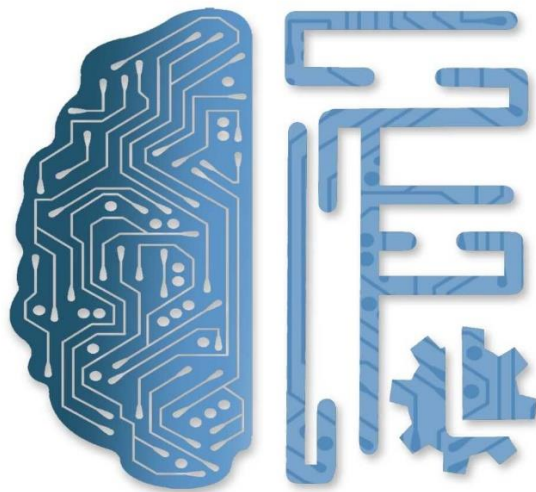


CRYPTOCURRENCY(BITCOIN) PRICE PREDICTION USING MACHINE LEARNING

Submitted by-

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The popularity of cryptocurrencies has skyrocketed in 2017 due to several consecutive months of super exponential growth of their market capitalization, which peaked at more than \$800 billions in Jan. 2018. Today, there are more than 1,500 actively traded crypto currencies. Between 2.9 and 5.8 millions of private as well as institutional investors are in the different transaction networks, according to a recent survey, and access to the market has become easier over time.

However, the application of machine learning algorithms to the cryptocurrency market has been limited so far to the analysis of Bitcoin prices, using random forests, Bayesian neural network, long short-term memory neural network, and other algorithms. The price of Bitcoin does not depend on the business events or intervening government authorities, unlike the stock market.

Thus, to forecast the value we feel it is necessary to leverage machine learning technology to predict the price of Bitcoin. So the project aim is to predict the price of bitcoin and help investor's make better investments. This research is concerned with predicting the price of Bitcoin using machine learning. The goal is to ascertain with what accuracy can the direction of Bitcoin price in USD can be predicted. The price data is sourced from the Bitcoin Price index.

The task is achieved with varying degrees of success through the implementation of a Bayesian optimized recurrent neural network (RNN) and Long Short-Term Memory (LSTM) network



Business Need Assessment:

A cryptocurrency price prediction app can be useful in real life for several reasons:

Investment decisions: Many people are interested in investing in cryptocurrencies to potentially profit from their price fluctuations. A price prediction app can provide insights and forecasts based on historical data, technical analysis, and machine learning algorithms. This information can help investors make informed decisions about buying, selling, or holding cryptocurrencies.

Risk management: Cryptocurrency markets are known for their volatility, and prices can change rapidly. A price prediction app can help users assess the potential risks associated with different cryptocurrencies by providing forecasts and indicating potential price movements. This information can assist in managing investment risks and implementing risk mitigation strategies.

Trading strategies: Traders in the cryptocurrency market often rely on technical analysis and market trends to devise their trading strategies. A price prediction app can offer technical indicators, charts, and predictions to help traders identify patterns and make more accurate trading decisions. This can be especially beneficial for day traders or those engaging in short-term trading.

Market awareness: Keeping track of numerous cryptocurrencies and their price movements can be challenging. A price prediction app can aggregate data from multiple sources and provide real-time updates on various cryptocurrencies in a single platform. Users can stay informed about market trends, news, and price changes without having to constantly monitor different cryptocurrency exchanges or news outlets.

Educational purposes: Price prediction apps often provide educational content and analysis that can help users understand the factors influencing cryptocurrency prices. They can offer insights into market dynamics, technical analysis techniques, and fundamental factors affecting cryptocurrencies. This educational aspect can be valuable for individuals seeking to expand their knowledge about cryptocurrencies and trading strategies.

cryptocurrency price prediction apps are based on statistical analysis, historical data, and algorithms, and their predictions are not always accurate. Cryptocurrency markets can be highly volatile and influenced by various factors,

including market sentiment, regulatory developments, and technological advancements. Therefore, it's crucial for users to exercise caution, conduct their own research, and consider multiple sources of information before making any investment decisions.

