Crypto Currency Analysis

Samrat Madake
KIT's College of Engineering (Autonomous)
Kolhapur, Maharashtra, India
samratmadake3000@gmail.com

Atharv Bhosale
KIT's College of Engineering (Autonomous)
Kolhapur, Maharashtra, India
atharvbb17@gmail.com

Raviraj Patil
KIT's College of Engineering (Autonomous)
Kolhapur, Maharashtra, India
ravipatil7512@gmail.com

Uddhav Borgalli
KIT's College of Engineering (Autonomous)
Kolhapur, Maharashtra, India
uddhavborgalli12@gmail.com

Uma Gurav
KIT's College of Engineering (Autonomous)
Kolhapur, Maharashtra, India
gurav.uma@kitcoek.in

***Abstract*—It is getting more and harder to manually assess price movements in the quickly changing world of cryptocurrency due to the high levels of volatility and massive data output. To address this, we came up with a system that uses historical data to assess cryptocurrency prices efficiently.**

This project uses data analytics and ML models such as (LSTM) to identify trends and correlations in historical price data. This approach eliminates the need for an extensive amount of manual effort and provides traders with data-driven insights to help in decision-making.

Our methodology, includes data preprocessing, model selection, and evaluation. By automating analysis and improving decision-making reliability and market accessibility, our project simplifies Bitcoin research.

***Index Terms*—Cryptocurrency, Moving Averages, RNN, LSTM (Long Short-Term Memory), Time-Series Forecasting.**

I. Introduction

The term "cryptocurrency refers to a decentralized digital currency that is protected by cryptographic methods and operates independently of any central authority, like banks.Utilizing blockchain technology. Example: Bitcoin was started in 2009 by a man people say that his name was Satoshi Nakamoto. Since then, the cryptocurrency market has rapidly transformed, utilizing blockchain technology and many cryptocurrencies to transform the financial sector completely. Because of their extreme volatility, cryptocurrencies present both lucrative opportunities and challenging analytical issues for investors and traders. Today there are many popular cryptocurrencies like Bitcoin, Ethereum, Solana, DogeCoin, Tether, etc.

Our project uses data analytics using Python and machine learning models such as Long short-term memory (LSTM) is a type of recurrent neural network (RNN) that's designed to learn and predict sequential data to identify trends and relations in historical price data. Also, we have made a user-friendly website, which simplifies the process. Our methodology includes data collection, data preprocessing, model selection, model training, and evaluation.

This approach reduces the need for an extensive amount of manual effort, like reading historical charts and data, and provides crypto traders with simplified analysis to help in decision-making.

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by Section-II, which highlights the Related Works. Section-III represents the Proposed Method, and Section-IV gives an overview of the Results and Discussion. This paper concludes with Section-V, offering the final insights in the Conclusion.

II. Related Work

A variety of techniques, including LSTM models for time-series forecasting and unlike deep learning models like LSTMs, ARIMA is not a deep learning algorithm but is widely used for simpler time series forecasting when the data shows clear patterns and trends., were utilised in the research to estimate the price of cryptocurrencies. The majority of studies often concentrate on the data back-end; very few articles discuss web-based systems that may provide time-dependent forecasts with online engagement.

We build on earlier work by incorporating machine learning models for prediction into a web interface that may offer real-time, dynamic user access to historical data analysis and forecasts.

