# Cryptocurrency Data Analysis

Introduction

This report provides a detailed exploratory analysis of cryptocurrency price data, specifically focusing on Bitcoin and Ethereum—the two leading cryptocurrencies. The analysis aims to uncover historical price trends, examine volatility, and explore the correlation between these major assets. By utilizing Python's robust data science tools such as Pandas for data manipulation, along with Matplotlib and Plotly for visualization, this project sheds light on the intricate dynamics governing cryptocurrency markets and demonstrates essential data handling and visualization skills.
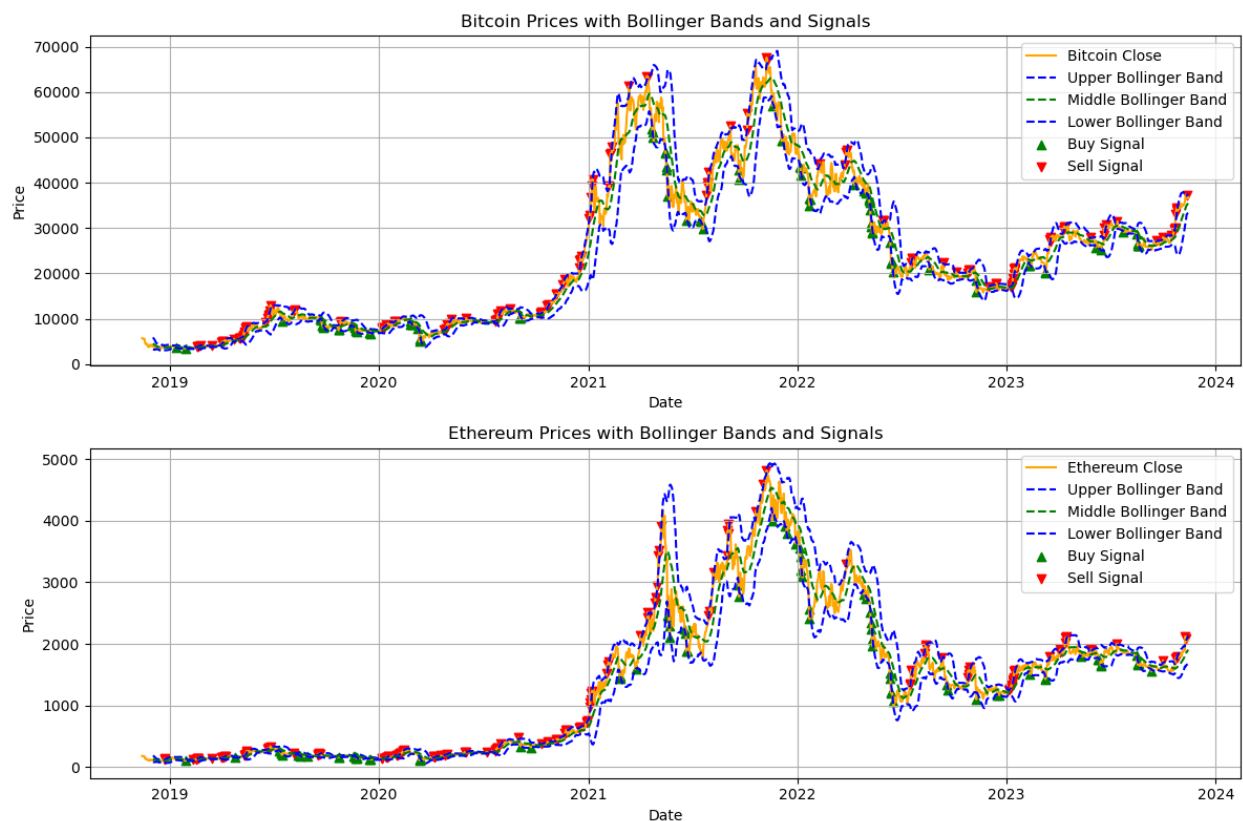
Project Objectives and Dataset

Objective: This project aims to analyze and compare the price trends, volatility patterns, and correlations between Bitcoin and Ethereum, offering insights into their market behaviors over time.

Dataset: The analysis is based on daily historical price data for Bitcoin and Ethereum. This includes Date, Closing Price, Open, High, Low, and Volume, alongside other pertinent financial metrics.

