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A Novel Approach for Analyze and Prediction of Bitcoin Price using Machine Learning

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Abstract: *Bitcoin is a type of Internet currency that is both a digital asset and a payment method. It enables for anonymous payment from one person to another, making it a popular payment mechanism for online illegal activity. Due to its recent price increase, Bitcoin has gotten a lot of attention from the media and the general public. The goal of this research is to discover the Bitcoin price's predictable price direction. Machine learning models are likely to provide us with the information we require to understand the future of cryptocurrency. It won't tell us what will happen in the future, but it might show us the overall trend and direction in which prices are likely to move. The proposed methodology aims to create a machine learning model that uses data to learn about the patterns in the dataset and then uses a machine learning algorithm to forecast the bitcoin price.*

Keywords: Cryptocurrency, Bitcoin, internet currency, Machine learning, Supervised learning, Prediction, Natural language processing**.**

I. INTRODUCTION

1.1 Data Science

Data science is an interdisciplinary field that use scientific methods, procedures, algorithms, and systems to extract knowledge and insights from structured and unstructured data, as well as to apply that knowledge and actionable insights to a variety of application areas. The term "data science" dates back to 1974, when Peter Naur proposed it as a replacement for the term "computer science. "The International Federation of Classification Societies was the first conference to address data science expressly in 1996. The definition, on the other hand, was still in motion. D.J. Patil and Jeff Hammerbacher, the pioneer leads of data and analytics operations at LinkedIn and Facebook, created the term "data science" in 2008. It has become one of the trendiest and most popular occupations in the industry in less than a decade.
Data science is a discipline that combines domain knowledge, computer skills, and math and statistics knowledge to extract useful insights from data. Data science is a combination of mathematics, business acumen, tools, algorithms, and machine learning approaches that aid in the discovery of hidden insights or patterns in raw data that can be used in the formulation of key business decisions.

1.2 Artificial Intelligence

Artificial intelligence (AI) is the simulation of human intelligence in robots that have been trained to think and act like humans. phrase can also refer to any machine that demonstrates human-like characteristics like learning and problem-solving. Artificial intelligence (AI) refers to intelligence demonstrated by machines rather than natural intelligence expressed by humans or animals. Leading AI textbooks define the topic as the study of "intelligent agents," which are any systems that sense their surroundings and take actions to maximise their chances of attaining their objectives. However, prominent AI researchers reject this definition, which uses the term "artificial intelligence" to denote robots that simulate "cognitive" functions that humans connect with the human mind, such as "learning" and "problem solving". The simulation of human intelligence processes by machines, particularly computer systems, is known as artificial intelligence. Expert systems, natural language processing, speech recognition, and machine vision are examples of AI applications. Since its inception as an academic study in 1956, artificial intelligence has gone through multiple waves of optimism, disappointment, and funding cuts (known as a "AI winter"), followed by new approaches, success, and renewed investment. Throughout its history, AI research has explored and rejected a variety of methodologies, including

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mimicking the brain, modelling human problem solving, formal logic, massive knowledge libraries, and imitating animal behaviour. Highly mathematical statistical machine learning dominated the subject in the first decades of the twenty-first century, and this technique has proven highly successful, helping to tackle many tough problems in industry and academics. The many sub-fields of AI research are based on specific aims and the application of certain techniques. Reasoning, knowledge representation, planning, learning, natural language processing, sensing, and the ability to move and manipulate objects are all conventional AI research goals. One of the field's long-term goals is general intelligence (the capacity to solve any problem). AI researchers use search and mathematical optimization, formal logic, artificial neural networks, and methods based on statistics, probability, and economics to solve these difficulties. Computer science, psychology, linguistics, philosophy, and a variety of other disciplines are all used in AI.

Human intelligence "can be so clearly described that a machine can be constructed to imitate it," according to the field's founders. This sparks philosophical debates about the mind and the ethics of building artificial intelligence that is human-like. Since antiquity, myth, fiction, and philosophy have all attempted to address these challenges. AI, with its vast potential and power, has also been suggested as an existential threat to humans in science fiction and futurology. Vendors have been scrambling to showcase how their products and services integrate AI as the hoopla around AI has grown. What they call AI is frequently just one component of AI, such as machine learning. For designing and training machine learning algorithms, AI requires a foundation of specialised hardware and software. Although no single computer language is synonymous with AI, a handful stand out, including Python, R, and Java. Learning, reasoning, and self-correction are the three cognitive functions that AI programming focuses on.

