

Solution Design Document - Statistical Analysis of Financial Markets - G4532

Project Case

The aim is to perform statistical technique on cryptocurrency price data to achieve:

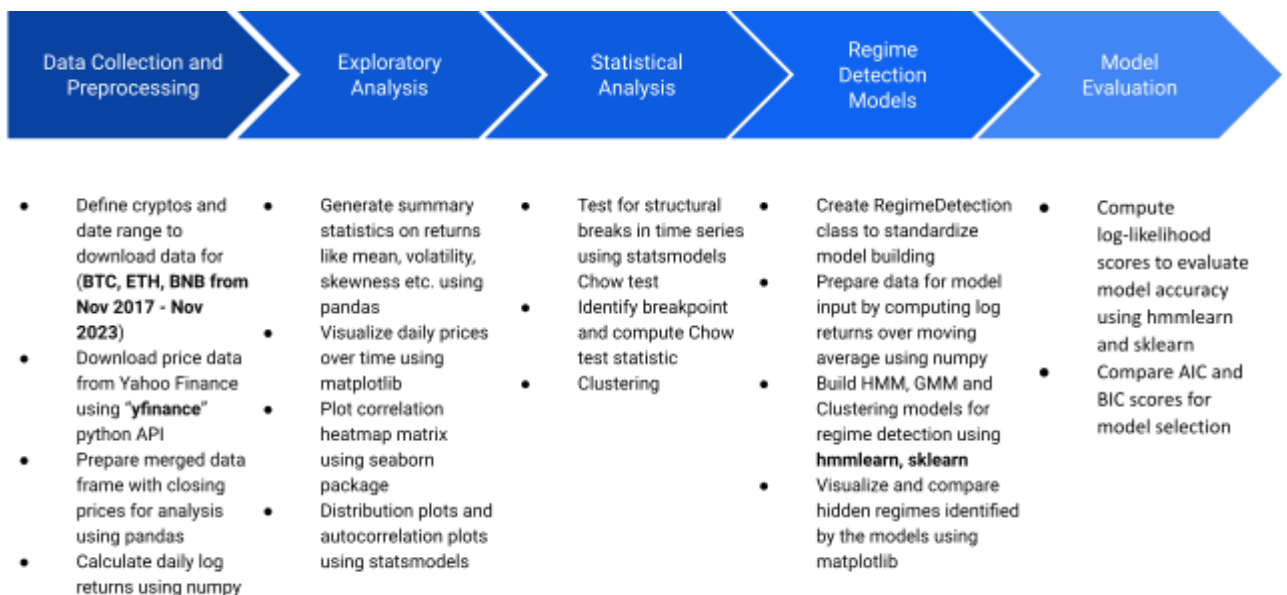
- **Identify Trends and Insights:** Statistical analysis helps us identify patterns, correlations, seasonalities in the time series data, leading in periodic cycles, mean reversion exhibited by cryptocurrency prices.
- **Build Hypotheses:** To understand the major occurrences that influence the pricing, methods like Chow test can validate on structural breaks in the series.
- **Model Pricing Behavior:** For finding the different characteristics of the pricing behavior methods like auto-regression, moving average, Markov switching model can support forecasting, simulation and strategic insights.
- **Classification and Clustering:** Clustering models based on the statistically identified features help in segmenting similar price patterns. This includes examples - volatile & stable regimes. Classification models are one of the preferred methods for bull vs bear markets strategies.

Statistical modeling reveals significant patterns, periods and segmentation in complex cryptocurrency data, supporting strategic decision making in the financial sector as well as trading systems.

Specifications

- Analyze price data for Bitcoin (BTC), Ethereum (ETH) & Binance Coin (BNB): Nov 2017 - Nov 2023.
- Check for structural breaks in the time series data - Chow test.
- Locate regimes in cryptocurrency prices using Regime Detection methods.
- Clustering - cryptocurrencies based on closing prices using Agglomerative Clustering.
- Model cryptocurrency log returns using Gaussian Mixture Models (GMMs).
- Analyze hidden states in prices using Hidden Markov Models (HMMs).
- Common trends in cryptocurrency prices using Markov Switching (MSM) model.
- Evaluate accuracy using log-likelihood, BIC.
- Analyze periodicity of regimes, effect on volatility etc. so as to gain insights.

Solution Architecture



Key Features

Market Classification into Bull Bear and stagnant regimes, visual representation of market behavior over time and of usage of various models on the dataset.