Tools and Libraries:

- **Python:** Primary programming language.

- **Pandas:** Used for sophisticated data manipulation.

- **Matplotlib and Plotly:** Employed for creating both static and interactive visualizations.

- **Jupyter Notebook:** Provides an interactive environment for conducting and presenting the analysis.

Data Preparation and Cleaning

1. **Label Standardization and Consistency:**

   o **Correcting Labels:** Typos in the currency column were corrected (e.g., "Etherium" to "Ethereum") to ensure uniformity across the dataset. This standardization is crucial for accurately filtering and comparing data.

2. **Parsing and Filtering Dates:**

   o **Date Conversion:** Dates were converted to a datetime format to enhance the accuracy of chronological analyses and visualizations.

   o **Common Date Range:** The dataset was filtered to include only the dates where data for both Bitcoin and Ethereum were available, ensuring a reliable basis for comparative analysis.

3. **Removal of Duplicates and Outliers:**

   o Duplicate entries were removed and outliers were checked to prevent skewed results and maintain data integrity.

Exploratory Data Analysis and Key Findings

1. **Price Trends Over Time:**

   o **Overall Growth Patterns:** Both Bitcoin and Ethereum have shown significant price growth within the analyzed period, though Bitcoin typically maintains higher absolute values. Their growth trajectories often mirror broader market trends, suggesting a reactive alignment with general market sentiments.

   o **Key Price Spikes:** Notable price spikes correspond with major market events, such as new institutional investments and regulatory changes, indicating their impact on market dynamics.

   o **Seasonal and Cyclical Patterns:** Observable seasonal trends suggest certain times of the year, like early January, often experience heightened trading activity and price volatility.

2. **Volatility Analysis:**

   o **Short-Term vs. Long-Term Volatility:** Both cryptocurrencies show significant short-term volatility, especially during market peaks, with Bitcoin generally exhibiting higher volatility than Ethereum.

   o **Rolling Standard Deviation:** The rolling standard deviations calculated over a 30-day window provide a quantitative view of volatility, highlighting periods of intense market activity.

3. **Market Correlation Analysis:**

   o **Strong Positive Correlation:** The analysis revealed a robust positive correlation between the prices of Bitcoin and Ethereum, influenced by overall market sentiment and similar reactions to global economic events.

   o **Correlation Coefficients:** The calculated correlation coefficients underscore the synchronized price movements of these two cryptocurrencies.

4. **Volume and Market Activity:**

   o **Volume Correlation with Price:** Trading volumes often peak alongside significant price changes, reflecting the speculative nature of the market.

   o **Comparative Volume Analysis:** While Bitcoin generally shows higher volumes due to its larger market presence, Ethereum also exhibits substantial volume during key market events.

Visualization Techniques and Skills Demonstrated

- **Line and Rolling Standard Deviation Plots:** These plots are instrumental in illustrating price trends and volatility over time.

- **Interactive Candlestick Charts:** Developed with Plotly, these charts provide detailed insights into daily price movements and are invaluable for identifying specific periods of high volatility.

- **Correlation Scatter Plots:** These plots visually represent the price relationship between Bitcoin and Ethereum, enhancing understanding of their market dynamics.

Advanced Python Skills Demonstrated

- **Efficient Data Manipulation:** Utilizing Pandas for complex data filtering, merging, and time-series analysis.

- **Dynamic Visualizations:** Creating interactive visualizations with Plotly to engage viewers and provide deeper insights into cryptocurrency behaviors.

- **Statistical Analysis:** Employing rolling calculations and correlation coefficients to quantify market trends and relationships.

Conclusions and Future Analysis Directions

This analysis not only highlights the correlated behaviors of Bitcoin and Ethereum but also their susceptibility to external market influences, illustrating the interconnected nature of the cryptocurrency market. Future research could expand to include sentiment analysis, broader cryptocurrency comparisons, and regulatory impact studies, providing a more comprehensive understanding of this volatile market landscape.

Skills and Technologies Demonstrated

- **Python Libraries:** Mastery in Pandas, Plotly, and Matplotlib.

- **Data Cleaning and Preparation:** Advanced techniques for robust data management.

- **Statistical and Correlation Analysis:** Insightful evaluations of market trends and behaviors, aiding in investment and trading strategies.