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BITCOIN VALUE PREDICTION

[1]Dr. Anil V Turukmane, [2]Chaparala Sri Manasa, [3]Veeranki Yasaswini, [4]Bollineni SriTonya, [5]Alla Vineetha

[1]Professor , [2,3,4,5]Under Graduate

[1,2,3,4,5]School of Computer Science and Engineering

[1,2,3,4,5]VIT AP UNIVERSITY, Amaravati, Andhra Pradesh, India

Abstract: The cryptocurrency industry, led by Bitcoin, has grown in popularity and significance in the past few years, capturing the interest of shareholders, buyers and sellers, and experts alike. Forecasting the future value of Bitcoin presents a formidable challenge yet holds substantial importance. In this project, we harness the capabilities of two potent deep learning algorithms: Long Short Term Memory (LSTM) and eXtreme Gradient Boosting (XGBoost) to forecast the value of bitcoin. LSTM, a deep learning model recognized for its aptitude in capturing sequential dependencies, is paired with XGBoost, an ensemble method adept at handling intricate, non-linear relationships. Our approach revolves around the analysis of historical Bitcoin price data, employing these two algorithms in tandem to furnish more precise and robust predictions. The overarching goal of this endeavor is to enrich our understanding of the dynamics within the Bitcoin market and to offer valuable insights to cryptocurrency enthusiasts and investors. Bitcoin, as the foremost digital currency, has garnered substantial attention from investors, leading to exponential growth. Nevertheless, the task of predicting Bitcoin's price remains daunting due to the inherent unpredictability of the market. Initially, our study intended to incorporate sentiment analysis, but complications related to data mapping led us to rely exclusively on historical Bitcoin transaction data. This alternative approach has yielded a notably accurate model, offering invaluable insights for prospective investors. Our investigation delved into various recurrent neural network (RNN) structures, encompassing LSTM, subjecting them to exhaustive testing, which entailed fine-tuning the number of activation function layers and units. In this comparative analysis, LSTM emerged as the leading performer in sentiment analysis among the predictive models. Given the exceptional volatility of Bitcoin, with price fluctuations approximately six times more pronounced than those of traditional fiat currencies, it is imperative to employ a model capable of handling long-term time series dependencies, a realm where LSTM excels.

Index Terms **- Bitcoin, Cryptocurrency, Deep Learning, Analytics, Long Short Term Memory, extreme Gradient Boost.**

I. INTRODUCTION

Cryptocurrencies have been defined as a disruptive force in an era marked by technical developments and digital innovation, altering the way we view and utilize currency. The advent of cryptocurrencies, spearheaded by bitcoin, has brought a transformative change in the financial world. Bitcoin, a currency without any central authority, has garnered a massive following and attention from investors, traders, and enthusiasts worldwide. Its highly volatile nature, characterized by significant price fluctuations, presents both opportunities and challenges for those who wish to engage in trading or investment.

The Bitcoin Value Price Prediction attempts to investigate and apply the capabilities of data analytics, machine learning, and financial modelling to estimate Bitcoin price changes in the future. The rising interest in Bitcoin as an investment asset, a store of wealth, and a medium of trade is driving our effort. Accurate price forecasting may have far-reaching consequences for investors, traders, businesses, and governments, providing insights into market patterns, risk management, and investment strategies.

Accurate forecasting can help in making informed decisions during the time of investment and also help in managing the risks. The goal of this research is to make significant improvements to the field of bitcoin value predictions by employing two powerful deep learning algorithms and they are Long Short Term Memory (LSTM) and extreme Gradient Boosting (XGBoost).

The LSTM falls under the recurrent neural network model (RNN) which is particularly good with modelling the sequential data. It is especially well-suited for time series forecasting, making it an excellent candidate for projecting Bitcoin's price, which is largely dependent on previous price trends and patterns. LSTM may be used to capture long-term relationships in data, which is essential for comprehending the dynamics of the bitcoin market.