Target Specifications and Characterization:

When developing a Bitcoin price prediction model, it's important to consider the target specifications and characterization to ensure accurate and meaningful predictions. Here are some key aspects to consider:

Timeframe: Specify the timeframe for which you want to make predictions. Bitcoin's price can be highly volatile, so predictions can vary significantly based on the timeframe. Common options include short-term (hours or days), medium-term (weeks or months), and long-term (months or years).

Granularity: Decide on the level of granularity you want for your predictions. For example, you may want to predict the daily closing price, hourly price movements, or even more fine-grained intervals. This choice depends on the specific use case and the needs of the users.

Prediction Type: Determine the type of prediction you want to generate. Common approaches include regression-based predictions (forecasting a specific price) or classification-based predictions (predicting price trends such as upward or downward movements).

Evaluation Metrics: Define the metrics you will use to evaluate the accuracy and performance of your predictions. Common evaluation metrics include mean absolute error (MAE), root mean square error (RMSE), or accuracy for classification-based predictions.

Input Features: Select the relevant input features that will be used to make predictions. These features can include historical price data, trading volume, market sentiment indicators, macroeconomic factors, or technical indicators such as moving averages or relative strength index (RSI). It's important to choose features that have shown correlation or predictive power in the past.

Model Selection: Decide on the specific machine learning or statistical model that will be used for prediction. There are various approaches to choose from, including regression models (linear regression, random forests, support vector machines), time series models (ARIMA, GARCH), or more advanced deep

learning models (LSTM, GRU). The choice of model depends on the complexity of the problem, available data, and computational resources.

Training and Validation: Determine how you will train and validate your prediction model. Split your historical data into training and validation sets, ensuring that the validation set represents a realistic out-of-sample scenario. This helps to evaluate the model's performance and avoid overfitting.

Interpretability: Consider whether interpretability is important for your use case. Some models, like linear regression, provide clear insights into the relationship between input features and predictions. In contrast, deep learning models may be more complex and provide less interpretability.

Bench marking alternate products:

To claim that your Bitcoin price prediction app is better than existing products, you need to highlight specific features, advantages, or innovations that set it apart. Here are a few potential reasons why your app could be better:

Advanced Algorithms: If your app incorporates state-of-the-art machine learning algorithms or predictive models that outperform traditional methods, you can emphasize the superiority of your prediction accuracy. Highlight any unique approaches or proprietary techniques you employ.

Data Sources and Integration: If your app utilizes a comprehensive range of data sources, including real-time market data, social media sentiment analysis, news feeds, or blockchain analytics, it can provide a more holistic view of market trends and potential influences on Bitcoin prices.

User-Friendly Interface: A user-friendly and intuitive interface can greatly enhance the user experience. If your app offers a clean, well-designed interface that is easy to navigate and understand, it can be more appealing to users, especially those who are new to cryptocurrency investing.

Customization and Personalization: If your app allows users to customize their predictions based on their specific preferences, risk tolerance, or investment strategies, it can provide a more tailored experience. Features such as adjustable timeframes, granular prediction intervals, or the ability to incorporate personal indicators can differentiate your app.

Transparency and Explanation: If your app not only provides predictions but also offers explanations and visualizations of the underlying factors influencing those predictions, it can help users understand the reasoning behind the forecasts. This transparency can enhance trust and empower users to make informed decisions.

Track Record and Performance Metrics: If your app can demonstrate a strong track record of accurate predictions or compare its performance against other popular prediction models, it can instill confidence in users. Presenting transparent performance metrics, such as historical prediction accuracy or backtesting results, can strengthen your app's credibility.

Community and Social Features: If your app incorporates a community aspect, such as a forum for users to discuss predictions, share insights, or follow expert traders, it can foster engagement and create a sense of community among users. Social features can add value beyond the predictions themselves.

Continuous Improvement and Updates: If your app is committed to continuous improvement and updates based on user feedback, technological advancements, or market changes, it demonstrates a dedication to staying ahead of the curve and providing an evolving, cutting-edge product.

Collaboration:

Building a powerful Bitcoin price prediction app involves a combination of technical expertise, data sources, and market insights. While there isn't a specific company that is necessary to collaborate with, here are some types of companies or entities you could consider partnering with to enhance your app:

Cryptocurrency Exchanges: Collaborating with reputable cryptocurrency exchanges can provide you with access to real-time and historical market data, including trading volumes, order book data, and price information. This partnership can help ensure the accuracy and timeliness of the data used in your price prediction models.

