



Accurate Cryptocurrency Price Forecasting using Deep Learning Techniques: A Comparative Analysis of Daily and High-Frequency Predictions

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Abstract: The rise and subsequent crash of the blockchain era have transformed cryptocurrencies into investment assets, necessitating accurate forecasts to guide investment decisions due to their highly unpredictable nature. While existing studies have utilized machine learning to predict Bitcoin prices with improved accuracy, few have explored the applicability of different modelling techniques to diverse data formats and dimensional attributes. This research focuses on categorizing Bitcoin prices into daily and high-frequency intervals, with the goal of anticipating cryptocurrency prices at various frequencies using machine learning techniques. For daily price prediction, a comprehensive set of high-dimensional aspects, including property and network characteristics, trading and market indicators, attention metrics, and gold spot prices, are leveraged. On the other hand, 5-minute interval price prediction relies on fundamental trading data obtained from cryptocurrency exchanges. Given the influence of major organizations on price control and the volatile nature of the cryptocurrency market, precise forecasting methods that consider factors such as market capitalization, maximum supply, volume, and circulating supply are essential. Deep learning techniques, such as recurrent neural networks (RNNs), long short-term memory (LSTM), and gated recurrent units (GRU), are employed as effective models for training the data. The proposed approach is evaluated using benchmark datasets and implemented in Python. The results demonstrate the efficacy of the suggested methodology in achieving accurate predictions. Consequently, neural networks, as intelligent data mining technologies, have gained widespread adoption in various sectors over the past decade, offering valuable insights into cryptocurrency price forecasting.

Keywords: LSTM, RNN, Cryptocurrency, blockchain.

I. INTRODUCTION

Blockchain may be a growing collection of data chunks organised into a data structure. Since the knowledge blocks are linked together, they cannot be altered or withdrawn. The foundational technology of the digital currency Bitcoin is blockchain. A distributed database of all executed transactions or digital events that have been shared among participating parties makes up the blockchain. The vast majority of the system's users verify each transaction. It includes every single transaction record. The most well-known cryptocurrency, Bitcoin, is an illustration of the blockchain.

A person or group of people going by the name of "Satoshi Nakamoto" issued a white paper titled "Bitcoin A Peer-to-Peer Electronic Cash System" in 2008, which is when the blockchain technology initially gained attention. The network-distributed digital ledger used by blockchain technology to record transactions makes it impervious to corruption. The blockchain allows for the recording of transactions for anything of value, including cars, real estate, and other assets. Bitcoin is a well-known example of how Blockchain is used. A cryptocurrency, bitcoin is used to trade digital assets over the internet. In order for two parties to carry out transactions over the Internet using Bitcoin, cryptographic proof is used in place of third-party trust. With the use of digital signatures, every transaction is secure.

A cryptocurrency is a form of digital or virtual money that is protected by encryption and virtually impossible to duplicate or counterfeit. Blockchain technology, a distributed ledger enforced by a dispersed network of computers, is the foundation of many cryptocurrencies' decentralised networks. The fact that cryptocurrencies are often not issued by any central authority makes them potentially impervious to intervention from or manipulation by governments. In order to make use of the blockchain that many cryptocurrencies are founded on, they were developed. For instance, Ethereum's ether was created to be used as payment for blockchain validation work. Ether (ETH) gained a new role as the blockchain's



staking mechanism in September 2022, when the blockchain switched to proof-of-stake. Banks can use Ripple's XRP to make transfers between multiple countries easier.

Understanding the different types of cryptocurrencies is crucial because there are so many of them available. A cryptocurrency without a purpose is probably going to be riskier than one with utility, so finding out if the coin you're looking at has a purpose will help you decide whether it's worth investing in. The goal of the introduction of cryptocurrencies was to transform the financial system. But there are costs and benefits to every change. The theoretical ideal of a decentralised system with cryptocurrencies and its actual execution diverge significantly at the current stage of cryptocurrency development.