XGBoost, on the other hand, is a gradient boosting algorithm which is recognised for its capacity to manage complicated, non-linear data connections. It is a collaborative method that creates a strong, accurate model by combining the forecasts of multiple weak models. This study tries to leverage the capabilities of both algorithms by adding XGBoost alongside LSTM, resulting in a rather dependable and strong prediction model.

Bitcoin value prediction models have far-reaching implications. Traders can make informed decisions, investors can manage risk more effectively, and policymakers can gain insights into market trends. Additionally, these models can serve as educational tools for understanding the dynamics of cryptocurrency markets.

In this project, we will collect and preprocess historical Bitcoin price data, train our LSTM and XGBoost models, and evaluate their performance of models in forecasting the price of bitcoin. Our ultimate goal is to produce a useful resource that will assist investors, researchers, and enthusiasts of cryptocurrencies by offering perspectives on the factors that affect Bitcoin's price and the potential for better choice-making in the market for digital currencies.

II. LITERATURE REVIEW

The [1] expectation of Bitcoin's price has been a prominent topic of significant study, highlighting cryptocurrency's growing importance in the global financial environment. This review presents an overview of the domain's core concepts, approaches, and findings.

Initial research endeavors primarily centered on time series analysis, with Katsiampa (2017) leading the way in utilizing the ARIMA models for forecasting value of bitcoin. While serving as a fundamental method, these techniques often struggled to capture the inherent volatility inherent in cryptocurrency markets.

In [3],A notable transition occurred as the field witnessed a substantial pivot towards machine learning methods, exemplified by studies like Glaser et al. (2014), who introduced artificial neural networks(ANN) and support vector machines(SVM). All these ML techniques excelled at identifying non-linear patterns within Bitcoin price data, exhibiting superior predictive accuracy compared to traditional models. Their adaptability to the ever-evolving dynamics of the market drew significant attention.

Investigations have focused on the relationship between the value of bitcoin and market perception. In 2012, Schumaker and Chen used the sentiment analysis for investigating the link between Twitter sentiment and variations in the value of bitcoin, highlighting the influence of market sentiment on the evaluation of cryptocurrencies.

Furthermore, the work of Lischke and Fabian (2017) contributed to a clearer understanding of how the Bitcoin market functions. In order to track the flow of Bitcoin between various wallet addresses and gain important insights about market behavior, they used blockchain analytics.

According to[4],Network theory was used by Kristoufek (2015) to examine relationships between different cryptocurrencies and their combined impact on Bitcoin's price, looking beyond the individual behaviors of Bitcoin. This revealed complex inter dependencies and cross-market effects, highlighting the ecosystem's interconnectedness.

The progression of bitcoin value prediction approaches from analysis of the time series to machine learning, sentiment analysis, and network theory is highlighted by these earlier research projects. The need for more precise and reliable prediction models is still being driven by issues with market volatility and data noise, though.

[7] Many people consider Bitcoin to be the most well-known digital money, garnering substantial attention from investors and experiencing exponential growth. However, predicting bitcoin's value is a formidable challenge because of the extreme volatility in market. Initially, we encountered data mapping issues when creating a sentiment analysis model, necessitating its abandonment in favor of utilizing solely historical Bitcoin transaction data to construct our predictive model. This approach yielded remarkably accurate results, fostering confidence among potential investors.

By[9],Our implementation encompassed various recurrent neural network (RNN) architectures, including LSTM and GRU, with thorough testing, like adjusting the number of layers and units of activation function. We also introduced a novel library called Gradio, which allowed us to craft a user-friendly interactive interface.

Users can input their .csv files, subsequently selecting one of the three models according to their preference. We also conducted web scraping from reputable Indian news websites, exclusively collecting news related to the dynamic cryptocurrency market.