Data Providers: Working with data providers that specialize in cryptocurrency data can enhance the quality and breadth of data used in your app. These providers can offer comprehensive historical data, sentiment analysis, news feeds, blockchain data, and other relevant information that can contribute to more accurate predictions.

Market Research Firms: Partnering with market research firms that specialize in cryptocurrencies and blockchain technology can provide valuable insights into market trends, investor sentiment, regulatory developments, and other factors that influence Bitcoin prices. These firms can offer research reports, analysis, and expertise to help improve the predictive capabilities of your app.

Machine Learning Experts: Collaborating with machine learning experts or data scientists who specialize in financial markets and time series analysis can enhance the predictive models used in your app. These experts can help develop and fine-tune the algorithms, select appropriate features, and implement advanced techniques to improve prediction accuracy.

Blockchain Analytics Companies: Blockchain analytics companies can provide insights into on-chain data, transaction patterns, and market movements. By partnering with such companies, you can leverage their expertise to incorporate blockchain-based indicators into your prediction models and gain a deeper understanding of the underlying market dynamics.

Financial Institutions: Collaborating with financial institutions that have experience in cryptocurrency trading or investment can provide valuable insights and expertise. They may have proprietary models, trading strategies, or access to additional data sources that can be integrated into your app to enhance its predictive capabilities.

Academic Institutions: Partnering with academic institutions that specialize in finance, economics, or machine learning can bring cutting-edge research, access to academic datasets, and collaboration with knowledgeable researchers. This collaboration can contribute to the development of robust and innovative prediction models.

Application Regulations:

The applicable regulations for a Bitcoin price prediction app can vary depending on the jurisdiction and the specific features and functionalities of the app. While I can provide general information, it's essential to consult legal experts or regulatory authorities in the relevant jurisdiction to ensure compliance. Here are some common regulations that may apply:

Financial Regulations: Depending on the country or region, financial regulations may govern the operations of your app, especially if it involves handling or facilitating financial transactions. This can include regulations related to anti-money laundering (AML), know-your-customer (KYC) requirements, and consumer protection laws.



Securities Regulations: If your app offers predictions or recommendations related to specific cryptocurrencies or tokens that are considered securities, it may fall under securities regulations. In some jurisdictions, providing investment advice or making predictions about securities may require licensing or registration with the relevant regulatory bodies.

Data Protection and Privacy Laws: If your app collects and processes user data, you may need to comply with data protection and privacy laws. These regulations typically require you to obtain user consent, handle personal data securely, and provide transparency regarding data usage and storage.

Intellectual Property Laws: Ensure that your app does not infringe upon any intellectual property rights, such as trademarks or copyrights. Avoid using logos, names, or content that could lead to infringement claims.

Advertising and Marketing Regulations: If your app engages in advertising or marketing activities, it may need to comply with specific regulations related to truth in advertising, fair competition, and privacy in marketing communications.

Regulatory Compliance: Depending on the jurisdiction, there may be additional regulatory requirements specific to cryptocurrency-related businesses. This can include licensing or registration with financial regulatory authorities, compliance with specific reporting or disclosure obligations, and adherence to specific anti-fraud or anti-manipulation regulations.

Constraints:

When developing a Bitcoin price prediction app, there are several constraints that you may encounter. These constraints can arise from technical, ethical, or practical considerations. Here are some common constraints to consider:

Data Availability: The accuracy and reliability of your predictions depend on the availability and quality of data. Constraints may arise if access to real-time or historical data is limited, or if there are restrictions on the types of data you can collect and utilize. Ensure you have access to reliable data sources and comply with any data usage restrictions or licensing requirements.

Computational Resources: Building and running prediction models can require significant computational resources, especially if you are utilizing complex algorithms or analyzing large datasets. Constraints may arise if you have limited computing power, storage capacity, or processing capabilities. Consider optimizing your algorithms and infrastructure to work within the available resources.