Today, users have the option of purchasing cryptocurrencies via brokers, exchanges, and private currency holders as well as selling them to them. The simplest methods for purchasing or selling cryptocurrencies are exchanges or services like Coinbase. Cryptocurrencies can be purchased and kept in online wallets after purchase. Both "hot" and "cold" digital wallets exist. Hot refers to the wallet's internet connection, which makes transactions simple but leaves it open to fraud and theft. However, cold storage makes it more difficult to conduct business while also being safer.

II. LSTM TECHNOLOGY

We will refer to the LSTM (Long Short-Term Memory) architecture throughout this paper. The purpose of the study was to better understand the impact of the timestamp on the value of Cryptocurrency coin by conceptualising variables from Cryptocurrency transactions in order to run prediction simulations under various simulation-designed scenarios.

Although there has been much research on time series prediction, the LSTM model was used for this investigation. This is due to the fact that the LSTM model predicted the timestamp data based on the root mean square error (RMSE), mean absolute error (MAE), and correlation coefficient (R), as well as the fact that it may be related to either a linear or nonlinear property, or even both.

While it's clear that elements like the open price at the beginning of the time frame and the close price at the end of the time window have an impact on the bitcoin transaction identified by the timestamp, it's not clear whether such influences can be characterised by patterns.

III. LITERATURE REVIEW

Nishant Jagannath created the Chain Analysis-Based Approach to Predict Ethereum Prices in 2021. In this work, they put up three self-adaptive approaches, each of which converges on a set of ideal parameters for properly forecasting the price of Ethereum. they contrast our findings with a conventional LSTM model. Our method has an accuracy rate of 86.94% and a low error rate. Additionally, they explain what on-chain metrics are, what they do, and how they relate to Ethereum and blockchain technology in general. This section also addresses the methods used to analyse the data in order to comprehend the activity of blockchain networks better and create a prediction model. On-chain data like active addresses, total addresses, and transaction volume show how the network is being used and adopted. In contrast, the hash rate shows how many computing resources are devoted to the network, which shows how many miners are engaged to this network. As a result of their investments in machinery, infrastructure, and continual electricity usage, which have no immediate payoffs, miners are typically financially committed. By making long-term investments in it, more miners on a network demonstrate that more people genuinely believe in it. They also strengthen the network's security, raising its value. As a result, indicators like hash rate and mining rate can aid in our understanding of the security of the network as a whole.

in the year of 2021 Zeinab Shahbazi is also worked on Improving the Cryptocurrency Price Prediction Performance Based on Reinforcement Learning Their technology includes a blockchain foundation for secure transaction environments and a reinforcement learning algorithm for price research and forecasting. This system primarily focuses on the coins Litecoin and Monero. The results demonstrate that the proposed system performs price prediction more accurately than any other cutting-edge algorithm. Three significant data sources are included in the cryptocurrency price prediction. A market statistic makes up the first one. The second is blockchain network information, which includes hash rate, transaction count, and fee information. Google Trends and Tweet Volume are the final two. The majority of research studies apply the aforementioned data sources to their model, which is typically a regression model. The data loader received aggregated data from the three sources.

A New Hybrid Cryptocurrency Returns Forecasting Method Based on Multiscale Decomposition and an Optimized Extreme Learning Machine Using the Sparrow Search Algorithm was developed by XIAOXU DU This model



decomposes the original return series into a finite number of components and residual terms using the variational modal decomposition (VMD) method; the residual terms are then decomposed, the features are extracted using the completed ensemble empirical mode decomposition with adaptive noise (CEEMDAN) method; the components are predicted by an extreme learning machine optimised by the sparrow search algorithm; predictions are summed to obtain the predictions.

R. SUJATHA worked on A Bayesian Regularized Neural Network for Analysing Bitcoin Trends For her predictions, she used thirteen different factors: price, volume, market cap, mean dollar invested age, social volume, social dominance, development activity, transaction volume, token age consumed, token velocity, token circulation, market value to realised value, and realised cap. she also use the seven probable attributes: Price, Volume, Market Cap, Social Dominance, Development Activity, Market Value to Realised Value & Realised Cap to map out the attribute selection and trend analysis. Asymmetric Autoregressive with External Input analysis was performed with seven attributes in mind. The Levenberg-Marquard, Bayesian Regularisation, and Scaled Conjugate Gradient methods were used in the work to train a neural network. According to the findings of the regression plots and error histogram, the Bayesian Regularised Neural Network is performing well and hence offers a better forecast.