Regarding predictive models, LSTM demonstrated superior accuracy in the realm of sentiment analysis when compared to other algorithms. Bitcoin's prices exhibit six times greater volatility than traditional fiat currencies, necessitating a model capable of accommodating long-term time series dependencies, a requirement satisfied by LSTM. To obtain a thorough grasp of the inner workings of the bitcoin market, we conducted time-series observations at 30-minute intervals during our predictive modeling.

[12], provides a brief understanding of the different techniques of machine learning employed for bitcoin value prediction, highlighting the strengths and weaknesses of each approach. It focuses on time series analysis methods and their application to forecast bitcoin values, discussing challenges which involves recent advancements in the field. Also, summarizing various sentiment-based models and their efficacy.
The primary goal of this paper is to make a comparative analysis on the five ML algorithms for predicting Bitcoin return time series data, namely the random forest (RF), alternating model tree, multi-layer perceptron regression, multiple linear regression and M5 Tree algorithms, and identify best algorithm among these.

From [13], We can see that older price prediction systems lack appropriate information and solutions for predicting price changes owing to real-time price prediction. Considering the issues stated in bitcoin value prediction, they created a solution basing on machine learning for predicting the value for a financial institution. The suggested framework has a block chain basis for a safe transaction environment, as well as a reinforcement learning algorithm for analysing and forecasting bitcoin prices.

[14] shows that the rise in the value of cryptocurrency has resulted in the decentralisation of power, limiting government control. The broad pricing range of electronic currencies emphasises the significance of good planning when forecasting currency prices. Training outcomes, dynamic LSTM models, and over time organizational assessments are all taken into account. For the benchmark data sets, the suggested technique is employed. The data demonstrate the effectiveness of digital currency predictions.
Cryptocurrency is a sort of currency that may be exchanged between people or organizations. They belong to a corporation that uses current encryption technologies to encrypt transactions. Electronic currencies are based on block chain technology, which includes qualities like as transparency and consistency. In contrast to typical financial systems, Bitcoin does not have a centralised command.

[15], This article uses a deep learning-based artificial neural network model called GRU (Gated Recurrent Unit) to successfully estimate bitcoin future values based on previous pricing data. The important performance measures for forecasting accuracies are the Root Mean Square Error (RMSE) and Mean Absolute Percent Error (MAPE).
Bitcoin's price volatility outperforms that of any traditional fiat currency. Due to this, it is utterly important for investors to take caution when allocating their capital, especially if they cannot sustain big losses.

Predicting future price changes is crucial since it helps reduce the inherent risks involved with bitcoin investing.

Accurate price prediction is required for conducting risk-free transactions in the Bitcoin environment. The application of regression-based machine learning technologies also required. Giving real-time estimates of Bitcoin's price, these advanced analytical approaches help investors to make better educated judgments. Using such strategies provides investors with a crucial tool for navigating the volatile seas of the bitcoin market, allowing for better financial security and wise investment practices.