TABLE I: Literature Review

Year	Author	Title	Methodology
2023	Sumesh Eratt Parameswarana,, Vidhyalavanya Ramachandran, Swati Shukla.	Crypto Trend Prediction Based on Wavelet Transform and Deep Learning Algorithm [2]	Analyzed SHIB cryptocurrency data from Yahoo Finance, applying wavelet transforms for feature extraction.
2024	Ahmed Bouteska, Mohammad Zoynul Abedin , Petr Hajek, Kunpeng Yuan	Cryptocurrency price forecasting – A comparative analysis of ensemble learning and deep learning methods [3]	The analysis includes trading data up to August 31, 2023, and considers the impact of the COVID-19 pandemic by splitting the data into pre- and post-COVID-19 periods. Various machine learning models, including LSTM, GRU, and ensemble methods like LightGBM, are evaluated against traditional models like ARIMA and SVM.
2023	Gaurang Sonkavde , Deepak Sudhakar Dharrao , Anupkumar M. Bongale , Sarika T. Deokate , Deepak Doreswamy and Subraya Krishna Bhat.	Forecasting Stock Market Prices Using Machine Learning and Deep Learning Models: A Systematic Review, Performance Analysis and Discussion of Implications. [4]	The paper provides a systematic review of various machine learning (ML) and deep learning (DL) models used for stock price prediction. It also analyzes their performance and discusses future research directions.
2022	Malti Bansal, Apoorva Goyal, Apoorva Choudhary	Stock Market Prediction with High Accuracy using Machine Learning Techniques. [5]	The paper explores machine learning (ML) algorithms for predicting stock prices of 12 major Indian companies using 7 years of historical data.
2012	K. Solanki, P. Aggarwal, A. Swamy.	Cryptocurrency Analysis, Visualization and Prediction. [6]	Analyze historical cryptocurrency prices, visualize trends, and predict future prices using machine learning and Utilized datasets from coinmarketcap.com, performed data visualization and applied LSTM models for price prediction.

III. Proposed Method

The cryptocurrency prediction model provides valuable insights but is constrained by market volatility and unexpected events. Key factors influencing predictions include historical data, trading volume, and market sentiment, but the model's accuracy isn't guaranteed, and improvements such as better data integration are necessary. Users should exercise caution when using the model for decision-making, as it can guide investors but cannot fully predict unpredictable market behaviour.

1. Data Collection: Historical Price Data gathers data (open, close, high, low, volume) of different cryptocurrencies from Yahoo Finance.

2. Data preprocessing: Handle Missing Values, Feature Engineering - Moving Averages - Simple moving average

(SMA), Normalize the Data, Train-Test Split: Split data while maintaining temporal order (e.g., 80 % train, 20% test)

3. Sequence Preparation: Creates sequences of 100 previous values (x) to predict the next value (y).

4. Model Definition: Stacks multiple LSTM layers with increasing complexity.

I. First LSTM Layer: 50 neurons, Input shape: (100, 1), return_sequences=True: Outputs sequences for stacking more LSTM layers. Dropout: 20% to reduce overfitting.

II. Second LSTM Layer: 60 neurons, return_sequences=True: Keeps output as sequences for further stacking. Dropout: 30% for additional regularization.

III. Third LSTM Layer: 80 neurons, return_sequences=True: Continues sequence output for deeper layers. Dropout: 40%, increasing regularization as the model deepens.

IV. Fourth LSTM Layer: 120 neurons, return_sequences=False: Outputs a single value (final layer). Dropout: 50%, as the layer is highly complex.

V. Dense Layer: 1 neuron for the final output (predicted value).

5. Model Compilation Configures the model with the Adam optimizer (for adaptive learning rates) and Mean Squared Error (MSE) as the loss function to minimize prediction errors.

6. Model Training Trains the model for 50 epochs with a batch size of 32, iteratively updating weights using backpropagation to minimize the MSE, and displays training progress via logs.

7. Data Preparation Combines the last 100 training data points with test data.

8. Model Prediction: Uses the trained model to generate predictions for test data. Rescales both predictions and actual values back to their original range.

9. Visualization: Plots predicted vs. actual prices to evaluate model performance.

10. Model Saving: Saves the trained model for future use.

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A. The Important Models for Implementation

Model Selection: Baseline Models: Start with simple models like LSTM and Moving Averages. Machine Learning Models: Train selected models using the training set, applying hyperparameter tuning and cross-validation to enhance performance. Model Evaluation: Analyze feature importance and utilize SHAP values for model interpretation. Overall, while the model can assist in understanding market trends, its limitations necessitate careful use in investment decisions.