Processes of Learning

This element of AI programming is concerned with gathering data and formulating rules for turning it into useful information.

Algorithms are rules that give computing equipment with step-by-step instructions for completing a certain task.

Processes of Reasoning

This element of AI programming is concerned with selecting the best algorithm to achieve a given result.

Processes of Self-Correction

This element of AI programming aims to fine-tune algorithms on a regular basis to guarantee that they produce the most accurate results feasible.

AI is significant because it may provide businesses with previously unavailable insights into their operations and because, in some situations, AI can execute tasks better than humans. AI systems generally accomplish operations quickly and with minimal errors, especially when it comes to repetitive, detail-oriented activities like evaluating vast quantities of legal papers to verify key fields are filled in correctly. Artificial neural networks and deep learning artificial intelligence are rapidly evolving, owing to AI's ability to analyse enormous volumes of data considerably faster and generate more accurate predictions than humans.

Data Scientist

Data scientists look into which questions need to be answered and where the relevant data may be found. They have analytical and business acumen, as well as the ability to extract, clean, and display data. Data scientists help businesses find, analyse, and evaluate massive amounts of unstructured data.

- Programming: Python, SQL, Scala, Java, R, and MATLAB are all required skills for a Data Scientist.
- Natural Language Processing, Classification, and Clustering are examples of machine learning applications.
- Tableau, SAS, D3.js, Python, Java, and R libraries for data visualisation.
- Platforms for big data: MongoDB, Oracle, Microsoft Azure, Cloudera

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1.3 Natural Language Processing

Machines can read and interpret human language thanks to natural language processing (NLP). Natural-language user interfaces and the acquisition of knowledge directly from human-written sources, such as newswire texts, might be possible with a sufficiently capable natural language processing system. Information retrieval, text mining, question answering, and machine translation are some simple uses of natural language processing. To generate syntactic representations of text, many contemporary techniques use word co-occurrence frequencies. "Keyword spotting" search algorithms are popular and scalable, but they're also stupid; a search query for "dog" might only return pages that contain the literal word "dog" and ignore papers that contain the term "poodle. "Lexical affinity techniques measure the emotion of a document by looking for words like "accident". Modern statistical NLP techniques can integrate all of these strategies, as well as others, and attain acceptable accuracy at the page or paragraph level in many cases. Beyond semantic NLP, "narrative" NLP's ultimate goal is to encapsulate a complete grasp of common-sense thinking. By 2019, deep learning systems based on transformers may be able to generate coherent text.

1.4 Machine Learning

Machine learning is the process of predicting the future based on historical data. Machine learning (ML) is an artificial intelligence (AI) technique that allows computers to learn without having to be explicitly programmed. Machine learning is concerned with the creation of computer programmes that can adapt to new data, as well as the fundamentals of machine learning, such as the construction of a simple machine learning algorithm in Python. Specialized algorithms are used in the training and prediction process. It feeds the training data to an algorithm, which then applies the training data to new test data to make predictions. Machine learning can be divided into three distinct areas. There are three types of learning: supervised, unsupervised, and reinforced. A supervised learning algorithm is given both the input data and the accompanying label to learn data, which must first be labelled by a person. There are no labels in unsupervised learning. It was made available to the learning algorithm. This method must determine how the input data is clustered. Finally, reinforcement learning interacts with its environment in a dynamic manner and receives positive or negative feedback in order to enhance its performance. To uncover patterns in Python that lead to meaningful insights, data scientists utilise a variety of machine learning methods. These algorithms can be divided into two classes based on how they "learn" about data in order to generate predictions: supervised and unsupervised learning. The technique of predicting the class of given data points is known as classification. Targets, labels, and categories are all terms used to describe classes. The task of estimating a mapping function from input variables (X) to discrete output variables is known as classification predictive modelling (y). Classification is a supervised learning strategy in machine learning and statistics in which a computer programme learns from the data input supplied to it and then applies that learning to classify fresh observations.