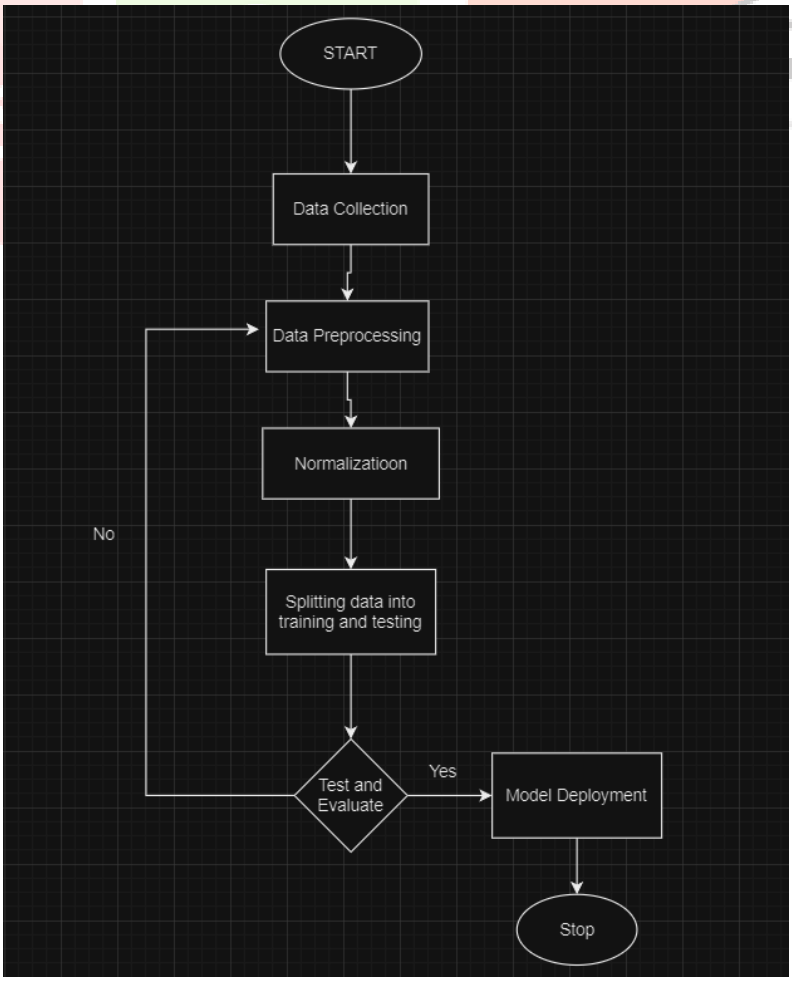
III. PROBLEM STATEMENT

The Bitcoin Value Prediction Project seeks to address the crucial difficulty of reliably anticipating Bitcoin price changes. As a decentralised and extremely volatile digital currency, Bitcoin poses a unique dilemma for investors, traders, and stakeholders. A variety of variables impact the cryptocurrency market, including market sentiment, legislative changes, macroeconomic trends, and technological breakthroughs. As a result, predicting its price with precision is extremely difficult.

The issue is the lack of credible forecasting models that can assist people and organisations in making educated decisions about their Bitcoin investments and strategy. Bitcoin price fluctuations can have significant financial ramifications, and mistakes can result in significant gains or losses. This research aims to use sophisticated data analysis and some suitable deep learning approaches to implement the models that could forecast the future price movements more accurately. By doing so, it hopes to give essential information and tools for confidently navigating the turbulent bitcoin market and making educated decisions.

IV. METHODOLOGY

The flow chart below depicts the steps and process that will be followed for the predicting the value of bitcoin. It provides clarity and basic understanding of the processes that will be used in the later stages of the project.



4.1 Data Preprocessing

When working on a project to anticipate the value of digital currencies, making the data suitable for the application of the techniques is essential. Properly processed data is essential for improving your prediction model's accuracy. To get the data ready for model training, data must be cleaned, transformed, and arranged.

4.1.1 Data Collection

Data collection entails the accumulation of data from diverse sources, serving the objectives of analysis, research, or decision making. In this specific context of a bitcoin value prediction project, data collection revolves around acquiring historical data related to Bitcoin prices and relevant influencing factors. We gathered the historical bitcoin price data. The collected data includes relevant features like Open Price(OP), High Price(HP), Low Price(LP), Close Price(CP), Adjusted Close Price and the Volume.

4.1.2 Data Cleaning

Data cleaning is the procedure of discovering and repairing flaws or inconsistencies in data to guarantee that existing data is precise, dependable, and appropriate for analysis. In the framework of a Bitcoin price forecasting project, data cleaning is indispensable for addressing problems within the historical price data and other associated information. We have checked for missing values, null values and duplicates and managed them accordingly.

4.1.3 Data Vizualization

Data visualisation is the incorporation of visual components to display data, such as graphical representations, charts and maps. Its primary goal is to provide complex information in an easy-to-understand and comprehend style, allowing users to draw insights from the data with clarity and comprehension. Data visualisation is a critical stage in data preparation. It assists you in gaining insights into data, identifying trends, and making educated decisions regarding data cleansing and feature engineering. We created graphs for each year and tracked the price of bitcoin from 2014 until 2022.

