Reinventing
Higher
Education

A technical analysis on Bitcoin

RSI, volatility and volume

Group 5
Modern Data Architectures in Big Data I
Master in Business Analytics and Big Data
IE University

Table of contents

Setting the scene: Bitcoin is known for its high volatility and rapid fluctuations – deciphering its trading patterns is as crucial as ever

FINANCIAL TIMES

December 5, 2023

Bitcoin's bounceback déjà vu

The crypto bulls are back again. Bitcoin surged to $42,000 on Monday, its highest in nearly 20 months, marking a dramatic 150 per cent rise so far this year. After losing more than 60 per cent of its value in 2022, its climb back has sparked yet another wave of euphoric calls.

Problem description and analysis scope: We are looking to help investors navigate the cryptocurrency market

OBJECTIVE

1

This project aims to conduct an **analysis of Bitcoin (BTC) trading patterns**, with a focus on technical indicators.

The objective is to identify the **strength of the market**, assess market **volatility**, and **predict price** movements in the cryptocurrency market.

ANALYSIS

2

The analysis approach is focused around combining a technical analysis (**RSI and volatility**) with a quantitative analysis (**trading volume**) to derive insights about potential market behavior.

EXPECTED OUTCOME

3

We expect to identify **divergencies** where the price makes a new high or low that is not confirmed by the technical indicators.

We expect to understand BTC **market sentiments** through analysis of the correlation of indicators, thereby **guiding investors** and traders on market momentum and uncertainty.

DATA PIPELINE

SOURCE

INGESTION

STORAGE

PROCESSING

Note: We are not addressing the serving layer in this project

DATA PIPELINE

SOURCE

INGESTION

STORAGE

PROCESSING

Note: We are not addressing the serving layer in this project

Data source: Binance

1 Binance is a global company that operates the **largest cryptocurrency exchange** in terms of daily trading volume of cryptocurrencies

2 The data source is a **streaming data source**, i.e.,, we will be getting data in motion/real-time data from the data source.

3 Specifically, we will be getting Binance's real-time data on the **BTC/USDT pair** through the Binance SPOT's Websocket API.

4 The data format is **JSON** files (dictionaries with key-value pairs), so we can classify the data as **semi-structured**. In addition, the data comes in the form of **JSON-lines**, making it easy to implement in Spark.

Example of a JSON file from source: semi-structured data consisting of a dictionary with key-value pairs