Fig.1 Process of Machine Learning

Supervised Machine Learning

Supervised Machine Learning is used in the vast majority of actual machine learning applications. When you have input variables (X) and output variables (y), you can use an algorithm to learn the mapping function from the input to the output, which is y = f. (X). The goal is to estimate the mapping function to the point that you can forecast the output variables (y) for new input data (X). Logistic regression, multi-class classification, Decision Trees, and support vector machines are examples of supervised machine learning techniques. The data used to train the algorithm must already be labelled with correct answers in order for supervised learning to work. Classification problems are a subset of supervised learning problems. The purpose of this task is to create a simple model that can predict the value of the reliant attribute using only the attribute variables. The only difference between the two tasks is that the dependent characteristic in categorical classification is numerical. A classification model tries to deduce something from seen data. A classification model will attempt to predict the value of one or more outputs given one or more inputs. When the output variable is a category, such as "red" or "blue," the problem is called a classification problem.

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1.5 Preparing the Dataset

This dataset was created in order to build models for the bitcoin price prediction. It contains

- The price of bit coin [USD]
- The total number of bit coin confirmed transactions per day
- Average transaction fees in USD per bit coin transaction [USD]
- Google bit coin trends search
- Gold ounce price [USD]
- Oil WTI price [USD]
- M2 money supply in the USA
- SP500 close index
- The time period is between 12.2014 - 04.2020

II. LITERATURE REVIEW

A literature review is a piece of writing that seeks to describe the most important aspects of current knowledge and/or methodological approaches to a specific issue. It is a secondary source that discusses published material in a specific subject area, as well as information in a specific subject area during a certain time period. Its ultimate objective is to keep the reader up to speed on current literature on a topic, and it serves as the foundation for other goals, such as future research that may be required in the field. It comes before a research proposal and may just be a list of sources. It usually follows a pattern and incorporates both summary and synthesis. A summary is a re-organization and reshuffling of information, but a synthesis is a re-organization and reshuffling of information. It could offer a fresh perspective on old material, or blend new and old perspectives, or it could chart the field's intellectual evolution, including significant controversies. The literature review may evaluate the sources and advise the reader on the most topical or relevant ones, depending on the situation. Investors, researchers, authorities, and the media have all been paying close attention to Bitcoin. Bit coin's price varies dramatically, which is a well-known and peculiar attribute that has gotten less attention. We explore the Bitcoin price fluctuation prediction problem in this work, which may be defined as determining whether Bitcoin price stays the same or reverses after a major volatility. We use an Attentive LSTM network and an Embedding Network to test these features (ALEN). An attentive LSTM network, in particular, can capture the Bitcoin price's temporal dependence representation, while an embedding network can catch the hidden representations from related crypto currencies. The results show that ALEN outperforms all other baselines in terms of state-of-the-art performance. We also look into the effect of parameters on the Bitcoin price fluctuation prediction problem, which investors might employ in a real-world trading scenario [1]. In this work, basic features, classic technical trading indicators, and features created by a Demising auto encoder are offered as options for price fluctuation prediction. We proposed that we could accurately predict the Bitcoin price by taking into account a variety of factors that influence its value. I discovered the benefits and drawbacks of bit coin price prediction by gathering information from various reference papers and applying it in real time. Each publication has its own set of methodology for predicting bit coin prices. Many articles have correct prices, while others do not; nonetheless, the time complexity of those forecasts is higher; therefore, to lower the time complexity in this study, we apply the LASSO (least absolute shrinkage selection operator) approach, which is linked to artificial intelligence. SVM (support vector machine), coinmarkupcap, Quandl, GLM, CNN (Convolutional Neural Networks), and RNN (Recurrent neural networks) were applied in the other publications. which do not have great time management, but in LASSO finding results from a larger database is quick and fast...so for this purpose we draw a comparison between other algorithms and the LASSO algorithm...so for this purpose we draw a comparison between other algorithms and the LASSO algorithm...so for this purpose we draw a comparison between other algorithms and the LASSO algorithm...so for this purpose we draw a comparison between other algorithms and the LASSO algorithm...so for this purpose we draw. We aim to understand and find daily trends in the Bitcoin market while gaining insight into optimal features surrounding Bitcoin price in the paper, which is the first moment of the research.