4.1.4 Normalisation

Normalisation is a process of data preparation used to standardize numerical properties in a dataset, often by modifying them to a similar range, which might be between 0 and 1 or centred around a mean of 0 with a regular deviation of 1. Normalisation's major goal is to promote uniformity among numerous features or variables, avoiding any one feature from having an overwhelming impact on the analysis or model training owing to its magnitude. Normalisation is frequently used to improve overall model performance. This procedure is critical in machine learning since it ensures that no one characteristic dominates the learning process owing to scale disparities. We utilized the Min Max scaler, which scales the features between 0 and 1.

4.2 Implementation of LSTM

The dataset has been split into two categories which is 60% for training and 40% for testing. Now, train the LSTM model with the training data and test it with the testing data. Subsequently accuracy, MSE, MAE, r2 score of the model were checked.

4.3 Implementation of XG BOOST

The dataset has been split into two categories which is 60% for training and 40% for testing. Now, train the XGBOOST model with the training data and test it with the testing data. Subsequently accuracy, MSE, MAE, r2 score of the model were checked.

V. RESULTS

5.1 LSTM Model

The training accuracy of LSTM model is 95.8% and the testing accuracy is 96.3%.

Fig 1.1: Bitcoin Value Prediction using LSTM

Predicted and Actual value of LSTM Model:

Fig 1.2: Comparison of values of LSTM

```
LSTM Model:
Predicted Value:
 [[57899.277]
 [57031.453]
 [57631.78 ]
 [55813.9  ]
 [60136.35 ]]
Actual Value:
 [[56041.058594]
 [57401.097656]
 [57321.523438]
 [61593.949219]
 [60892.179688]]
```

5.2 XGBOOST Model

The training accuracy of XG Boost model is 99.9% and the testing accuracy is 75.4%.

Fig 2.1: Bitcoin Value Prediction using XG BOOST

Actual and Predicted value of XG Boost Model:

Fig 2.2: Comparison of values of XG BOOST

```
XG BOOST Model:
Predicted Value:
 [[57899.277]
 [57031.453]
 [57631.78 ]
 [55813.9  ]
 [60136.35 ]]
Actual Value:
 [[56041.058594]
 [57401.097656]
 [57321.523438]
 [61593.949219]
 [60892.179688]]
```

VI. CONCLUSION

In conclusion, by combining the strengths of both LSTM and XGBoost, you can leverage the deep learning capabilities of LSTM to capture long-term dependencies and the predictive accuracy of XGBoost for short-term fluctuations. This ensemble technique has the capacity for boosting resilience and accuracy of Bitcoin value forecasts. The development of an LSTM framework for bitcoin value prediction is a worthwhile effort which can give insights into the turbulent cryptocurrency industry. It's crucial to realise that the value of bitcoin is impacted by a variety of variables, like as news, mood, and global events, which may not be entirely conveyed by historical price data. The price fluctuation of Bitcoin presents both possibilities and threats. The models have shown impressive accuracy in forecasting price trends, enabling users to make informed decisions.Our prediction algorithms provide a vital tool for traders and investors to navigate these tumultuous seas. Users may better manage risk and optimise their investing plans by gaining insights on

possible price moves. This information can be invaluable for policymakers, researchers, and anyone interested in studying the cryptocurrency ecosystem.

VII. FUTURE SCOPE

Future applications of Bitcoin value prediction using LSTM and XGBoost may include highly accurate trading algorithms for cryptocurrency markets, risk management tools, investment decision support, and enhanced financial products. Furthermore, this technology may find applications in broader financial market analysis, asset management, and portfolio optimization. As cryptocurrencies continue to integrate with traditional finance, these prediction models will become increasingly valuable for individuals and institutions seeking to navigate the dynamic and evolving landscape of digital assets.

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