Research on Sentiment Analysis and Emotion Detection on Tweets Related to Cryptocurrency was developed by NAILA ASLAM in 2022. Employing Ensemble, A suggested ensemble model, multiple machine learning and deep learning techniques, including the LSTM-GRU Model are all studied. Additionally, given the chosen models, TextBlob and Text2Emotion are investigated for emotion analysis. Comparatively, more people express happiness when using cryptocurrencies, followed by sentiments of dread and surprise. The results indicate that using BoW features improves the performance of machine learning models. The suggested LSTM-GRU ensemble outperforms both machine learning and cutting-edge models, with accuracy ratings of 0.99 for sentiment analysis and 0.92 for emotion prediction. The planned structure's architecture methodology. On an Intel Core i7 11th generation computer running Windows, all experiments are performed. TensorFlow, Keras, and the scikit learning frameworks are used to create machine and deep learning models in the Python programming language. The first stage in the suggested method is TwitterTM data. utilising the Tweepy library to collect data. In this case, Tweets are deleted and a TwitterTM developer account is created. Specific hashtags, such as #cryptocurrency, #cryptomarket, and #BTC, are used to collect tweets. This approach results in the collection of 40,000 tweets. The data collecting runs from July to August 2021.

IV. PROPOSED METHODOLOGY

The RNN (LSTM) deep learning model will forecast the coin price in addition to training it. With the aid of the pymongo package, those predicted data will be stored in a mongo database. In this case, the client will use the Coin name in the coin API to obtain the data. The system will acquire all essential data when the API sends requests to related APIs like the Forecasted API, Sentimental Analysis API, and Financial Ratios API. With the aid of the Python Pandas library, that data will be pre-processed after being fetched.

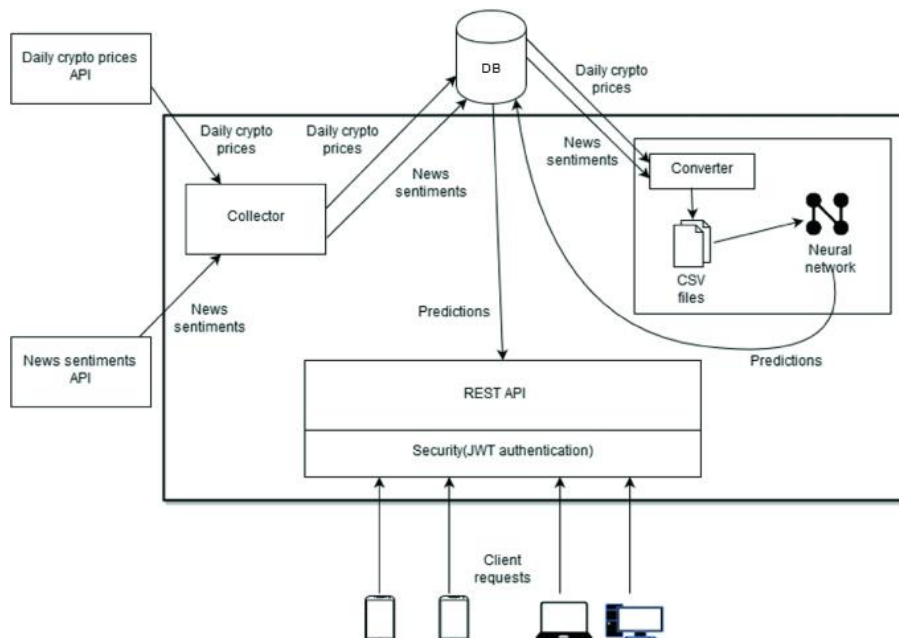


Fig 1: Cryptocurrency price prediction system



All of the data will then be sent to the appropriate API, where it will be promptly rendered and displayed to the user via Angular. The study developed variables from Cryptocurrency transactions in order to run prediction simulations under a variety of simulation-designed scenarios in order to better understand the impact of the timestamp on the price of Bitcoin, which was the study's intended purpose. Using historical data as inputs, forecasting is a process that produces accurate predictions of the future course of trends. RNN and LSTM, two deep learning techniques, are employed in this case to forecast the data.

