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PREDICTING BITCOIN PRICING TRENDS
USING TIME SERIES FORECASTING
TECHNIQUES.



Agenda

Introduction

Aim & Objective

Literature Review

Methodology

Results & Discussion

Conclusion & Recommendation

Introduction



Background

- Bitcoin is a cryptocurrency launched in Jan – 2009.
- Volatility and complexity of the cryptocurrency.
- Time series models to predict bitcoin prices.
- Study can help investors to make strategic decisions.

Problem Statement

- Research papers related to the thesis report.
- Authors about ARIMA model.
- Authors about LSTM model.
- Comparative study on ARIMA and LSTM model.
- Some challenges which are faced by this domain.

Aim & Objectives

- Bitcoin price prediction.
- Building time series models.
- Evaluation and comparison of models.

Introduction



Significance of Study

- Investors can make their investment strategies.
- Financial institutes can regulate their policies.
- It also contributes to the growth of the cryptocurrency world.

Scope of Study

- Prediction based on historical data.
- Model can capture trends, patterns, and seasonability.
- Do not cover unpredicted events and unexpected market shifts.
- Do not cover sentiment analysis.

Aim & Objectives



Aim

- The main aim of this research is to predict Bitcoin prices by using time series forecasting techniques. The goal of this research is to obtain a machine-learning algorithm model with high prediction accuracy that helps investors invest money in cryptocurrency or stocks.

Objectives

- To analyze the hidden patterns.
- To determine the optimum pre-processing technique.
- To propose LSTM and ARIMA models.
- To evaluate and compare the performance of both models.

Literature Review



Introduction to Bitcoin

- According to author Alazzam Bitcoin is classified as a form of digital currency that functions within a decentralized network known as blockchain.
- Author Centobelli says that The price of Bitcoin exhibits a notable degree of volatility, characterized by substantial variations that transpire within brief time intervals.

LSTM Better than Others

- Study shows that LSTM integrates sentiment analysis with deep learning which achieves superior performance compared to alternative algorithms.
- Mr. R. Arunachalam employed LSTM within a Recurrent Neural Network to forecast Bitcoin prices, and they found that it performed better than other forecasting techniques consistently.

ARIMA Better than Others

- Some research indicates that ARIMA surpasses LSTM in predicting Bitcoin prices by reaching a reduced Mean Absolute Percentage Error (MAPE) value of less than 10 percent.
- The study found that ARIMA performs better than LSTM when data is simple, linear, and small.

Literature Review



Limitations of ARIMA

- Research indicates that ARIMA models exhibit sensitivity towards outliers. The presence of extreme values within a time series can have a disproportionate impact on the estimate of parameters, resulting in less accurate models.
- Study shows that ARIMA model performance may diminish when employed for long-term forecasting, particularly in instances when the fundamental dynamics of the data undergo alterations.

Limitation of LSTM

- Authors found that the provision of higher batch sizes during minor epochs results in a decrease in the accuracy of predictions.
- Some study shows that the performance of LSTM models can be influenced by the selection of hyperparameters, including the activation function, learning rate, and dropout values.

Review on Hybrid Model

- Research findings indicate that the integration of LSTM and ARIMA hybrid models has demonstrated superior performance compared to each model in the prediction of Bitcoin price.
- Because of the model combination it provides an accurate representation of both long-term relationships and short-term variations in the Bitcoin price data.

Methodology



Dataset

- Bitcoin dataset which is publicly available on the Kaggle website.
- There are a total of 2747 data points available. from 2014 to 2022.
- Out of seven columns I used Adjusted Closing value for prediction.

Data Preparation

- If there is any missing value or Nan value then I impute it with the imputation method.
- For data duplicates or outliers I just remove such data points.

Data Pre-Processing

- Normalize the data into 0 & 1 by using MinMaxScaler from Sklearn.
- I divided data into train and test data sets.

Methodology



ARIMA Model

- ARIMA is AutoRegressive Integrated Moving Average model that uses p , d , & q as a hyperparameter.
- I chose the ARIMA model because of its Flexibility, Simple Interpretability, Effective handling of trends and seasonability, forecasting accuracy, and availability of software.

