table 1: Data values

Date	Name	Close	Open	High	Low	Volume	Change %
2/15/2024	BTC	52069.40	51805.20	52447.10	51751.10	90.05K	0.55%
2/14/2024	BTC	51782.40	49708.60	52010.70	49263.80	80.35K	4.16%
2/15/2024	ETH	2772.58	2775.12	2824.91	2760.98	588.63K	0.02%
2/14/2024	ETH	2855.12	2640.12	2785.51	2619.77	491.97K	5.11%
2/15/2024	LTC	60.757	69.82	70.89	69.045	1.21M	-0.09%
2/14/2024	LTC	79.82	68.96	70.739	68.429	1.41M	1.25%

4. Methodology

Machine learning is an important branch of artificial intelligence (AI). According to whether there is a target variable, it can be divided into supervised learning, unsupervised learning, and reinforcement learning. The purpose of this study is to predict future cryptocurrency prices, so a regression function with supervised learning is used. The unified execution logic of machine learning is that after the algorithm is preset, a learner is generated, and a high-precision learner is obtained by repeated training of the learner through training data and the process of validation. Finally, the test data is substituted into the trained learner for evaluation and application.

4.1 Linear Regression

This technique is used to identify the relationship between dependent and independent variables and is leveraged to predict future outcomes. When only one dependent variable and one independent variable are used in a regression analysis, it is called simple linear regression. As the number of independent and dependent variable increase, it is then referred to as multi-linear regression. Linear regression is a simple yet powerful technique for cryptocurrency price prediction, especially when the relationship between the independent variables and the dependent variable is linear or can be approximated as linear. However, it may not capture complex

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nonlinear relationships present in cryptocurrency markets, which could limit its predictive accuracy compared to more sophisticated machine learning algorithms. The main goal is to derive a line that optimally fits the data. The ideal line minimizes the total prediction error, which refers to the distance between points on the regression line. This error reflects the disparity between the actual data points and the predicted values generated by the regression model.

4.2 Gradient Boosting Regressor

Gradient Boosting Regressor is a popular machine learning algorithm used for regression tasks. It is an ensemble learning method that builds a series of weak learners, typically decision trees, sequentially. Each new learner is trained to correct the errors made by the combination of previously trained learners. Gradient Boosting Regressor combines the predictions of these weak learners to generate a strong predictive model. It is highly flexible and can capture complex nonlinear relationships in the data. It typically performs well in practice and is less prone to overfitting compared to other algorithms. It can handle different types of data and is robust to outliers. It can be computationally expensive and may require tuning of hyperparameters to achieve optimal performance. It may not perform well with noisy or sparse datasets. It may be sensitive to outliers in the data. Overall, Gradient Boosting Regressor is a powerful algorithm for regression tasks and is widely used in various applications, including predicting cryptocurrency prices and stock market trends.

4.3 Import the Libraries

Importing libraries is the first step in training a machine learning model. It is essential to import the necessary libraries to access and utilize the required functions and classes for building and training the model.

5. Data Preprocessing

The collected data may contain errors, missing values, and outliers that need to be cleaned and preprocessed before using it for machine learning models. One hot encoding is a valuable preprocessing technique for handling categorical variables in machine learning tasks, enabling algorithms to effectively learn from categorical data and improve predictive performance. The data should also be normalized.

6. Train the Model

Training data is an essential component of every machine learning model. The train_test_split function from the scikit-learn library to split the dataset into training and testing sets. The function returns four arrays: X_train, X_test, y_train, y_test.

7. Model Evaluation

After training, the model is evaluated on the test data using the evaluate function. The test loss and accuracy are computed and printed. Evaluation metrics are essential for determining a model's performance and its relevance for solving an identified problem. The choice of the evaluation metrics is based on the relevance of the problem to be solved and the characteristics of the target variables. In the case of Cryptocurrency price prediction, evaluation metrics are chosen based on their ability for determining the accuracy of the model's predictions. The metrics MSE, RMSE, MAE, and R-squared are calculated. The error metrics (MSE, RMSE, MAE) compute the difference between the actual and predicted prices, whereas R-squared measures the proportion of variance in the predicted prices.

Table 2. Model Result

Model	Mse	Rmse	Mae	R2
Lr	53313	230.19	105.24	0.9997
Gbr	41393	203.45	73.46	0.9999

8. Web Application

8.1 Flask

Flask is a micro web framework written in Python. It is classified as a micro framework because it does not require particular tools or libraries. It has no database abstraction layer, form validation, or any other components where pre-existing third-party libraries provide common functions. Flask is designed to keep the core of the application simple and scalable. Instead of an abstraction layer for database support, Flask supports extensions to add such capabilities to the application.

8.2 Local Host

When user run a Flask app in debug mode, it will start a local server on can handle HTTP requests and responses. The local server had their computer that a default address of http://127.0.0.1:5000, which is also known as localhost. Then, it open this address in to see the web application that have created with Flask. The localhost page shows the web browser the response that defined in your Flaskapp.

