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Analyzing Crypto Currency Price Trends With LSTM-Based Models

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***Abstract*— Cryptocurrency price prediction using Long Short-Term Memory (LSTM) is a popular method for forecasting future prices of the cryptocurrency It is supervised and organised by a blockchain, a peer-to-peer network that also acts as a secure record of transactions.. LSTM is a type of recurrent neural network (RNN) that is capable of learning long-term dependencies, making it well-suited for time series data like financial markets. In this approach, historical price data is used to train the LSTM model, which can then be used to make predictions about future price movements.To implement this, the first step is to preprocess the data, which involves scaling and transforming the data into a format that can be fed into the LSTM model. Then, using a sliding window technique, the LSTM model is supervised on the preprocessed data to predict the following value in the time series on the basis of a certain number of earlier values. After training, the model can be used to make predictions about future price movements. These predictions can be evaluated using various performance metrics such as mean squared error or root mean squared error to assess the accuracy of the model. Overall, the use of LSTM for Bitcoin price prediction has shown promising results, with some studies reporting high levels of accuracy in predicting future price movements. However, it is important to note that cryptocurrency markets are highly volatile and unpredictable, and there are many factors beyond historical price data that can affect the price of Bitcoin.**

Keywords*— *Cryptocurrency, Bitcoin, Technology, Block, Network, Blockchain, price of bitcoin, Digital, Transaction, Model.

I. INTRODUCTION

To begin, bitcoin is classified as an economic asset. The economy encompasses the production and consumption of products, as well as the administration of budgets.. Cryptocurrency can also be named as the digital money that can also be used to depict an economy. However, cryptocurrency had a massive impact on rapid economic volatility. The way of combining the cryptocurrency with the economic participants is known as the Crypto economy.Through cryptography and economic incentives, It's important to pay attention to Crypto Economics when building a decentralized network.With the introduction of Bitcoin, Cryptoeconomics was an important block to consider when designing a decentralized network.

Cryptocurrency is a payment system which can be done on the internet and is completely independent of banks to verify transactions.. Cryptocurrency transactions will only be possible through the computer network and these transactions will be carried from any corner of the world. Rather than physical money that may be exchanged and sold, cryptocurrency payments are digital additions to an online database that tracks individual transactions.Unlike a central bank digital currency, Bitcoin is controlled by its users. The cryptocurrency is considered to be centralized if a cryptocurrency is created before being 1 issued by a single issuer. Each cryptocurrency uses distributed ledger technology, also known as a blockchain, which is a public financial transaction database, when it is implemented using decentralized control. There are different instances for cryptocurrency such as Bitcoin, ethereum, dogecoin and lite coin etc.

The bitcoin will be achieved through bitcoin mining and once it is achieved, it will have the authentication with the unique information. The price of cryptocurrency will be decided by considering both the external and also the internal factors. For instance, recently the conflict between Ukraine and Russia resulted in the little drop of the price of bitcoin as 50 percent of the population in Russia uses bitcoin. Bitcoin, the first ever invented cryptocurrency, was created in the year 2009 and it became the most widely used cryptocurrency. The primary motivation for trading cryptocurrencies is to make a profit, with values rising rapidly at times. Traders and investors show much acceptance in bitcoin as it is compared with other cryptocurrencies.

As the price of cryptocurrencies is very high, it demands security to the maximum extent. Cryptocurrency uses the most updated and secure technology to stand far from the security threats. As a security feature, the cryptocurrency use block chain technology. Bitcoin, on the other hand, has remained safe and unaccessed until this day. A block chain has a record that is updated as the information stored changes. The expanding list of records is what it's called. Each block contains transaction data followed by the date and a cryptographic hash of the last block it worked on. The timestamp always demonstrates that the hash was created using transaction data that existed at the time the block was released. Because each successive block contains information about the prior block, they form a chain that reinforces the ones before it. As a result, data in one block cannot be modified without affecting all following blocks, making blockchains resistant to data modification once recorded. The block chain technology was very difficult to access. Even Though it is accessed, it is very difficult to

achieve the security questions. The user has to achieve the most complex mathematical problems to access the block chain technology.

After Satoshi Nakamoto invented the most popular bitcoin in the year 2008 with the help of the work by Stuart Haber, W. Scott Stornetta, and Dave Bayer, blockchain technology gained a lot of fame and recognition. Numerous open-source programmes and blockchains that are widely utilized by cryptocurrencies were influenced by the creation of bitcoin. Among other things, blockchain has the ability to alter economic and societal institutions. Among other things, blockchain has the ability to alter economic and societal institutions. According to data presented by the 2 World Economic Forum, blockchain technology will account for more than 20% of global GDP by 2025. The blockchain technology will be very difficult to access as it is simply not possible because it would require attacking every single node or miner on the planet. Another reason why blockchain cannot be hacked is due to the way blockchains are distributed. Thus, using this technology made the cryptocurrency more secure and unaccessed. However, the above reasons made the usage of bitcoin increase. As we know, the price of bitcoin was independent of the government which is why the people show keen interest in accepting bitcoin.