Regulatory Compliance: As mentioned earlier, regulatory constraints can impact the development and operation of your app. Compliance with financial, securities, data protection, and advertising regulations may impose limitations on the features, data handling practices, or marketing strategies of your app. Ensure that you understand and adhere to applicable regulations.

Prediction Accuracy: Bitcoin price prediction is a challenging task due to market volatility and complex factors influencing prices. There are inherent limitations to the accuracy of predictions, and it's important to manage user expectations accordingly. Communicate the limitations and uncertainties associated with predictions to avoid misleading users.

User Trust and Privacy: User trust is crucial for the success of your app. Constraints may arise if users have concerns about the security of their personal information, data privacy, or the handling of their financial transactions.

Implement robust security measures, adhere to privacy regulations, and be transparent about your data handling practices to instill user confidence.

Market Uncertainty: Cryptocurrency markets are highly volatile and influenced by various factors, including market sentiment, regulatory changes, and technological developments. These uncertainties can impose constraints on the accuracy and reliability of predictions. Communicate the limitations of predictions and provide users with comprehensive risk disclosures.

Ethical Considerations: Ethical constraints may arise when developing a price prediction app. For example, providing inaccurate predictions or misleading information could harm users' financial decisions. Ensure that your app is developed and operated ethically, adhering to best practices and providing users with transparent and reliable information.



Intellectual Property: Constraints may arise if your app infringes upon the intellectual property rights of others. Avoid using copyrighted content, trademarks, or proprietary algorithms without proper authorization or licensing.

System Architecture:

The proposed system implements machine algorithm to build the model to predict the price of the bitcoin based on historical dataset available on online database. In the proposed model, The bitcoin price prediction can be done using the LSTM(Long Short Term Memory) is one of the type of the RNN (Recurrent Neural Networks). The tool used for project are anaconds navigator. The procedure to be followed for the proposed system is given as follows:

- 1.First, collect the data set using the Rest-API to collect the historic of the bitcoin prices from the online database.

- 2.Arrange the data into the data frame according to the problem definition, so as to get analysis correct and produce the results which are efficient to meet goals of the system.

- 3.Then the rows of the dataset which are outdated for analysis/prediction to build a model and in-order to feed the levant data to the model extra columns are removed and stored into a CSV file.

- 4.Then data-preprocessing is performed to missing values for the attributes,

5. The data preprocessing is performed to missing values for the de noise and inconsistency in the data.

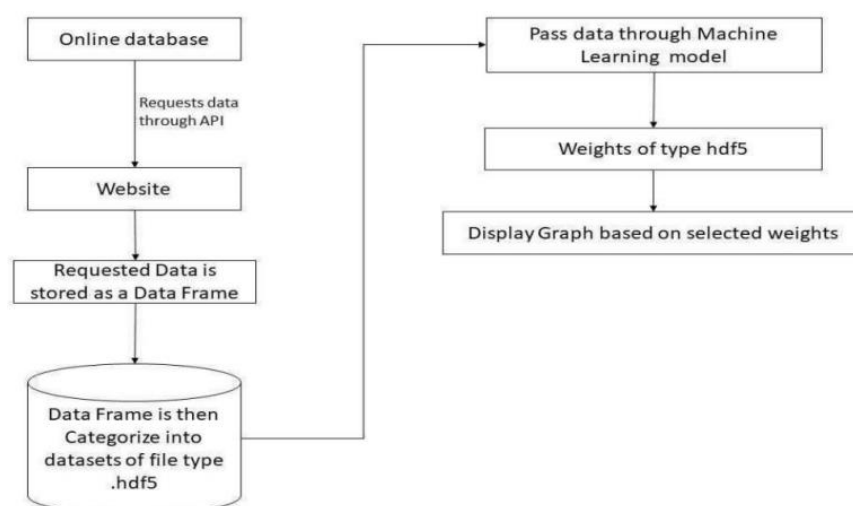
- 6.Then we Build the model for the data set using the LSTM (RN) algorithm to predict values of bitcoin on daily basis.

- 7.Test the pedictions with differem layers of the RNN Model.

