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Crypto Currency Price Prediction

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ABSTRACT:-

Cryptocurrencies, known for their decentralized structure and extreme price fluctuations, have significantly impacted global financial systems. Accurately forecasting their prices is crucial for informed investment and trading decisions. This project focuses on building a predictive model using deep learning—specifically, Long Short-Term Memory (LSTM) networks—to estimate future prices of leading cryptocurrencies based on their historical closing data. To begin, real-time price data is sourced from Yahoo Finance, with an emphasis on daily closing values. The raw data undergoes preprocessing steps such as normalization using MinMaxScaler and transformation into time-step sequences to make it suitable for sequential learning models. The LSTM model is carefully structured with multiple layers to capture time-based patterns and complex dependencies within the data. Once trained, the model is used to generate price forecasts for the next 30 days through a recursive prediction process. Model performance is evaluated through visual tools like line graphs, heatmaps, and trend analysis, which help compare predicted values against actual market data. The model proves effective in recognizing short-term market trends, offering practical insights for navigating cryptocurrency markets. To handle challenges like market volatility, risk of overfitting, and limited historical data, the project incorporates regularization methods and thorough model optimization strategies, ensuring more reliable and generalizable predictions.

INTRODUCTION

Cryptocurrencies represent a transformative advancement in modern finance, changing how transactions are processed and assets are managed through decentralized blockchain-based networks. Since Bitcoin's launch in 2009, the market has seen the rise of thousands of digital currencies, drawing increasing interest from investors around the world. Unlike conventional assets, cryptocurrencies are not regulated by centralized entities, making them highly volatile and sensitive to a range of unpredictable factors—including media influence, economic news, changes in regulation, technological progress, and speculative trading behavior. This volatility offers both high-reward opportunities and significant risks, making precise price forecasting a crucial tool for market participants.

Conventional forecasting models often fall short when applied to the erratic and nonlinear nature of cryptocurrency price trends. To overcome these limitations, advanced techniques such as machine learning and deep learning have emerged as effective alternatives. In particular, Long Short-Term Memory (LSTM) networks—a specialized variant of Recurrent Neural Networks (RNNs)—excel at capturing long-term dependencies and temporal patterns in sequential datasets, making them ideal for financial time series forecasting.

The objective of this project, titled **Crypto Currency Price Prediction**, is to create an intelligent prediction model using LSTM to estimate future values of popular cryptocurrencies like Bitcoin and Ethereum, based on past closing price data.

The project initiates with the extraction of historical daily closing prices from Yahoo Finance. Preprocessing is a crucial step and includes normalization through MinMaxScaler and framing the data into sequences—where each input sample comprises the past 60 days of data used to predict the next day's price.

The LSTM-based architecture is developed using Keras and TensorFlow frameworks. It includes several hidden layers and dropout layers to minimize overfitting, with a dense output layer to generate the final prediction. After training, the model is employed to forecast cryptocurrency prices over a 30-day horizon using recursive prediction techniques. Model evaluation involves both visual and quantitative analysis: predictions are compared to actual values through line plots and heatmaps, while performance metrics like Root Mean Square Error (RMSE) help assess the model's accuracy.

LITERATURE SURVEY

1. Survey of stock market prediction using machine learning approach

Authors: Ashish Sharma ; Dinesh Bhuriya ; Upendra Singh
2017 International conference of Electronics, Communication and Aerospace Technology (ICECA)

The stock market is inherently nonlinear and complex, making its analysis and prediction a significant area of focus in recent years. Investors often rely on forecasts to make informed decisions, aiming to maximize profits while minimizing potential risks. Accurate prediction in the stock market is crucial but remains a challenging task due to its dynamic and unpredictable nature. Traditional approaches such as fundamental and technical analysis, though widely used, may not always provide consistent or reliable results. Among the various predictive techniques, regression analysis has been frequently applied to estimate stock prices based on historical data. This paper provides an overview of widely used and effective regression methods for forecasting stock market trends. Looking ahead, the accuracy and performance of multiple regression techniques could be enhanced by incorporating a broader set of influencing variables.