8.2 Output Design

The stock closing price is 52742.

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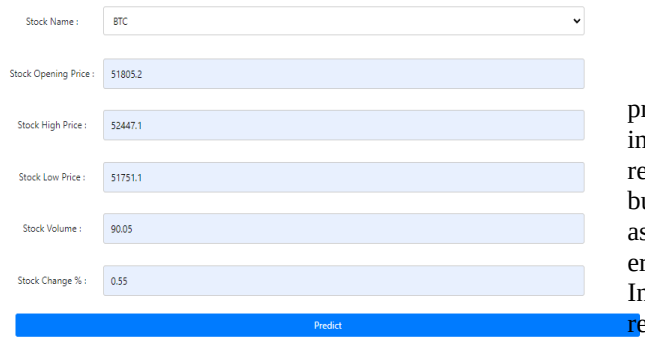

Fig.1: Output screen

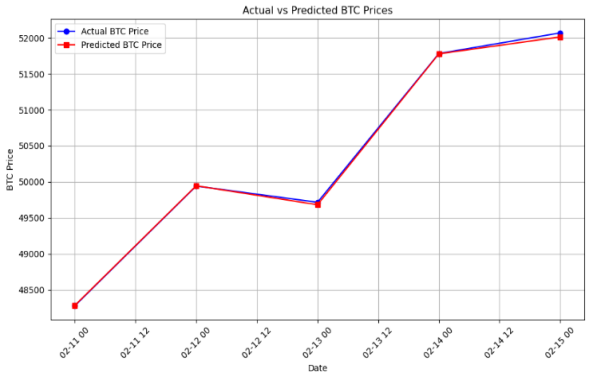

Fig.2: Graph shows that comparison between actual and predicted BTC prices over the specified dates

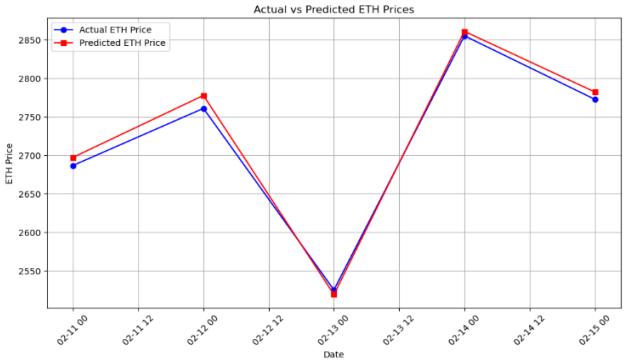

Fig.3: Graph shows that comparison between actual and predicted ETH prices over the specified dates

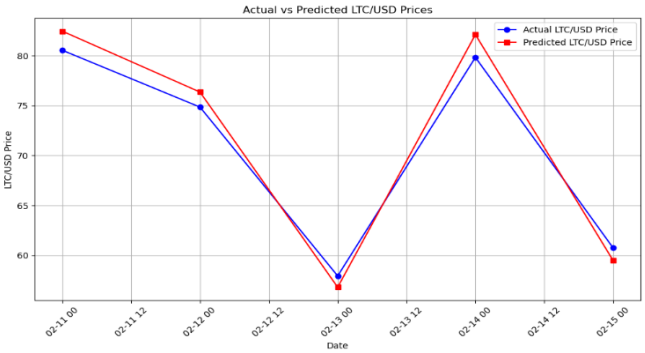

Fig.4: Graph shows that comparison between actual and predicted LTC prices over the specified dates

9. Future Work

By analyzing trends and patterns in price movements, predictive models seek to anticipate market fluctuations and inform investment decisions. Techniques such as linear regression and neural networks are commonly employed to build accurate prediction models. Evaluation metrics such as accuracy, mean squared error, and root mean squared error are used to assess the performance of these models. Incorporating external factors like market sentiment and regulatory changes can enhance the predictive power of the models. The ultimate goal is to develop reliable tools that assist traders, investors, and policymakers in navigating the volatile cryptocurrency markets effectively. Through continuous research and innovation, the field of cryptocurrency price prediction evolves to meet the demands of an ever-changing digital economy.

10. Conclusion

In conclusion, employing a web application for predicting cryptocurrency prices significantly enhances understanding and decision-making in the dynamic and ever-changing crypto market. In cryptocurrency price prediction, the performance of different models, namely Linear Regression (LR) and Gradient Boosting Regressor (GBR), was evaluated using various metrics including Mean Squared Error (MSE), Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), and R-squared (R2) value. It is evident that the Gradient Boosting Regressor (GBR) model outperforms the Linear Regression (LR) model across all metrics, achieving lower MSE, RMSE, and MAE values, and higher R2 value. This suggests that the GBR model provides more accurate predictions of cryptocurrency prices compared to the LR model. Therefore, for cryptocurrency price prediction, employing the Gradient Boosting Regressor model is recommended as it offers superior performance and predictive accuracy.

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