II. Literature Survey (Related Work)

Dennis Etal.[1] employed various trait selection mechanisms and machine learning techniques such as artificial neural networks, support vector machines, and intermittent neural networks, as well as k-means clustering in the bitcoin price prediction. In order to obtain the most crucial features, however, this study has a disadvantage in that it solely focuses on investors. Because bitcoin has the potential to alter the dynamics of global frugalness, policymakers should be viewed as important system partners.

Sean McNally Etal.[2] used a Bayesian optimised intermittent neural network with LSTM to read the pattern of the Bitcoin price in USD. They also compared the deep literacy approaches using the ARIMA model.

In Atsalakis Etal.[3] The thing of this study is to anticipate the bitcoin exchange rate using computational intelligence styles, particularly hybrid neuro-fuzzy regulators. Artificial neural networks and a neuro-fuzzy system were employed in this model.

Goodfellow Etal.[4], to represent financial signal and trading, a deep direct underpinning learning system was presented. To induce exact vaticination findings, they used reinforcement literacy (RL), deep literacy (DL), and their current deep neural network (NN). They use commodity unborn requests and stock request data to validate the proposed approach.

Madan Etal.[5] employed machine learning to try to anticipate bitcoin's price and investigate girding tendencies. They used 25 bitcoin-related parameters to read the daily price change.

Lahmiri Etal.[6] They used machine learning algorithms to read the everyday value of cryptocurrencies like Bitcoin, ripple, and digital currency that have a lot of data. For high liquidity cryptocurrencies, they used GRNN (Generalised Retrogression Neural Network) and RNN (Recursive Neural Networks).

Chen et al. [7]examined a variety of statistical methods for predicting bitcoin prices, including logistic regression, direct discriminant analysis, and various machine learning models including the support vector machine (SVM), LSTM, and others. They used statistical methods for daily price prediction while machine literacy-based models were used for 6-minute price prediction. Their findings demonstrate that machine learning models outperform statistical methods for high frequency data.

Vinothini et al.[8] In order to read the stock's closing prices and compare the predicted performance of the ML model using the LSTM models,developed LSTM grounded DL networks. By adding a novel analytical model based on information from Twitter that links public attitudes about stock price with request sentiments, we further improve the prediction models. It uses the views expressed on Twitter and data from past weeks to forecast future changes in stock prices.

Nivetha Et al.[9] A machine learning method called LSTM was suggested for predicting future stock prices. Because it serves as the cornerstone for stock price forecasting and other financial forecasting models, they emphasised on time series prediction. The findings from the LSTM algorithm are more accurate and efficient than those from the earlier ARIMA model.

Ji et al [10].'s demonstration of a comparison analysis for forecasting Deep learning-based networks such as deep neural network (DNN), LSTM, CNN, deep residual network, and their combinations are used to calculate the price of bitcoin. They found that while DNN-based networks are more suited for predicting price direction, LSTM networks produce better for the regression challenge, or the estimation of bitcoin worth.

III. System Implementation (Methodology)

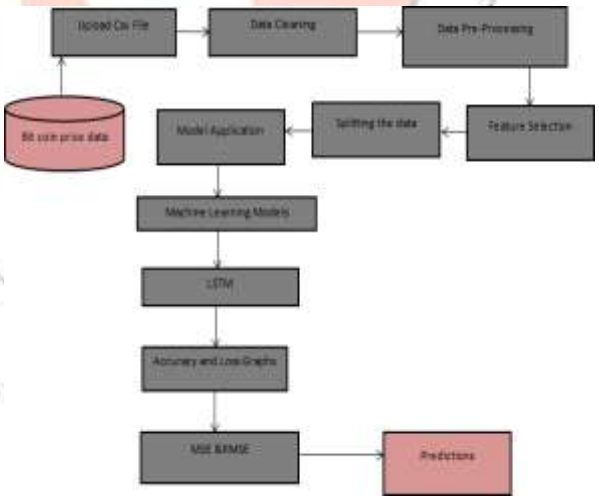

Fig.1 System Architecture

The proposed system may include the following components:

Data Collection: Collecting historical Bit coin price data from various sources, such as crypto currency exchanges and financial databases, as well as incorporating additional sources of data, such as social media and news articles.

Dataset : Open source data obtained from Github and source link is:https://min-api.cryptocompare.com/data/ histoday.