2. Short-term prediction for opening price of stock market based on self- adapting variant PSO-Elman neural network
Authors: Ze Zhang ; Yongjun Shen ; Guidong Zhang ; Yongqiang Song ; Yan Zhu, 2017 8th IEEE International Conference on Software Engineering and Service Science (ICSESS)

Stock price movements represent a complex, nonlinear, and dynamic system, making accurate prediction a challenging task. The Elman neural network, a type of recurrent neural network with a context layer that stores previous states, is particularly well-suited for time series prediction tasks. In this study, the Elman network is employed to forecast the opening prices of stocks. However, due to the inherent limitations of the standard Elman network, a self-adaptive variant of the Particle Swarm Optimization (PSO) algorithm is introduced to enhance performance. This optimization technique is used to fine-tune the network's initial weights and thresholds, which are then used to train the Elman network. As a result, a hybrid prediction model based on the self-adaptive PSO-enhanced Elman network is developed. The model is validated using real stock market data and its performance is compared with both the traditional Elman network and the Backpropagation (BP) neural network. The results demonstrate that the proposed model achieves higher accuracy and better stability compared to the conventional neural network approaches.

3. Combining of random forest estimates using LSboost for stock market index prediction
Authors: Nonita Sharma ; Akanksha Juneja,2017 2nd International Conference for Convergence in Technology (I2CT)

This study focuses on forecasting future stock market index values using historical data as the foundation. The analysis is conducted using 10 years of historical data from two major Indian stock indices: CNX Nifty and S&P BSE Sensex. Predictions are generated for various time frames, including 1 to 10 days, as well as 15, 30, and 40 days ahead. The proposed approach introduces a hybrid model that integrates predictions from a Random Forest ensemble, enhanced through Least Squares boosting (LSboost), forming an LS-RF model. To evaluate its effectiveness, the model's performance is compared with that of the widely used Support Vector Regression (SVR) method. The target of prediction is the closing price of the stock indices. Experimental results indicate that the proposed LS-RF model delivers more accurate predictions than SVR, demonstrating its potential as a reliable tool for stock price forecasting.

4.Using social media mining technology to assist in price prediction of stock market
Authors: Yaojun Wang ; Yaoqing Wang,2016 IEEE International Conference on Big Data Analysis (ICBDA)

Predicting stock market prices is widely recognized as a highly complex task due to the dynamic and volatile nature of the market. Research has shown that short-term price fluctuations, particularly for small-cap stocks, are significantly influenced by market sentiment. This study explores the use of social media mining to quantitatively assess market sentiment and combines it with additional relevant factors to enhance short-term stock trend prediction. The experimental results demonstrate that integrating sentiment analysis from social media with other market data improves the accuracy of the prediction model, making it a more effective approach for forecasting stock movements.

5.Stock market prediction using an improved training algorithm of neural network
Authors: Mustain Billah ; Sajjad Waheed ; Abu Hanifa,2016 2nd International Conference on Electrical, Computer & Telecommunication Engineering (ICECTE)

Accurately forecasting the closing price of stocks remains a challenging task due to market complexity and volatility. Computer-assisted prediction models, such as Artificial Neural Networks (ANN) and Adaptive Neuro-Fuzzy Inference Systems (ANFIS), have shown promise in this area. Recent studies suggest that ANFIS often delivers more accurate results compared to conventional neural networks. In this work, an enhanced version of the Levenberg-Marquardt (LM) training algorithm for neural networks is introduced to improve prediction performance.The improved LM algorithm demonstrates significant efficiency, achieving approximately 53% lower prediction error than both ANFIS and the standard LM algorithm. Additionally, it requires 30% less processing time and 54% less memory compared to the traditional LM, and 47% less time and 59% less memory than the ANFIS model.

6.Efficacy of News Sentiment for Stock Market Prediction
Authors: Sneh Kalra ; Jay Shankar Prasad,2019 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (COMITCon)

Predicting stock market trends remains a complex and challenging task due to the market's inherently stochastic behavior. The vast amount of information generated daily through news articles, blogs, financial reports, reviews, and social media offers valuable insights for both researchers and investors. This study aims to analyze stock price fluctuations in relation to company-specific news content. A daily prediction model is proposed that integrates both historical stock data and news sentiment to forecast movements in the Indian stock market. The Naïve Bayes classifier is employed to determine the sentiment of news articles, categorizing them as either positive or negative. For each trading day, the model considers the frequency of positive and negative news sentiments, the variance in closing prices between consecutive days, and historical price data. Using this approach, the model achieves prediction accuracy rates ranging from 65.3% to 91.2%, depending on the techniques applied.