Here we will train a deep learning model using historical data that we will pass along. By obtaining the correlation between the past and the present, the model will forecast the data. These predicted data will be kept in a database and immediately rendered to the user. Since there may be lags of uncertain length between significant occurrences in a time series, LSTM networks are well-suited to categorising, processing, and making predictions based on time series data. Consider a sequential data example, which may be data from the currency market for a specific currency.

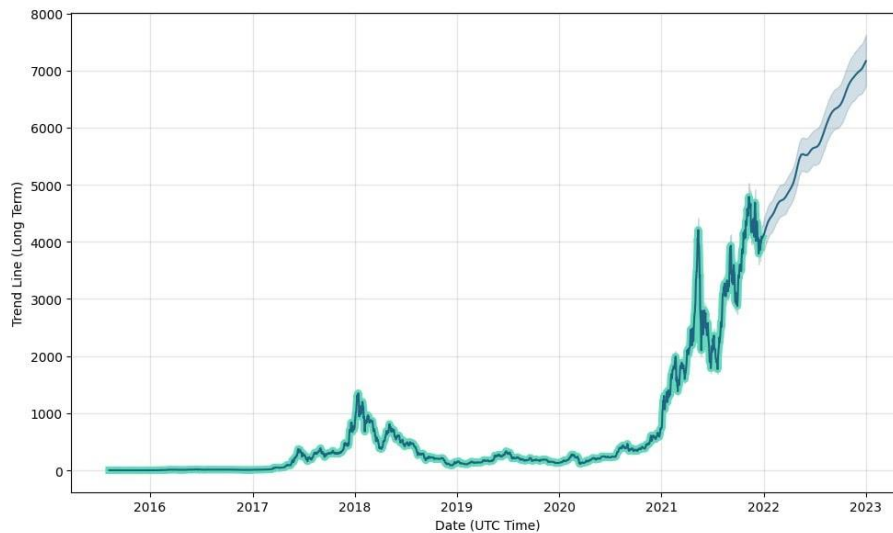


Fig 2: Cryptocurrency forecasted data of Bitcoin

Based on many features, such as the volume of the currency, the opening value, etc., a LSTM may be able to learn to anticipate the value of the various currencies. While these characteristics affect the currency's price, it also has a significant impact on the value of the currency in the previous days. In fact, one of the main determining factors for predictions for a trader is these data from the prior days (or the trend). In addition to polarity (positive, negative, or neutral), feelings and emotions (angry, pleased, sad, etc.), urgency (urgent, not urgent), and even intentions (interested vs. uninterested), are all emphasised in sentiment analysis models. Sentiment research is crucial because it enables companies to immediately comprehend the views of their customers as a whole.

we can make quicker and more accurate decisions by automatically classifying the sentiment behind reviews, social media conversations, and more. In this module, we'll use Google News to help us get company news, crawl it with the help of the Python package called lovely soup, and then analyse it by feeding it to the Vader sentiment analysis model.

V. CONCLUSION AND FUTURE ENHANCEMENT

Our goal of creating a system that can be used to predict the price of a cryptocurrency using historical data has been achieved, and in this research, two strategies have been applied Sentimental Analysis forecast data from the coin API dataset. Positive outcomes have been achieved by all strategies due to an increase in forecast accuracy. Utilizing recently developed deep learning techniques for coin prediction has produced encouraging results, clearing the way for their implementation in successful exchange schemes. It has led to the conclusion that deep learning techniques can be used to predict the currency market more effectively and accurately. This study examined the timestamp-based cryptocurrency transaction procedure. a neural network model that was created using the LSTM algorithm to predict how the transaction procedure for cryptocurrencies will change over time. The primary contribution of this research study is the frequent neural network training that takes into account two factors, specifically the timestamp and weighted Price.



The coin price prediction method can be further enhanced in the future by utilising a dataset that is significantly larger than the one being used right now. then project the currency's price. Our prediction models' accuracy would rise as a result. Other deep learning models could also be researched to see what accuracy level they produce. Additionally, using this in mobile applications will facilitate quick data access for end users.

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