Dataset is:

```
In [84]: print('Null values:',hist.isnull().values.sum())
         Null values: 0

In [85]: print('NA values:',hist.isnull().values.any())
         NA values: False
```

Data Preprocessing: Cleaning and processing the collected data to remove any anomalies and ensure that the data is suitable for use in training the LSTM model.

Feature Extraction: Extracting relevant features from the

```
In [57]: hist.info()
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2001 entries, 0 to 2000
Data columns (total 9 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   time             2001 non-null   object
 1   high             2001 non-null   float64
 2   low              2001 non-null   float64
 3   open             2001 non-null   float64
 4   volumefrom       2001 non-null   float64
 5   volumeto         2001 non-null   float64
 6   close            2001 non-null   float64
 7   conversionType   2001 non-null   object
 8   conversionSymbol 9 non-null      object
dtypes: float64(6), object(3)
memory usage: 140.8+ KB
```

preprocessed data to provide inputs to the LSTM model.
Model Training: Using the preprocessed data and extracted features to train the LSTM model to learn patterns and dependencies in the historical Bitcoin price data.
Model Evaluation: Evaluating the performance of the LSTM model in terms of accuracy, precision, recall, and other key measures.
Prediction: Using the trained LSTM model to make predictions about future Bit coin price movements.
Overall, the proposed system for Bit coin price prediction using LSTM aims to incorporate novel techniques and approaches to further enhance the accuracy of Bitcoin price prediction and provide valuable insights and support to traders and investors in the cryptocurrency market.

Lstm :

A type of recurrent neural network are long short-term memory networks. Information can be safely removed from or retrieved from the cell state, which will be managed by the gate structures. It excels at modelling sequence data because it retains previous information.
On their path to a new Cell State and Hidden State, these three values travel through the following gates:

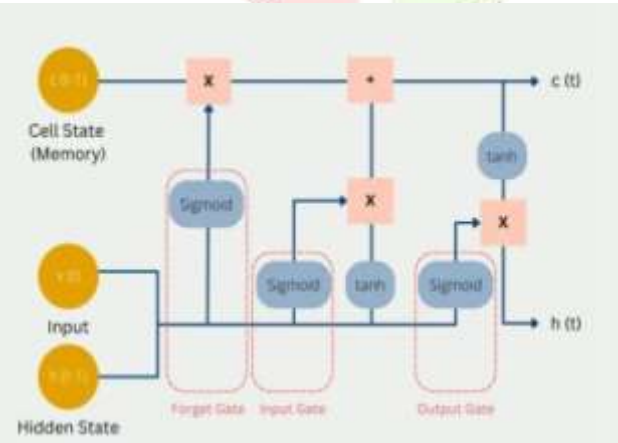

Fig. 2 LSTM Architecture

Output gate: Information that is no longer necessary for the LSTM to grasp things or is of lower value is removed by doubling a filter. This is necessary to improve the LSTM network's performance. These variables are passed to the sigmoid function, which can only return values between 0 and 1. A number of 0 indicates that all prior knowledge is lost, whereas a value of 1 indicates that all prior knowledge is retained. The results of this are multiplied by the current Cell State, which causes knowledge that is no longer necessary to retain to be dropped out because it is multiplied by 0.
Input gate: The input gate establishes the amount of current input needed to complete the task. For this, the hidden state and the current input are multiplied by the weight matrix from the previous run. All data from the Input Gate that seems to be meaningful is added to the Cell State (t) to generate the new Cell State. This updated Cell State, which is now the current state of the short-term memory, will be used in the subsequent run.
Output gate: At the Output Gate, the Hidden State is then used to calculate the LSTM model's output. Depending on the context, it may be, for instance, a phrase that enhances the statement's meaning. The sigmoid function controls what data can enter across the output gate and the cell state multiplies after its activation with the tanh function.
The issue can be recreated through time and layers with the help of LSTMs. Recurrent networks can learn over a long period of time (over 200) by keeping a more steady error, creating a channel to remotely link causes and effects. Data is stored in LSTMs outside of the gated cell recurrent network's usual flow. Similar to data, information can be saved, written to, and read from a cell in a computer memory. The cell chooses what to store and when to read, write, and erase through gates that open and close. The series is converted to supervised data using the next function. There are two models available from Keras. The first is a time series predictive sequential model, and the second is a useful API. Using input forms, the dense layer is used as the output layer. "adam" is the optimizer function used. This has a 0.01 learning rate and a mean absolute error loss function. Absolute error is the utilised loss mechanism.
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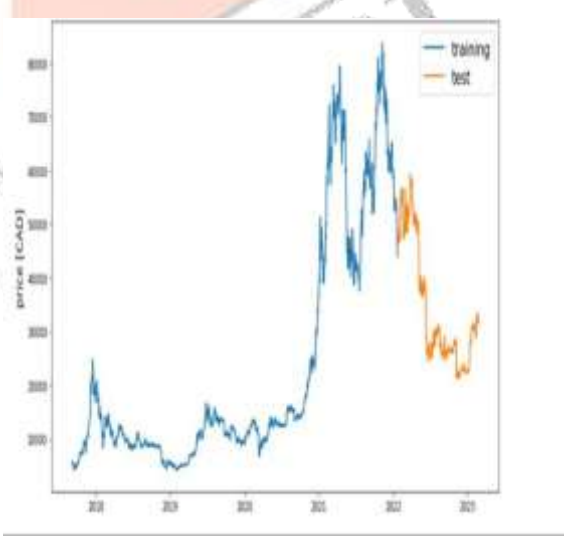
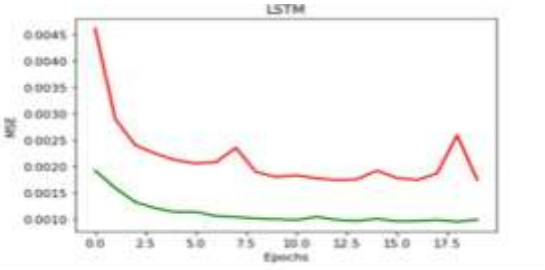
IV. EXPERIMENTS & RESULTS