III. PROPOSED SYSTEM

Because of its recent price increase, Bitcoin has gotten a lot of attention from the media and the general public. The goal of this research is to discover the Bitcoin price's predictable price direction. The entire dataset will be analysed using the

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supervised machine learning technique (SMLT) to capture several pieces of information such as variable identification, uni-variates analysis, bi-variates and multi-variates analysis, missing value treatments, and data validation, data cleaning/preparing, and data visualisation. Our research offers a detailed guide to model parameter sensitivity analysis in terms of prediction performance. Propose a machine learning-based approach, as well as compare and contrast the performance of several machine learning algorithms for the provided dataset.

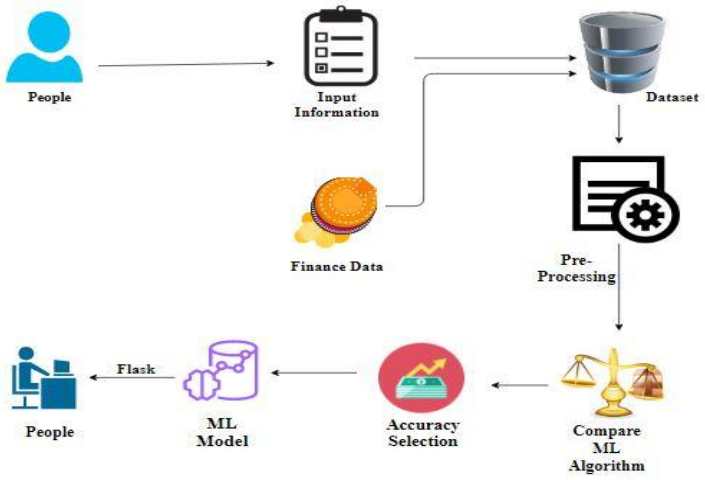

Figure 2: System Architecture of Proposed model

Use Case Diagram of the Proposed System:

Use case diagrams are used to analyse a system's high-level requirements. As a result, when a system's requirements are analysed, the functionality are captured in use cases. As a result, use cases are nothing more than the system's features laid out in a logical order.