LSTM Model

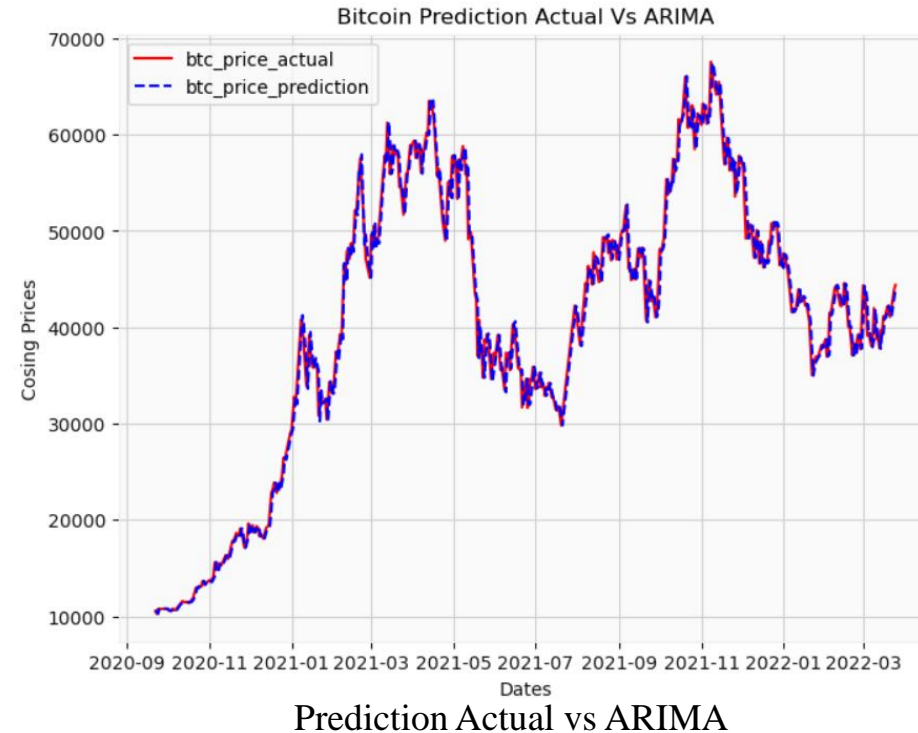
- LSTM is a recurrent neural network in which I used Dense Dropout hyperparameters.
- I chose the LSTM Model for Bitcoin prediction because it captures long-term dependencies, learns hidden patterns efficiently, does parallel processing, adapts different time lags, and handles irregularity of sample effectively.

Evaluation Metrics

- Mean Absolute Error
- Mean Squared Error
- Mean Absolute Percentage Error
- Root Mean Squared Error
- R^2 – Score.



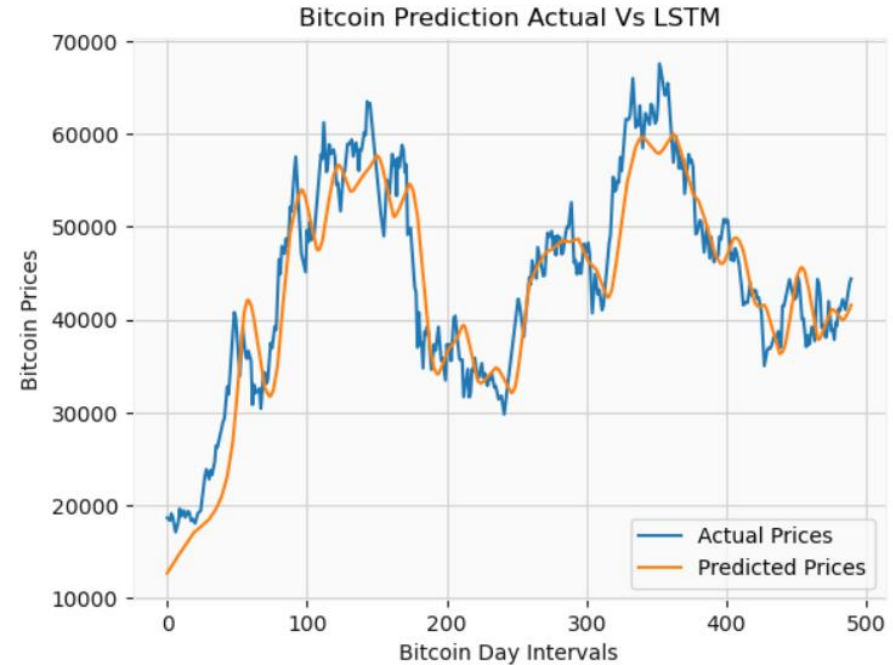
Results & Discussion



- The actual and predicted prices follow a similar trajectory.
- Exactly the same trend is shown by the predicted bitcoin price line.



Results & Discussion



Prediction Actual vs LSTM

- The actual and predicted prices follow a similar trend but are not as accurate as ARIMA prediction.
- Prediction shifts up and down from actual Bitcoin prices.



Results & Discussion

Comparative Analysis of ARIMA & LSTM

Evaluation Metrics	ARIMA Result	LSTM Result
Mean Absolute Error	1178.50	3530.32
Mean Absolute Percentage Error	0.03	0.08
Mean Squared Error	2830220	19538224
Root Mean Squared Error	1682.32	4420.20
R2 Score	0.98	0.85

- The above table explains that ARIMA achieves a significantly lower MAE (1178.50) compared to LSTM (3530.32).
- ARIMA has a much lower MAPE (0.03) than LSTM (0.08).
- ARIMA's MSE (2830220) is substantially smaller than LSTM's (19538224).
- ARIMA's RMSE (1682.32) is significantly lower than LSTM's (4420.20).



Conclusion

- The ARIMA model Achieves better accuracy and precision across all evaluation metrics.
- Therefore, for accurate and precise Bitcoin price predictions, ARIMA is the preferred choice.



Recommendation

- It is recommended to build a hybrid LTMS model with sentiment analysis which could use authentic posts for sentiment analysis.
- It is recommended to implement real-time prediction frameworks to enable timely decision-making for traders and investors.
- And also recommended a hybrid model of ARIMA & LSTM so the model can capture both short-term and long-term aspects and linear & non-linearity.



Thank you



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