Graph plotted between Testing and Training data:



Loss Function of the model :



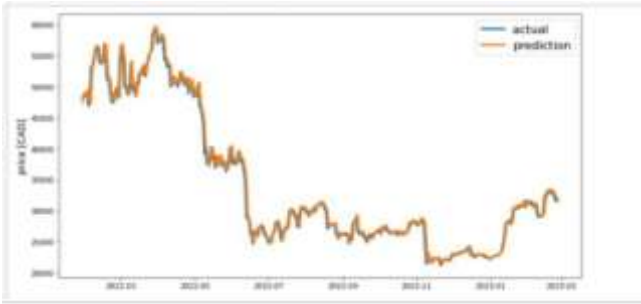
Designed performance metrics of the model

```
train, test, X_train, X_test, y_train, y_test = prepare_data(
    hist, target_col, window_len=window_len, zero_base=zero_base, test_size=test_size)

model = build_lstm_model(
    X_train, output_size=1, neurons=lstm_neurons, dropout=dropout, loss=loss,
    optimizer=optimizer)

history = model.fit(
    X_train, y_train, validation_data=(X_test, y_test), epochs=epochs, batch_size=batch_size, verbose=1, shuffle=True)
```

Graph for Actual and Prediction values:



Comparision between proposed and existing results

Reference	Cryptocurrency	Method	Result
[2]	BTC	LSTM	R2 score:53%
[6]	BTC	LSTM	R2 score:77%
[9]	BTC	LSTMARIMA	R2 score:49%
This paper	BTC	LSTM	R2 score:80%

V. EVALUATION METRICS

Performance Metrics:

As the target variable is largely unpredictable, we want to correct the model when the error is advanced. The Root Mean Squared Error(RMSE) gives enormous crimes a lot of weight because it places the crimes before comprising. We've also considered Mean Absolute Error(MAE) because of its easy interpretability.

$$RMSE = \sqrt{1/n \sum_{i=1}^{n} (\widehat{y_i} - y_i)^2}$$

$$MAE = 1/n \sum_{i=1}^{n} |\widehat{y_i} - y_i|$$

The results obtained form our model is:

MAE	MSE	Accuracy
0.02163496141560	0.0009845247506448	0.8011672533724

VI. CONCLUSION

Bitcoin price prediction using LSTM is a promising field of research that has gained significant attention in recent years. The ability to accurately predict future Bitcoin price movements can provide valuable insights and support to traders and investors in the highly volatile and dynamic cryptocurrency market.

In conclusion, Bitcoin price prediction using LSTM is a promising field of research that has the potential to provide valuable insights and support to traders and investors in the cryptocurrency market. The proposed system incorporating novel techniques and approaches can further enhance the accuracy of Bitcoin price prediction and improve the reliability of predictions.

VII. FUTURE WORK

There are several potential avenues for future enhancement of Bit coin price prediction using LSTM, including:

Deployment : in future we will be doing model deployement using linear regression.

While LSTM can accurately predict Bitcoin price movements, it can be difficult to interpret the model's predictions. Developing interpretability techniques, such as feature importance Analysis and visualisation tools, for example, might give useful insights into the variables influencing Bitcoin price changes.

Overall, future improvement of Bitcoin price prediction using LSTM will require a multi-disciplinary approach that integrates techniques from computer science, economics, finance, and other fields.

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