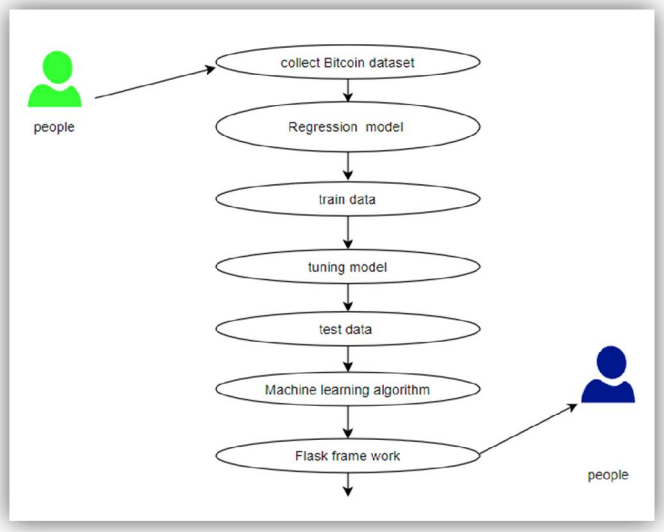

Figure 3: Use case diagram

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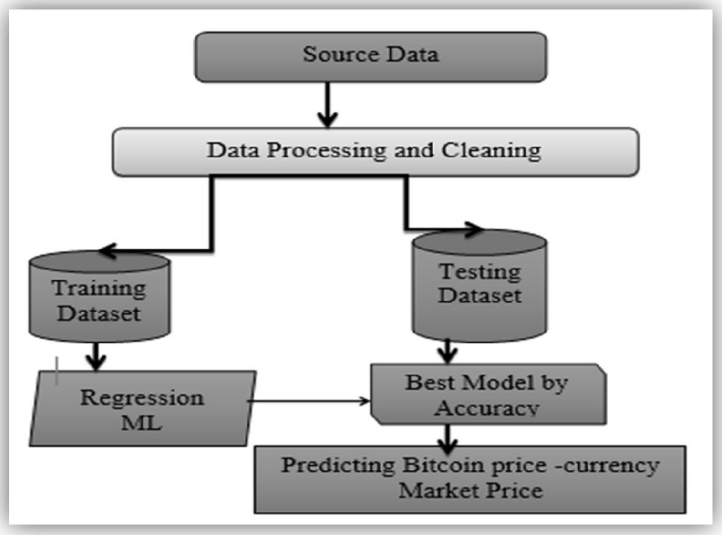

Figure 4: Dataflow diagram for proposed method

IV. MODULE DESCRIPTION

4.1 Data Pre-Processing

Machine learning validation approaches are used to calculate the error rate of the Machine Learning (ML) model, which is as close to the genuine error rate of the dataset as possible. Validation approaches may not be required if the data volume is large enough to be representative of the population. However, in real-world circumstances, it is necessary to work with data samples that are not always representative of the population of a dataset. Duplicate the value and the data type description to identify the missing value, whether it is a float variable or an integer variable. While tuning model hyper parameters, a sample of data is employed to offer an unbiased evaluation of a model fit on the training dataset. As competence on the validation dataset is incorporated into the model setup, the evaluation becomes increasingly biased. The validation set is used to test a model, although it is only used on a regular basis. This data is used by machine learning specialists to fine-tune the model hyper parameters. Data collection, analysis, and the process of addressing data content, quality, and organisation can be time-consuming. Understanding your data and its properties is helpful during the data identification phase; this knowledge will assist you choose which algorithm to employ to build your model. A variety of data cleaning jobs utilising Python's Pandas module, with a focus on the most common data cleaning work, missing values, and the ability to clean data more quickly. It prefers to spend less time cleaning data and more time analysing and modelling it. Some of these sources are simply unintentional errors. Other times, there may be a more serious reason for the lack of data. From a statistical standpoint, it's critical to comprehend the various sorts of missing data. The type of missing data will determine how missing values are filled in, how missing values are detected, and how simple imputation and detailed statistical approaches are used to deal with missing data.

It's crucial to understand the sources of missing data before putting it into code. Here are some common explanations for missing data:

- A field was left blank by the user.
- Data was lost during a manual transfer from a legacy database.
- A programming error occurred.
- Users declined to fill out a field related to how the results would be utilised or interpreted based on their opinions.

Variable identification with Uni-variates, Bi-variates and Multi-variates analysis:

- Import libraries for access and functionality, and read the given dataset.
- General Properties of Analysing the Given Dataset.
- Display the Given Dataset as a Data Frame.

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- Display Columns
- The data frame's shape
- To describe the data frame
- Verifying the dataset's data type and metadata
- Checking for data duplication
- Validating Data Frame Missing Values
- Checking the data frame's unique values.
- Checking the data frame's count values.
- Rename and delete the data frame you've been given.
- To indicate the value type.
- To add additional columns.

Data Validation/ Cleaning/Preparing Process

Importing library packages and loading the specified dataset. Identifying variables based on data shape, data type, and evaluating missing values and duplicate values. A validation dataset is a sample of data saved from training your model that is used to measure model skill while tweaking models and techniques for making the greatest use of validation and test datasets while evaluating your models. To analyse the uni-variates, bi-variates, and multi-variates processes, data cleaning / preparation includes renaming the given dataset and dropping columns, among other things.

The methods and techniques for cleaning data will differ depending on the dataset.