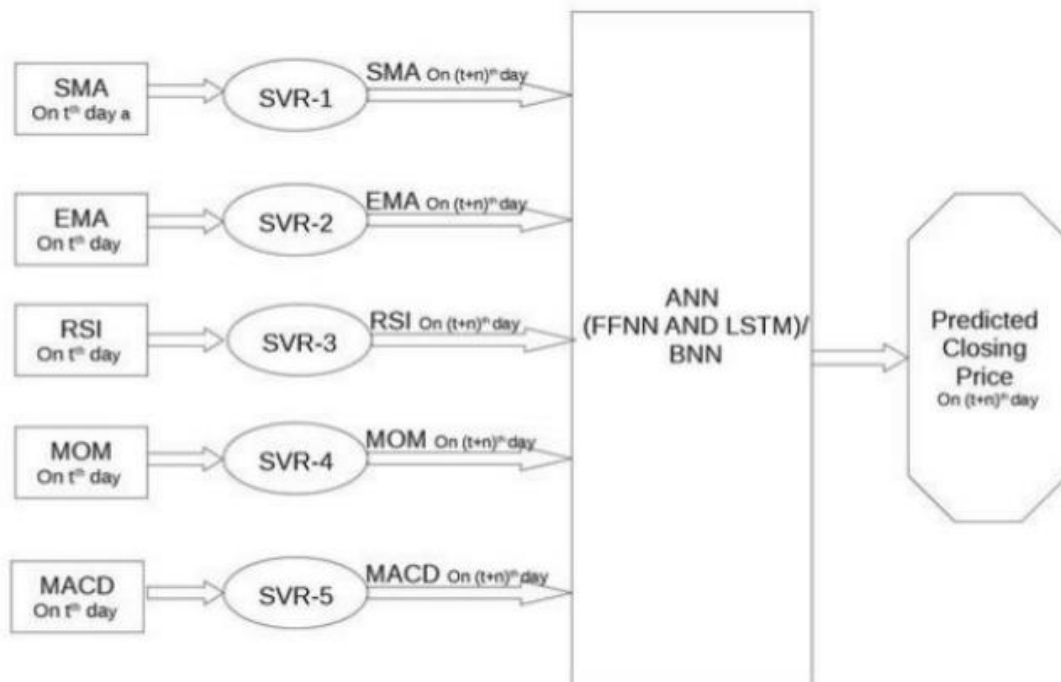
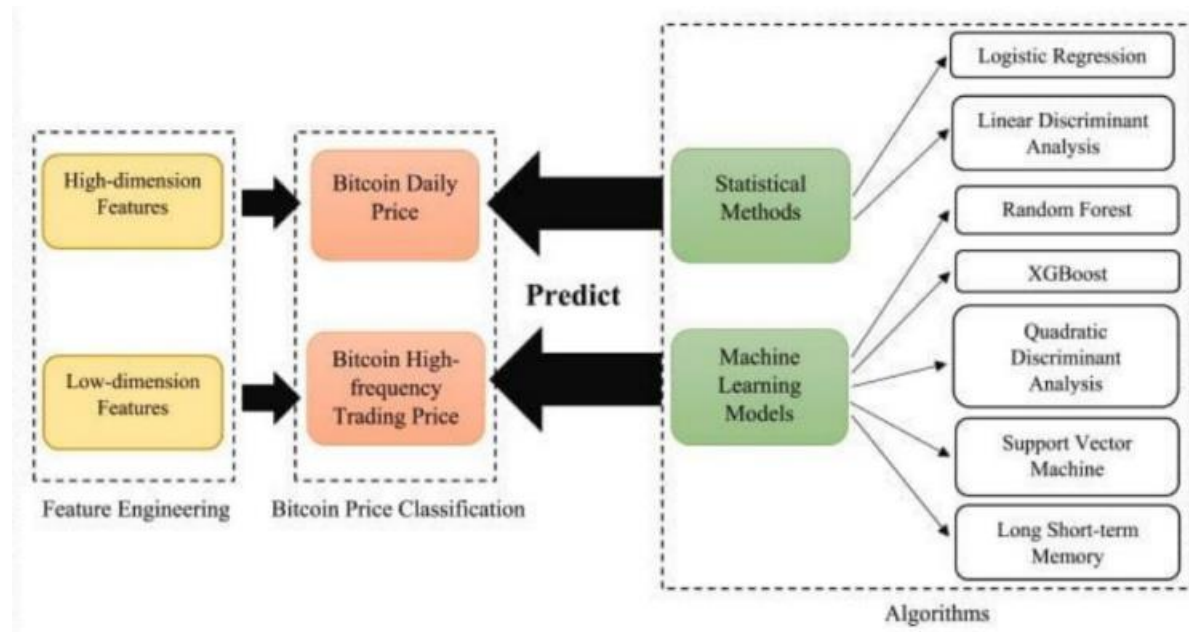
Architecture:

The architecture of the proposed system has the following components:

1. dataset which consists of the bitcoin price that have been found from last 10 years
2. Training data to train the models
3. Testing data to apply the models.
4. Data storage-stores data.
5. Classification and prediction algorithms.
6. Forecast engine.



Working model:



Algorithm or tools used:

- RNN- Recurrent Neural Network
- LSTM-Long Short-Term Memory
- MLP- Multi-Layer Perceptron
- GPU- Graphics Processing Unit
- CPU-Central Processing Unit
- XGB-Extreme Gradient Boosting

Implementation:

The project is implemented in the following modules:-

1)Import python libraries

2)Data set

3)Processing of data

4)Training and Testing

5)Building Model

6)Prediction

1)Import python libraries-

```
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
import seaborn; seaborn.set()
from sklearn.metrics import mean_squared_error
# Input data files are available in the "../input/" directory.
# For example, running this (by clicking run or pressing Shift+Enter) will list the files in the input directory

# Any results you write to the current directory are saved as output.
import matplotlib.pyplot as plt
%matplotlib inline
from matplotlib.pyplot import rcParams
rcParams['figure.figsize'] = 15,6
from statsmodels.tsa.stattools import adfuller
from statsmodels.tsa.seasonal import seasonal_decompose
from statsmodels.tsa.stattools import acf, pacf
from statsmodels.tsa.arima_model import ARIMA

/usr/local/lib/python3.7/dist-packages/statsmodels/tools/_testing.py:19: FutureWarning: pandas.util.testing is deprecated. Use the functions in the public API instead.
import pandas.util.testing as tm
```

2)Data set-

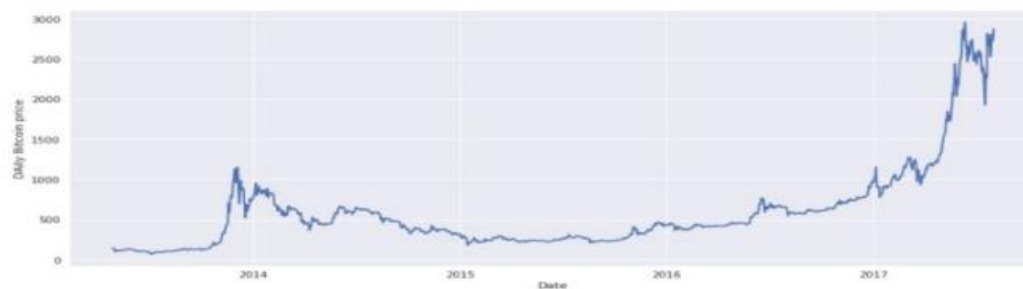
```
data = data.sort_index()
data.head()
```

	Open	High	Low	Close	Volume	Market Cap
Date						
2013-04-28	135.30	135.98	132.10	134.21	-	1,500,520,000
2013-04-29	134.44	147.49	134.00	144.54	-	1,491,160,000
2013-04-30	144.00	146.93	134.05	139.00	-	1,597,780,000
2013-05-01	139.00	139.89	107.72	116.99	-	1,542,820,000
2013-05-02	116.38	125.60	92.28	105.21	-	1,292,190,000

3)Data representation-

```
data['Close'].plot()
plt.ylabel("DAily Bitcoin price")
```

<matplotlib.text.Text at 0x7f70570fa748>



4)Data pre-processing-

```
bitcoindf['date'] = pd.to_datetime(bitcoindf.date)
bitcoindf.head().style.set_properties(subset=['date', 'close'], **{'background-color': 'skyblue'})
```