DATA PIPELINE

SOURCE

INGESTION

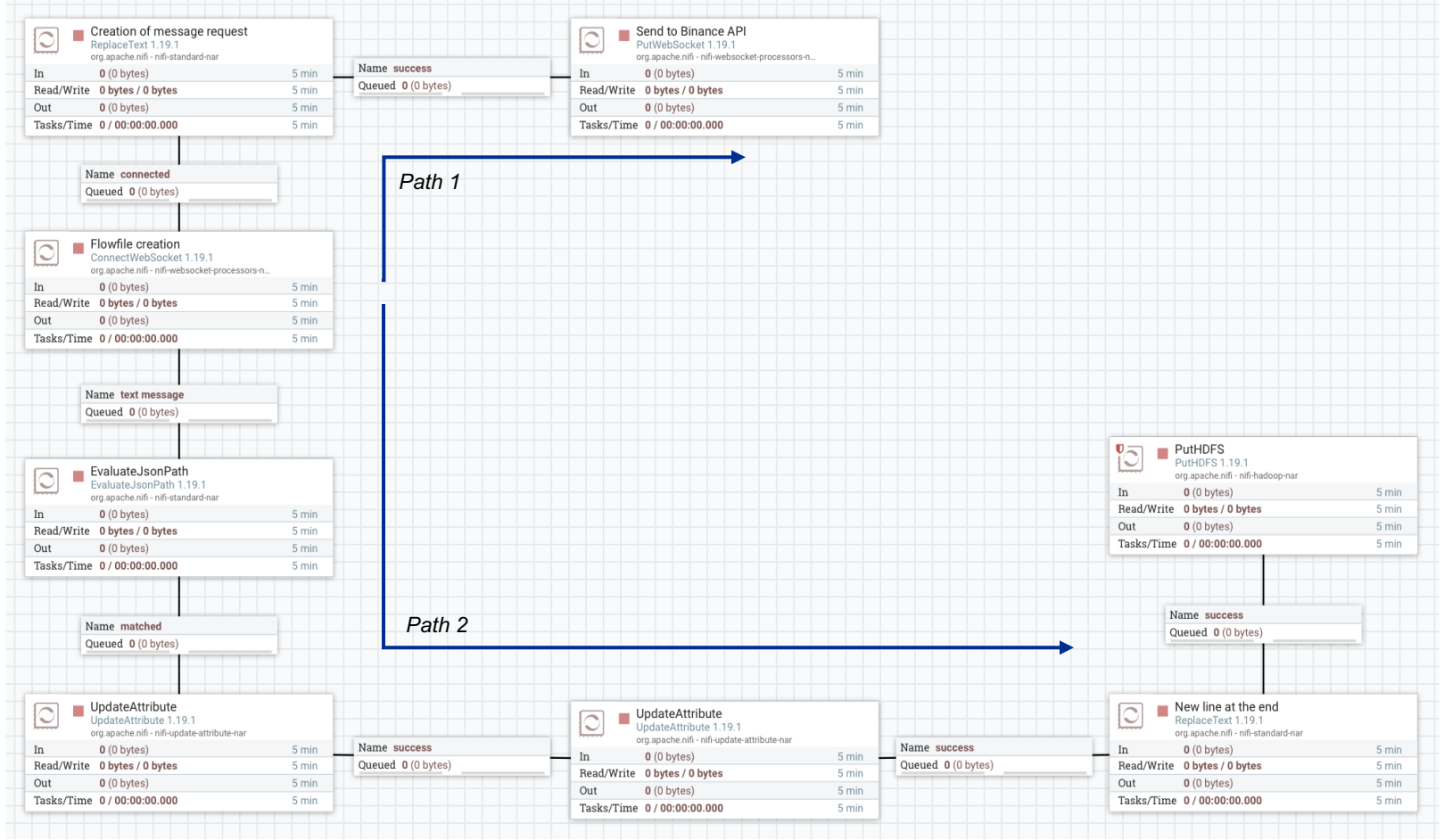
STORAGE

PROCESSING

Note: We are not addressing the serving layer in this project

Data ingestion using NiFi

Overview of NiFi workflow



Comments

- Tool of choice: NiFi (reliable, powerful and easy to use)
- The first step was to set up security configuration to connect with external service
- After this, we created the flow, which consists of two main paths
- The first path sends a message request to the Binance API (Websocket API/Push API), specifying what data we want to subscribe to
- The second path takes the data from Binance (push updates with very high update frequency) and ingests it into our storage layer
- Since we were ingesting streaming data into a batch storage layer (HDFS), we instructed the ingestion flow to append every event (small streaming file) to a combined file, thus creating historical data (batch data)
- We specified the naming convention of the combined file as follows: {timestamp:format ('yyyyMMddHH')}.json