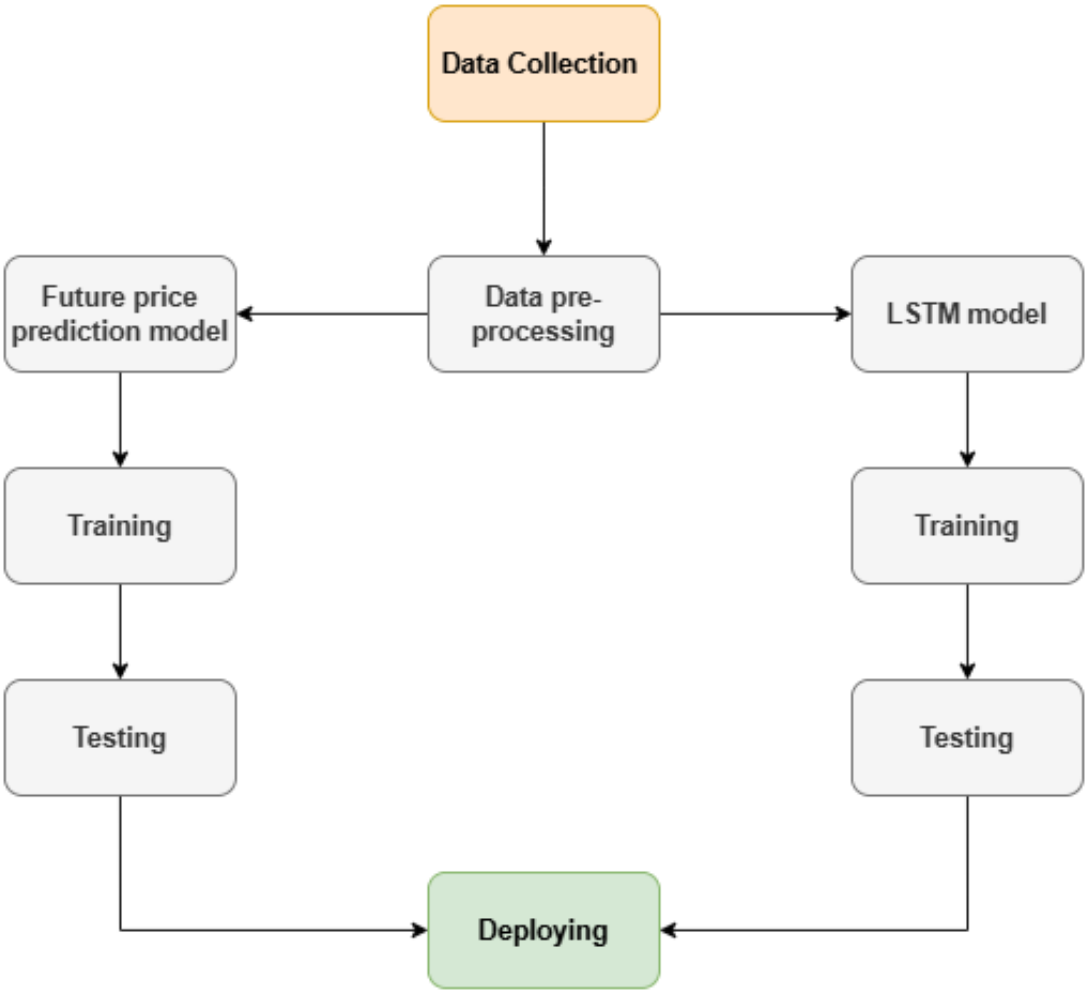

Fig. 1: Block diagram of the proposed work

B. Comparison of moving average for 100 and 200 days

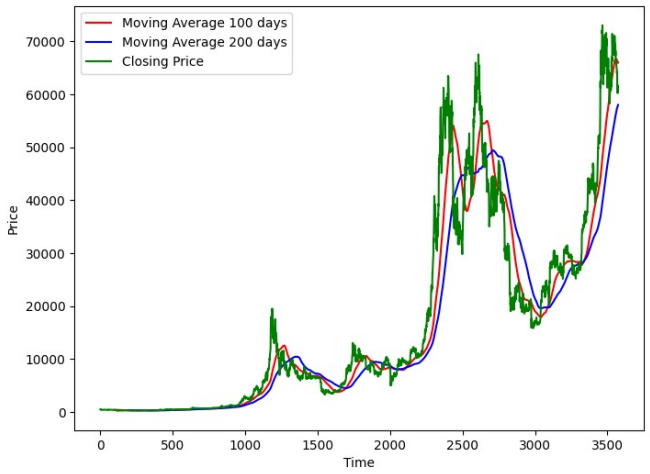

Fig. 2: Moving Average of BITCOIN.

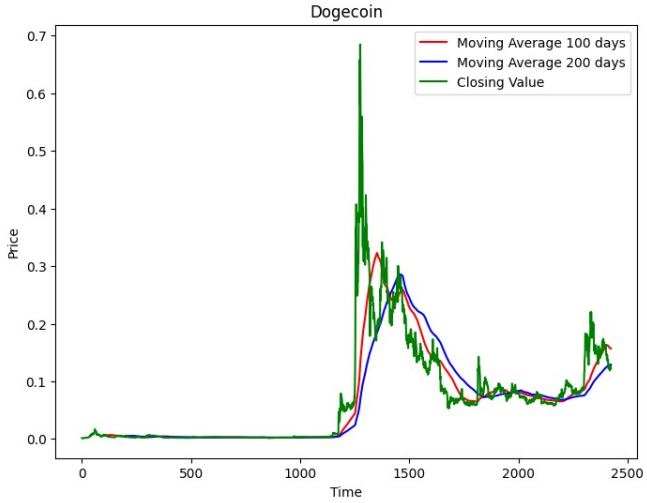

Fig. 3: Moving Average of DOGECOIN.

- Moving Average 100 days (Red line): A short-term average of the last 100 days.
- Moving Average 200 days (Blue line): A longer-term average that smooths price changes over 200 days.
- Closing price (Green line).

Moving Average: A moving average is a statistical calculation used to analyze data points by calculating averages of different subsets of the total data set. In the case of cryptocurrencies, it establishes the average price of a digital asset over a certain period of time, which could be days, weeks, or even months. It is common practice to compute moving averages for 15, 30, 50, 100, and 200 days. whereas we have calculated SMA which is a Simple Moving Average. The SMA calculates the average price over a specific number of periods. It treats all data points equally.

$$SMA = \frac{\sum_{i=1}^{n} \text{Closing Prices}_i}{n}$$

Observations on the Dogecoin chart.

- There is a huge spike around the midpoint, corresponding to a significant price rally, followed by a steep decline.
- Like the previous chart, the moving averages here help smooth out the volatility. The red 100-day average reacts quicker to price changes than the blue 200-day average. The 100-day moving average crossing above the 200-day moving average (golden cross) could signal a bullish trend, while a cross below (death cross) might indicate a bearish trend.
  The chart suggests that after the major spike, Dogecoin settled into a more stable price range, with occasional smaller peaks.

Key observations:

This plot shows the main peaks, with steep falls between them. The longer the period, the mushier it is with 200-day responding slower to changing prices than 100-day.

Crossover of the two moving averages can form signals to potentially buy or sell. The red line (the 100-day) crossing the blue line (the 200-day) may indicate a bullish trend (a golden cross), while vice versa could be interpreted as a bearish one (death cross).

IV. Results and Discussions

The predicted price is almost 95% matching to the actual price. As we can see in the above figures and graphs.

The graph displays the study of Bitcoin's price over time. A comparison is made between the Original Price (green line) and the Predicted Price (red line). The close relationship between the two lines indicates that the prediction model correctly captures general patterns, including notable price fluctuations and upward or downward movements. The y-axis displays the price in US dollars, and on x-axis is the time intervals.