7. Literature review on Artificial Neural Networks Techniques Application for Stock Market Prediction and as Decision Support Tools
Authors: Muhammad Firdaus ; Swelandiah Endah Pratiwi ; Dionysia Kowanda ; Anacostia Kowanda

This literature review aims to investigate the application of Artificial Neural Network (ANN) techniques in stock market prediction. The study employs a content analysis approach, drawing data from the ProQuest electronic database. Relevant literature published between 2013 and 2018 was identified using keywords related to ANN and stock market forecasting. Out of 129 peer-reviewed journal articles initially reviewed, four met the inclusion criteria for detailed analysis. These selected studies utilized six different ANN-based techniques for stock prediction. The findings indicate a consistent pattern of high prediction accuracy across all studies. Two of the studies reported accuracy levels exceeding 90%, while the other two showed accuracy above 50%. The review concludes that ANN models demonstrate reliable performance in forecasting stock market trends. Notably, four techniques achieved over 95% accuracy, with the highest accuracy of 98.7% achieved using a Signal Processing/Gaussian Zero-Phase Filter (GZ-Filter), as reported in the 2018 Third International Conference on Informatics and Computing (ICIC).

8.Stock Market Prediction Analysis by Incorporating Social and News Opinion and Sentiment
Authors: Zhaoxia Wang ; Seng-Beng Ho ; Zhiping Lin, 2018 IEEE International
Conference on Data Mining Workshops (ICDMW)

Stock prices serve as key indicators of a company's financial health and are influenced by numerous factors, including public sentiment and external events. These events can impact investor emotions differently, thereby affecting market trends. As a result, stock prices are inherently dynamic, noisy, and nonlinear, making accurate prediction a complex challenge. Machine learning techniques have shown considerable promise in addressing such nonlinear time series forecasting problems due to their powerful pattern recognition and learning capabilities. Learning-based models have gained popularity in financial forecasting, with continuous enhancements being made to improve their predictive accuracy. Despite these advances, accurately forecasting stock movements remains difficult. Information from news articles and social media platforms is particularly valuable in financial analysis, yet integrating these unstructured data sources effectively remains a challenge. This study introduces a novel, enhanced learning-based approach that incorporates sentiment analysis from news content to forecast stock prices. The model demonstrates improved performance over traditional learning methods, as shown through experiments using real stock market data, with a significant reduction in Mean Square Error (MSE). The findings highlight the potential of the proposed approach and suggest promising directions for future research in sentiment-driven stock price prediction.

METHODOLOGY

This project is designed to systematically forecast cryptocurrency prices using deep learning techniques, specifically Long Short-Term Memory (LSTM) networks. The project workflow includes the following key phases:

1. Data Collection

Historical cryptocurrency price data, particularly the **'Close' price**, is collected using the yfinance Python library. Data is fetched for popular cryptocurrencies like Bitcoin (BTC), Ethereum (ETH), etc., over a specific time range.

2. Data Preprocessing

Raw price data is preprocessed to make it suitable for training:

- **MinMaxScaler** is used to normalize the data to a 0–1 range.
- A **sliding window** approach is used to convert the time series into supervised format. Each input sequence consists of **60 previous time steps** to predict the next value.
- Data is reshaped into a 3D array to fit LSTM input requirements.

3. Model Development

An LSTM model is constructed using the **Keras Sequential API**:

- Two stacked LSTM layers are used to capture temporal patterns.
- Dropout layers are added to prevent overfitting.
- Dense layers are used to output a single price prediction.
- The model is compiled using the **Adam optimizer** and **Mean Squared Error (MSE)** as the loss function.

4. Model Training

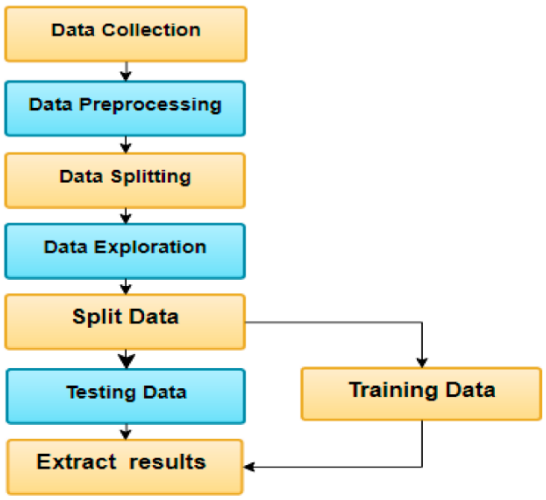
The model is trained on preprocessed data for a fixed number of epochs (e.g., 20) and a batch size of 32. The model learns to map the past 60-day price window to the next day's price.