DATA PIPELINE

SOURCE

INGESTION

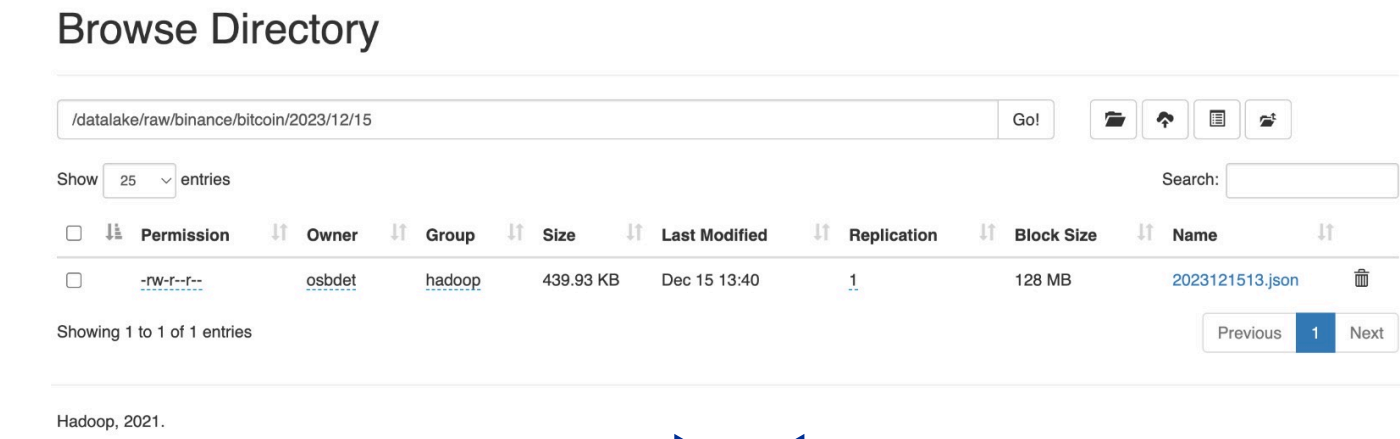
STORAGE

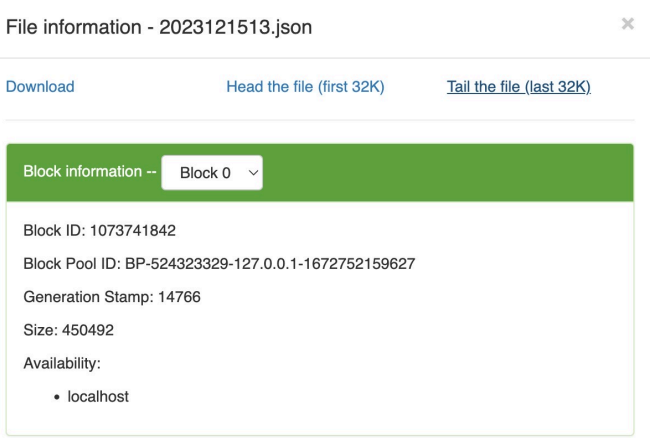
PROCESSING

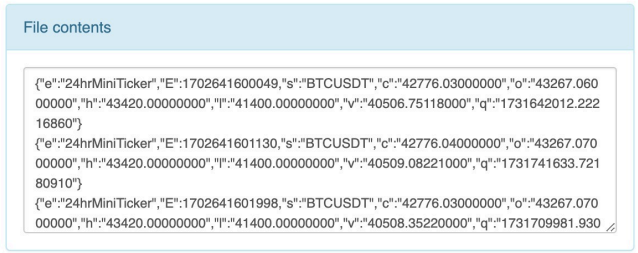
Note: We are not addressing the serving layer in this project

Data storage in HDFS

Overview of HDFS directory structure







Comments

- Tool of choice: HDFS (ideal for big files (e.g., historical data) due to the distributed nature of the file system, very reliable and secure)
- As mentioned, the many small streaming files are consolidated into one file to create historical data, which is stored in our batch storage layer in HDFS (using streaming data for historification)
- Given the relatively short ingestion time, the file size remains small (not even filling a block in HDFS). However, the pipeline would also be able to handle much larger volume of data through longer ingestion time
- Our HDFS directory structure is reflected in the screenshots on the left, and the path is as follows: /datalake/raw/binance/bitcoin /2023/12/15
- Also, it can be seen that the file follows the naming convention specified in the ingestion layer: ('yyyyMMddHH').json

DATA PIPELINE

SOURCE

INGESTION

STORAGE

PROCESSING

Note: We are not addressing the serving layer in this project

Data processing with Spark

1 Spark is a **widely adopted processing tool**, mainly due to its ease of use (declarative, functional programming), its speed, and its multi-purpose capabilities (supports several languages and libraries, unified processing framework)

2 Spark's **high-level API** allows you to read files from your storage layer and to create dataframes on top of these files

3 We use this feature in Spark to create a **DataFrame on top of the semi-structured data** from Binance that we have stored in HDFS in order to conduct generic batch processing

4 Based on this DataFrame, we **distil insights** using Spark Processing. We also deploy the **Pandas library in Python** and the Plotly library in Python to visualize findings

Through an initial exploratory data analysis, we gained an overview of our dataset

Overview of dataset

Number of observations	2422
Time range start	13:00 2023-12-15
Time range stop	13:40 2023-12-15
Minimum closing price	42610.96
Maximum closing price	42784.62
Trading range	173.66
Minimum price (last 24 hrs)	43420.0
Maximum price (last 24 hrs)	41400.0
Trading range (last 24 hrs)	2020.0

Dataset divided into 5-minute time intervals

Price development	Number of intervals	Average volume
Positive change	5	40165.83
Negative change	3	40339.74

Correlation between volume and percentage price change by interval:

-0.83

Magnitude of price change for intervals with **negative** price change **>** Magnitude of price change for intervals with **positive** price change

The relationship between price and volume was further investigated

Description: Each closing price and volume observation was classified based on its percentile rank, i.e., the data was split into 5 percentile ranges (0-20, 20-40, 40-60, 60-80, 80-100) and classified as very high, high, medium, low and very low.