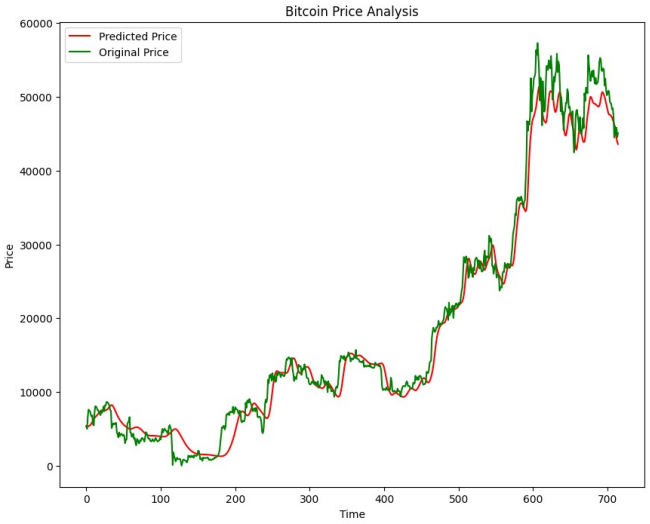

Fig. 4: Price Prediction of BITCOIN.

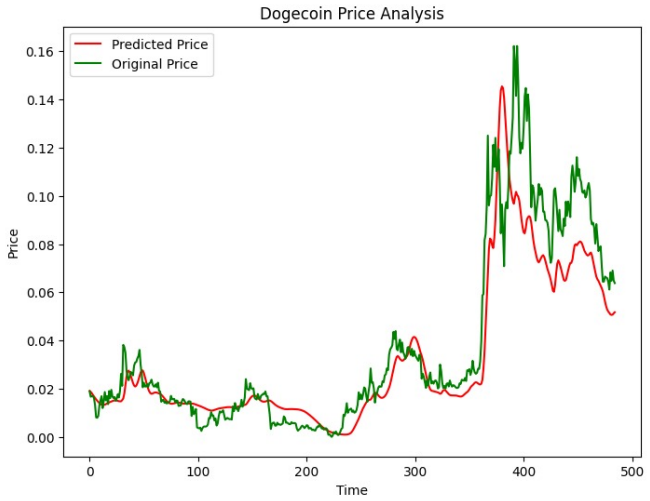

Fig. 5: Price Prediction of DOGECOIN.

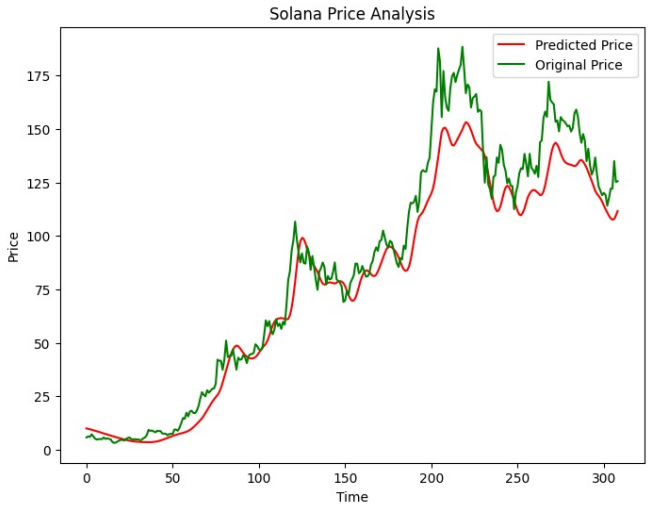

Fig. 6: Price Prediction of SOLANA.

V. Conclusion

This project uses historical data and machine learning to predict the price of bitcoin. We preprocess the data and train an LSTM model by collecting information from Yahoo Finance. Also, we integrated an API named CoinGecko to fetch the real-time price of cryptocurrencies. The accuracy of the model is evaluated by comparing the real and anticipated prices through the visualization of the results. Our accuracy is more than 90%. Our project shows how machine learning can be applied to the finance domain, particularly in cryptocurrency markets. Our future scope is to include more cryptocurrencies. Use different ML models to see which model is best fit. Also to implement a model/technique that can predict prices in the future, which will actually be a game changer for traders.

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