	Date	BTC price [USD]	n-transactions	fee [USD]	btc search trends	Gold price[USD]	SP500 close index	Oil WTI price[USD]	M2(Not seasonally adjusted)[1e+09 USD]
0	2014-01-02	749.27	54770.0	0.18	8	1225.0	1831.98	95.14	11089.3
1	2014-01-03	781.23	60980.0	NaN	8	1238.4	1831.37	93.66	11089.3
2	2014-01-04	807.39	52052.0	NaN	8	NaN	NaN	NaN	11089.3
3	2014-01-05	828.74	58662.0	0.38	8	NaN	NaN	NaN	11089.3
4	2014-01-06	904.98	67358.0	NaN	8	1237.8	1826.77	93.12	11089.3

Fig.4 dataset

	BTC_price_USD	n_transactions	fee_USD	btc_search_trends	Gold_price_USD	SP500_close_index	Oil_WTI_price_USI
count	1002.000000	1002.000000	1002.000000	1002.000000	1002.000000	1002.000000	1002.00000
mean	5352.851926	254421.630739	2.230409	15.163673	1369.540319	2584.999880	57.67094
std	3892.224190	88589.954049	5.568724	15.852566	114.562397	383.177031	15.85266
min	172.000000	54142.000000	0.030000	2.000000	1097.700000	1755.200000	-36.98000
25%	884.052500	207520.500000	0.230000	6.000000	1293.550000	2265.067500	49.54500
50%	5895.335000	267637.500000	0.700000	13.000000	1345.650000	2672.275000	56.28500
75%	8171.610000	322157.500000	1.767500	17.750000	1420.275000	2864.117500	63.95000
max	18911.790000	490644.000000	54.790000	100.000000	1768.900000	3386.150000	107.95000

Fig.5 Dataset

Module Diagram

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4.2 Exploration Data Analysis of Visualization

In applied statistics and machine learning, data visualisation is a crucial skill. Statistics is concerned with quantitative data descriptions and estimations. Data visualisation is a valuable set of tools for acquiring a qualitative understanding of data. This might be useful for spotting patterns, faulty data, outliers, and other things when exploring and getting to know a dataset. Data visualisations can be used to express and demonstrate crucial relationships in plots and charts that are more visceral and meaningful to stakeholders than measurements of association or significance with a little subject knowledge.

Data visualisation and exploratory data analysis are fields in and of themselves, and it will be recommended that you read some of the books indicated at the end for further information.

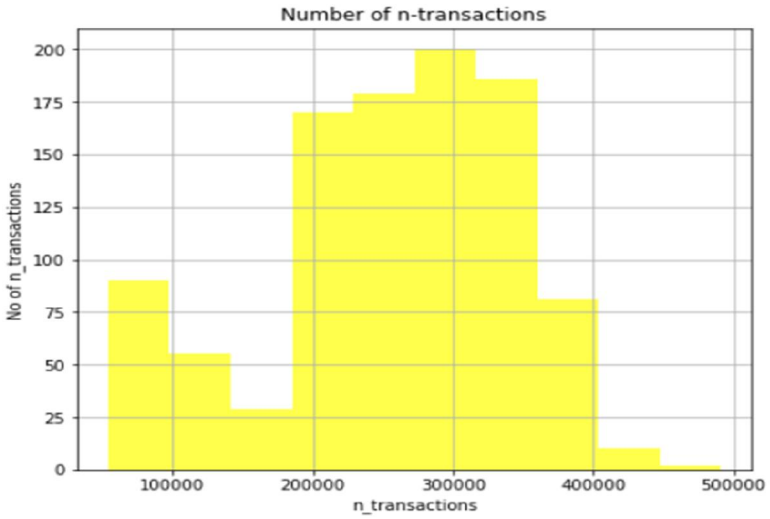

Fig.6 N_Transactions

Data may not make sense until it is presented in a visual format, such as charts and graphs. The ability to visualise data samples and other objects quickly is a crucial talent in both applied statistics and applied machine learning. It will show you how to use the many sorts of plots available when visualising data in Python to better understand your own data.

- How to use line plots to visualise time series data and bar charts to visualise categorical data.
- How to use histograms and box plots to summarize data distributions.

