BSc Computer Science

Module Title

Machine Learning

Assessment Title

Project Proposal

Assessment Weighting

10% of the total module mark

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The Problem

Accurately predicting the future price movements of Bitcoin remains a significant challenge. While the cryptocurrency market offers substantial potential returns, its inherent volatility makes informed investment decisions difficult. This project seeks to investigate the consistency of Bitcoin price trends and leverage the potential of machine learning algorithms for short-term price nature prediction over a set time frame. The effectiveness of Machine Learning algorithms in capturing short-term trends within the inherently volatile Bitcoin market. The limitations of AI-based prediction in such a dynamic and unpredictable environment. (Chen et al., 2019)

Context and background

Bitcoin's price history exhibits periods of significant upward and downward trends. However, unlike traditional financial markets, Bitcoin experiences high volatility. The market remains largely unconstrained compared to established financial systems due to limited regulations, public perception, and media coverage. Technological advancements and Innovations in the blockchain space can impact investor confidence. There is a need to find a method that can accurately use machine learning algorithms to predict Bitcoin price. As Bitcoin lacks seasonality, machine learning models are applicable and useful.

The dataset

We will be using Yahoo Finance as our main dataset for finding information on bitcoin trends as it is a public resource that is consistently updated with real data. This project will utilize historical Bitcoin price data: sources like cryptocurrency exchanges and market data aggregators provide extensive historical records. The chosen dataset will encompass factors beyond just price, including trading volume, reflecting market activity which can indicate potential price shifts. Analysing the tone of social media conversations surrounding Bitcoin can offer insights into investor confidence. Extracting sentiment from news articles related to Bitcoin can also provide additional clues about market sentiment.

Methodology

Machine Learning Algorithms:

This project will explore the application of Long Short-Term Memory (LSTM) networks. LSTMs are a type of recurrent neural network (RNN) adept at handling time series data, so it is perfect for possible future predictions like bitcoin or other stock type analysis. Additionally, Support Vector Machines (SVMs) could be included for classification tasks, potentially predicting the direction of the short-term trend.

Existing Implementations:

Open-source libraries like Tensor Flow and PyTorch offer pre-built LSTM functionalities. These libraries will be utilized as a foundation, with potential modifications for data pre-processing: techniques like normalization and scaling will be applied to ensure the data is suitable for machine learning algorithms. Hyper parameter tuning: Adjusting internal algorithm parameters to optimize performance for Bitcoin price prediction.

Evaluation

Qualitative Analysis:

We'll check the AI's prediction skills with graphs showing predicted vs. actual price movements. This reveals if the model captures the general trends. Additionally, we'll split data into training and testing sets. Trained on unseen data, the model predicts prices. Comparing these predictions with actual values tests the model's ability to handle new information.

Quantitative Analysis:

Performance metrics like Mean Squared Error (MSE) and Mean Absolute Error (MAE) will be employed to assess the accuracy of price predictions. Additionally, the Sharpe Ratio can be used to evaluate the risk-adjusted performance of the prediction model compared to simply buying and holding Bitcoin.

References

Chen, Z., Li, C. and Sun, W. (2019) Bitcoin price prediction using machine learning: An approach to sample dimension engineering. Available at: https://www.sciencedirect.com/science/article/pii/S037704271930398X (Accessed: 10 March 2024).