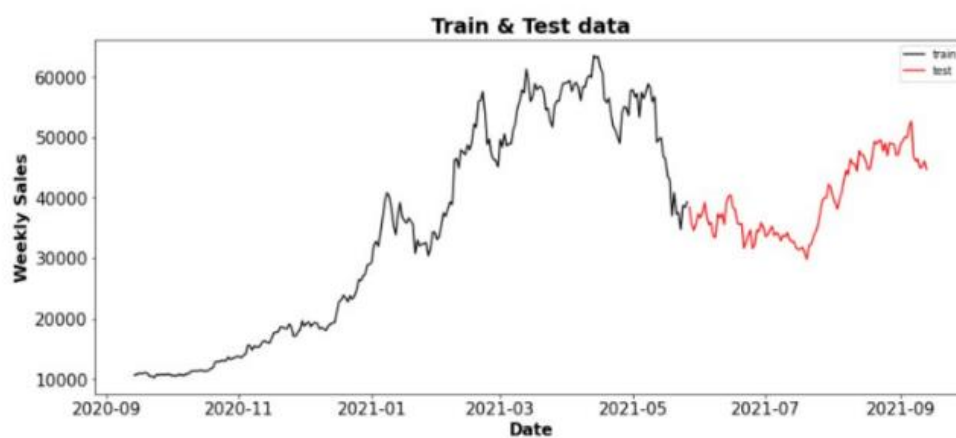
	date	open	high	low	close	adj_close
0	2015-09-13 00:00:00	235.242004	235.934998	229.332001	230.511993	230.511993
1	2015-09-14 00:00:00	230.608994	232.440002	227.960999	230.643997	230.643997
2	2015-09-15 00:00:00	230.492004	259.182007	229.822006	230.304001	230.304001
3	2015-09-16 00:00:00	230.250000	231.214996	227.401993	229.091003	229.091003

5)Training and Testing-

```
training_size=int(len(closedf)*0.70)
test_size=len(closedf)-training_size
train_data,test_data=closedf[0:training_size,:],closedf[training_size:len(closedf),:]
print("train_data: ", train_data.shape)
print("test_data: ", test_data.shape)
```

train_data: (255, 1)

test_data: (110, 1)



6)Building model-

Import XGBRegression module and fit X_train and y_train for training model

```
from xgboost import XGBRegressor
my_model = XGBRegressor(n_estimators=1000)
my_model.fit(X_train, y_train, verbose=False)
```

```
XGBRegressor(base_score=0.5, booster='gbtree', colsample_b
ylevel=1,
             colsample_bynode=1, colsample_bytree=1, gamma
=0, gpu_id=-1,
             importance_type='gain', interaction_constrain
ts='',
             learning_rate=0.300000012, max_delta_step=0,
max_depth=6,
             min_child_weight=1, missing=nan, monotone_con
straints='')
```

7)Prediction-

```
predictions = my_model.predict(X_test)
print("Mean Absolute Error - MAE : " + str(mean_absolute_erro
r(y_test, predictions)))
print("Root Mean squared Error - RMSE : " + str(math.sqrt(mea
n_squared_error(y_test, predictions))))
```

```
train_predict=my_model.predict(X_train)
test_predict=my_model.predict(X_test)
```

Mean Absolute Error - MAE : 0.02658387822445798

Root Mean squared Error - RMSE : 0.03641535799501778

Conclusion:

In conclusion, my internship experience working on a Bitcoin price prediction app project has been highly rewarding and educational. Throughout the project, I had the opportunity to contribute to the development of an innovative app aimed at providing users with valuable insights and predictions to navigate the volatile cryptocurrency market. During my time as an intern, I actively participated in various stages of the project, including data collection, pre-processing, model development, and app design. I gained valuable knowledge and hands-on experience in the field of cryptocurrency analysis and prediction. One of the key challenges I faced during the project was ensuring the availability and reliability of data. I employed rigorous data collection methods and utilized a diverse range of data sources, including real-time market data, historical price records, and sentiment analysis. By carefully selecting and pre-processing the data, I aimed to enhance the accuracy and reliability of our prediction models. In conclusion, my internship experience working on the Bitcoin price prediction app has been a valuable stepping stone in my professional journey, equipping me with practical skills and insights that will undoubtedly contribute to my future endeavours in the field of data analysis and financial technology.