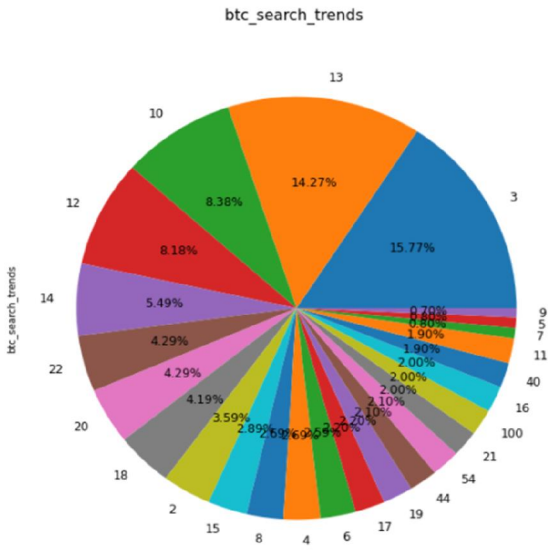

Fig .7 btc_search_trends

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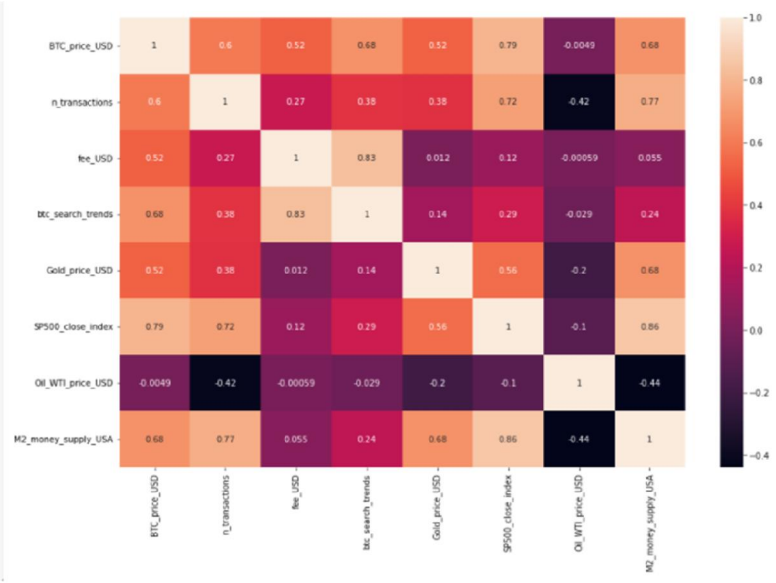

Fig.8 Accuracy details

Module Diagram:

Data Visualization

V. RESULT AND DISCUSSION

It's critical to evaluate the performance of numerous different machine learning algorithms consistently, and sickest-learn will show you how to make a test harness to compare multiple distinct machine learning algorithms in Python. This test harness can be used as a framework for your own machine learning tasks, with additional and different algorithms to compare. The performance characteristics of each model will vary. You may gain an idea of how reliable each model is on unseen data using resampling approaches like cross validation.

It must be able to utilise these estimations to select one or two of the best models from the set you've built. When you have a fresh dataset, it's a good idea to visualise it using a variety of ways so you can see it from multiple angles. Model selection follows the same logic. To choose the one or two to complete, you should look at the estimated accuracy of your machine learning algorithms in a variety of methods. Using various visualisation approaches to display the average accuracy, variance, and other features of the distribution of model accuracies is one way to accomplish this.

In the following part, you'll learn how to do it in Python using scikit-learn.

The key to a fair comparison of machine learning algorithms is to ensure that each method is evaluated in the same way on the same data, which can be accomplished by requiring each algorithm to be evaluated on the same test harness.

Below 6 different algorithms are compared:

- Logistic Regression
- Linear Regression
- Decision Tree Regression
- Random Forest Regression
- Support Vector Regression
- Lasso Regression

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Each algorithm is tested using the K-fold cross validation technique, which is programmed with the same random seed to ensure that the identical splits to the training data are performed and that each algorithm is evaluated in the same way. Before that, there was a comparison algorithm. Using the Scikit-Learn packages, create a machine learning model. Pre-processing, linear model with logistic regression method, cross validation with K Fold method, ensemble with random forest method, and tree with decision tree classifier are all included in this library package. Additionally, the train and test sets should be separated. By comparing accuracy, it is possible to forecast the outcome.

VI. CONCLUSION

Data cleaning and processing, missing value analysis, exploratory analysis, and model creation and evaluation all were part of the analytical process. the best accuracy on a public test set will be discovered, as will the highest accuracy score. this programme can assist you in determining the current bitcoin market price.

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