**Cryptocurrency predictor using ML**

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**Abstract**

This paper discusses the emergence, assimilation, and influence of cryptocurrencies in finance and beyond. From inception as a decentralized alternative to traditional currencies, cryptocurrencies have become progressively popular, encompassing participant demographics from individual investors to large financial institutions. This paper examines the history, technology, and economics of cryptocurrency growth. It also examines market dynamics for the top leaders, Bitcoin and Ethereum. Emphasis is on price patterns over time and the underlying causes of volatility. This kind of data analysis shows that digital assets are changing the face of the financial markets-as an opportunity and a source of risk. The paper also discusses regulatory hurdles, including issues with CBDCs, in view of the way these have created pressure to accommodate frameworks of cryptocurrency within the authorities of governments. This work gives an element of what cryptocurrency is and weighs its role in the future of global finance.

**Introduction**

**Background and Motivation:**

Cryptocurrency emerged in 2009 through Bitcoin, a revolutionary digital asset, designed to function independently from the old traditional financial systems. Bitcoin launched a decentralized, blockchain-based currency and therefore introduced a new class of digital assets to challenge the old norms of money. The primary appeal of cryptocurrency is the secure, transparent, and borderless transactions that enable the users to be in control without intermediaries like banks. Over the past ten years, thousands of cryptocurrencies have emerged, and blockchain technology has been applied in various sectors-it has opportunities and challenges. This paper is driven by the significant impact of cryptocurrency on financial markets, from retail investors to the institutional adoption; it attempts to explore the volatile features, concerns in terms of regulation, and scalability issues facing this technology. Understanding these factors is crucial because cryptocurrencies are increasingly impacting global finance, thus prompting governments and institutions to adjust to a rapidly evolving digital landscape.

**Objective:**

The intention of this paper is to investigate using techniques from machine learning to predict prices of cryptocurrencies with a focus on performance enhancement in prediction ability and the emergence of patterns in market trends. Different ML models such as linear regression, decision trees, random forests, and neural networks are evaluated to analyze their effectiveness in predicting future prices of such cryptocurrencies as Bitcoin and Ethereum. This paper identifies some of the key factors moving prices and attempts to test how well such models are likely to be able to pick up patterns in data. Of specific interest, this study investigates the problems such as market volatility and data quality and diverse indicators across different markets with the objective of providing answers to the question whether machine learning can be employed for the real-time cryptocurrency price prediction.

**Literature Review**

Literature about cryptocurrency includes its technological foundations, economic consequences, and regulatory matters. It was the emergence of Nakamoto in 2008 that introduced a decentralized digital currency using blockchain: an open, distributed ledger that records transactions without the need for intermediaries. The initial research focused on the new technology behind Bitcoin and its ability to challenge conventional financial systems (Narayanan et al., 2016). With Buterin introducing Ethereum in 2014, blockchain applications widened into smart contracts, through which programmable and auto-executing financial transactions occur, holding prospects for decentralized finance or DeFi (Werner et al., 2021).

The crypto currencies show their face as highly volatile products with specific risk-return profiles.

According to such pieces of research by Corbet et al. (2018), price volatility of cryptocurrencies like their existence is attributed to features relating to investor sentiment news which concern regulation and regulatory responses and macroeconomic development pattern trends. For instance, Bouri et al. (2017) found that for every episode of market disturbance that is experienced, there must be a Bitcoin hedging as if it is always having some safe haven with variable capability over time with this attribute varying across distinct existing cryptocurrencies.

One significant feature of the literature involves price trends and volatility. By using historical data, it has been demonstrated that Bitcoin and Ethereum have seasonality trends and periodic fluctuations and are often affected by factors such as liquidity and trading volume and external economic forces (Baek & Elbeck, 2015). Such tools as time series analysis and moving averages often become important techniques in capturing these trends so as to evaluate price predictability especially within short and medium term windows (Al-Yahyaee et al., 2018). Regulatory discourse also comes into play in that governments and financial institutions research the potential integration or regulation of digital assets (Auer & Claessens, 2018). Studies demonstrate that regulation has an influence on the price and adoption of cryptocurrencies since uncertainty may foster market sentiment and shift investment behavior. Building on this research, the study focuses on Bitcoin and Ethereum's price volatility as well as the characteristics of the cryptocurrency markets.

**Related work:**

Prior research on cryptocurrency focuses on its technological, economic, and regulatory dimensions. Nakamoto's (2008) whitepaper introduced Bitcoin, initiating studies into blockchain technology’s potential to eliminate traditional intermediaries and enhance transparency in financial transactions. This decentralized ledger model spurred research into other cryptocurrencies, particularly Ethereum, which expanded the blockchain’s capabilities with smart contracts (Buterin, 2014). These smart contracts enabled decentralized finance (DeFi) applications, fostering greater interest in cryptocurrency ecosystems (Werner et al., 2021).

From an economic perspective, researchers have examined cryptocurrency’s volatility and unique risk-return characteristics. Corbet et al. (2018) and Liu & Tsyvinski (2018) demonstrate that Bitcoin and other major cryptocurrencies display extreme price fluctuations, driven by both investor sentiment and macroeconomic factors. Bouri et al. (2017) suggest that Bitcoin can sometimes act as a hedge or safe-haven asset, though its behavior varies across different market conditions.

Studies also show that regulations significantly affect cryptocurrency prices and market participation. Auer & Claessens (2018) highlight that regulatory news impacts price volatility and investor confidence. This paper builds on these studies by analyzing historical data for Bitcoin and Ethereum, examining trends, volatility, and the influence of market events on cryptocurrency price dynamics.

**Methadology**

The objective of this study is to analyze historical price data for Bitcoin and Ethereum to uncover trends, patterns, and correlations that can shed light on cryptocurrency market dynamics. The key components of this methodology are data preparation, trend analysis, volatility analysis, correlation analysis, and evaluation.

**Data Preparation**:  
The dataset comprises daily price information for Bitcoin and Ethereum, including open, close, high, low, volume, and market capitalization. The data is preprocessed by handling any missing values and outliers, standardizing data fields, and converting date formats for time series analysis. This prepares a clean, reliable dataset for consistent analysis.

**Trend Analysis**:  
To examine trends, moving averages (e.g., 30-day, 90-day) are applied to the closing prices of both Bitcoin and Ethereum. This helps smooth out short-term fluctuations, providing a clearer picture of long-term price behavior and enabling detection of seasonal patterns in cryptocurrency prices.

**Volatility Analysis**:  
Volatility is assessed by calculating daily percentage changes and applying rolling standard deviation over 30-day and 90-day windows. This approach reveals short-term and long-term price volatility, providing insight into periods of stability or market turbulence for each cryptocurrency.

**Correlation Analysis**:  
A 30-day rolling correlation is used to assess the relationship between price and trading volume, as well as between trading volume and market capitalization. This helps identify the impact of liquidity on price fluctuations and the potential interaction between volume and price trends.

**Evaluation**:  
The findings are evaluated through period-specific analyses, focusing on high-volatility periods to understand the drivers behind sudden market shifts. Additionally, the results are compared to benchmark indices and historical market events to validate the trends and correlations observed.

This comprehensive methodology leverages historical data, moving averages, and volatility measures to provide insights into cryptocurrency market behaviors, particularly for Bitcoin and Ethereum.