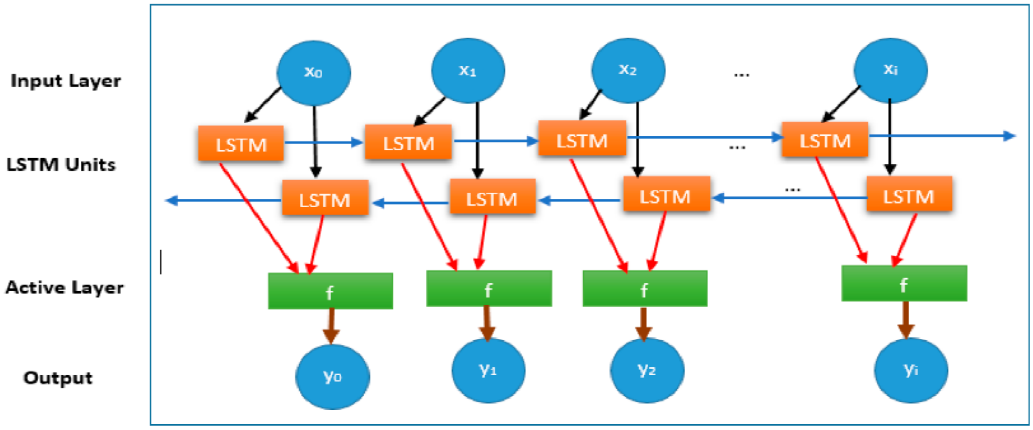
5. Future Price Prediction

After training, the model uses the last 60 days of actual data to recursively predict the prices for the next **30 future days**. Each prediction is added to the input window to generate the next forecast step.

6. Evaluation and Visualization

- **Line plots** show Actual vs. Predicted prices.
- **Heatmaps** display prediction intensity across cryptocurrencies.
- **Trend plots** analyze upward/downward movement patterns.





CONCLUSION

In this project, we aimed to build a reliable, data-driven system capable of predicting cryptocurrency prices using deep learning techniques. Cryptocurrencies, unlike conventional financial instruments, are characterized by extreme volatility and are influenced by a wide variety of unpredictable factors. This inherent complexity makes price forecasting both a fascinating and challenging problem. To address this, we employed Long Short-Term Memory (LSTM) networks—an advanced type of recurrent neural network (RNN) specifically designed for time-series data analysis. LSTM's capability to capture long-term dependencies and sequential patterns made it an appropriate choice for modeling the irregular and nonlinear nature of cryptocurrency markets.

The process began with the collection of historical price data from Yahoo Finance, with a particular focus on closing prices. The data was then normalized using the MinMaxScaler to bring values into a uniform scale. We applied a sliding time window technique to segment the data into sequences, where each sequence of 60 days was used to predict the price for the next day. This transformed the raw time-series data into a supervised learning format suitable for model training.

The model was trained to forecast the prices for the next 30 days using these sequential patterns. For performance evaluation, we utilized visual methods such as actual versus predicted price plots, trend analysis, and heatmaps to identify patterns and assess model accuracy. While the crypto market's speculative and volatile nature limits absolute precision, the model provided useful insights into trend direction and price fluctuations.

Although perfect accuracy remains unattainable in such unpredictable markets, this work shows that deep learning can deliver meaningful forecasting outcomes. Directional trends and volatility estimates, in particular, can help investors make more informed decisions.

Additionally, the project underscores the need for regular model updates and retraining. As cryptocurrency markets evolve due to policy shifts, global events, or emerging technologies, forecasting models must adapt accordingly. LSTM’s flexibility makes it a strong candidate for such ongoing learning.

This system provides a solid starting point for more advanced financial forecasting tools. Future work may integrate external variables such as trading volume, sentiment analysis from news and social media, and global economic indicators. The model also has the potential to be deployed as a real-time prediction service through a web interface or API.
Overall, this project bridges theoretical understanding and practical application, demonstrating how artificial intelligence can support smarter, data-informed investment strategies in today’s digital financial landscape.

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