Distribution of combinations of price type and volume type (%)

	Very high volume	High volume	Medium volume	Low volume	Very low volume
Very high price	7.56	3.01	NaN	3.96	5.29
High price	1.86	3.55	1.61	5.57	7.56
Medium price	4.75	7.51	2.93	0.99	3.84
Low price	1.49	2.48	8.71	4.38	2.73
Very low price	4.34	3.43	6.77	3.96	0.62

No clear-cut patterns, potentially due to the limited size of the data set. Overall, low price and very low price is prevalent during medium volume and low volume, while high price and very high price is prevalent during low volume and very low volume. High price is, however, also prevalent during very high volume

Project results

Insights from the technical analysis

Insights from the RSI chart

Price Trends

Aids investors in identifying the underlying momentum of price trends:

- RSI > 70 = bullish momentum (overbought)
- RSI < 30 = bearish momentum (oversold)

Market Sentiment

RSI trends provide insights for momentum confidence:

- Rising RSI may indicate increasing bullish sentiment
- Falling RSI could reflect growing bearish sentiment

Support and Resistance Levels

RSI levels near overbought or oversold territories can help in identifying:

- Psychological price levels that act as support or resistance

Therefore, investors can expect:

- Rally
- Sell-off

Insights from the volatility chart

Market Stability

State of the market:

- Low volatility: stable market attractive for long-term investment positions
- High volatility: dynamic market that tends to offer short-term trading opportunities

Price Fluctuations

A barometer for the level of risk present in the market at any given time

Assess risk depending on momentum:

- Increasing volatility: larger or stronger swings (movements) than usual
- Decreasing volatility: stability and smaller swings

Larger price swings increase the chance of substantial gains but also the likelihood of considerable losses

Investor Sentiment

Investors get insights from the volatility spikes in the crypto market by analyzing collective market reactions to events

For market entry or exit

Insights from the volume chart

Trading Activity

Volume spikes can indicate a high level of interest in a security:

- Bullish
- Bearish

Used to confirm the strength of a price movement as high conviction

Confirmation of Trends

Consistently HIGH volume in the direction of the trend:

- Confirmation of the trajectory
- Trend is backed by strong investor participation and is likely to continue

Consistently LOW volume in the direction of the trend:

- Possible rejection of the trajectory
- Trend is NOT backed by strong investor participation and is NOT likely to continue

Potential Reversals

A divergence (contradiction) between volume trends and price action can:

- Precede a reversal or rejection of the current trajectory
- Provide an early signal for potential changes in the price direction

Example: Price rises on declining volume

Deep dive: Insights from ”Case A” with time being 13:15

RSI: OVERSOLD (“<30”)

VOLATILITY: Increasing volatility equals stronger movements are more probable.

VOLUME: Consistent low or decreasing volume in the direction of the trend suggest stabilization and not support for the current trajectory of the market.

CONCLUSION:

Uncertainty rising and current trend is not supported by volume. The current market price action will probably be rejected (divergence in the graph) and price reversal is expected.

Deep dive: Insights from ”Case B” with time being 13:35

RSI: OVERSOLD (“<30”)

VOLATILITY: Low volatility equals stable market attractive for long-term investment positions not for short term trading.

VOLUME: Low or decreasing volume in the direction of the trend suggest stabilization and not support for the current trajectory of the market.

CONCLUSION:

Potential reversal is less probable, stability in the current trend and not expecting sudden moves of price is not supported but not rejected so continuation of price action is expected.

Summary and conclusion

THE WHAT

A recent surge in the Bitcoin price calls for an analysis to understand Bitcoin's trading patterns. Through a combined technical and quantitative analysis of data on the BTC/USDT pair, the project investigates the RSI, volatility and volume to derive insights about the market's behavior.

THE HOW

At the center of the project stands the data pipeline. Binance makes up the data source, delivering semi-structured streaming data on the BTC/USDT pair. NiFi is used to ingest the data from the source into HDFS, which makes up our storage layer. Finally, Spark is used for data processing with Python and its libraries being used for visualization.

THE OUTCOME

The combined analysis of RSI, trading volume, and market volatility provides a multifaceted view of financial market dynamics, in this case the "BTC/USDT" pair, offering technical and business insights into investor behavior and sentiment to place an entry position or invest with greater confidence.

Reinventing Higher Education

Thank you

Group 5
Modern Data Architectures in Big Data I
Master in Business Analytics and Big Data
IE University