Xtreamly AI Volatility Periodic Classification

Xtreamly

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Abstract

Xtreamly aims to identify cryptocurrency markets regime change to navigate trading strategies. This paper presents the properties of classyfying market regimes, its applications, and the implementation of the API. These innovations support advanced DeFi strategies by enabling scenario-based decision-making and effective risk management.

1 Introduction

1.1 Problem Definition

Cryptocurrency markets exhibit varying volatility regimes characterized by rapid price movements and shifting conditions. Accurately detecting and forecasting the current volatility regime is essential for defining robust risk-adjusted trading strategies.

1.2 Applications

Xtreamly provides a structured volatility classification framework to drive scenario-based investment decisions. This approach streamlines the integration of volatility forecasts across multiple use cases, enhancing decision-making and risk management:

- **Agentic Trading Bots**: LLM-powered agents can adjust their strategies and order execution parameters based on the current volatility regime.

- **Strategy Configuration**: Dynamic position sizing, hedging, and leverage levels can be tailored to the identified market regime.

Our classification guides DeFi strategies by:

- Identifying low-volatility periods for stable yields.

- Flagging high-volatility states for risk mitigation.

- Enabling dynamic portfolio rebalancing.

2 Methodology

We define three mutually exclusive volatility regimes—low, medium, and high—each with specific statistical criteria.

2.1 Low Volatility

Represents a stable market environment with minimal price movement, ideal for high-risk strategies. Requirements:

- **Minutely %Return** The 99% quantile of the minute-by-minute price change does not exceed 1%.

- **Period %Return** The price remains within 2.5% of its period starting price.

- **Period #Count** Number of low volatility distinct periods up to 60 instances per month.

- **Period %Coverage** Covers at least 20% of the total time in the testing period.

2.2 Medium Volatility

Defined by moderate price fluctuations, offering opportunities for risk-calibrated strategies. Requirements:

- **Minutely %Return** The 99% quantile of the minute-by-minute price change does not exceed 1%.

- **Period %Return** The price remains within 5% of its period starting price.

- **Period %Coverage** Covers at most 60% of the total time in the testing period.

2.3 High Volatility

Defined by moderate price fluctuations, offering opportunities for risk-calibrated strategies. Requirements:

- **Minutely %Return** Minute-by-minute price changes significantly exceed the thresholds of low and medium volatility periods.

- **Period Standard deviation** Standard deviation of price returns is significantly higher than in low volatility periods.

- **Period Duration** Average duration: up to 6 hours.

- **Period %Coverage** Covers at most 50% of the total time in the testing period.

2.4 Predictive Models

We employ proprietary models to forecast short-term volatility (up to 15 minutes ahead), enabling anticipatory adjustments rather than reactive classification.

2.5 Assets

Extensive testing was performed on BTC and ETH. While results are consistent across all assets, this paper highlights ETH outcomes; BTC findings are included in the Appendix.

2.6 Testing Periods

Model performance was evaluated using 1-minute data from Q4 2024 and Q1 2025. Training excluded these periods to ensure unbiased testing.
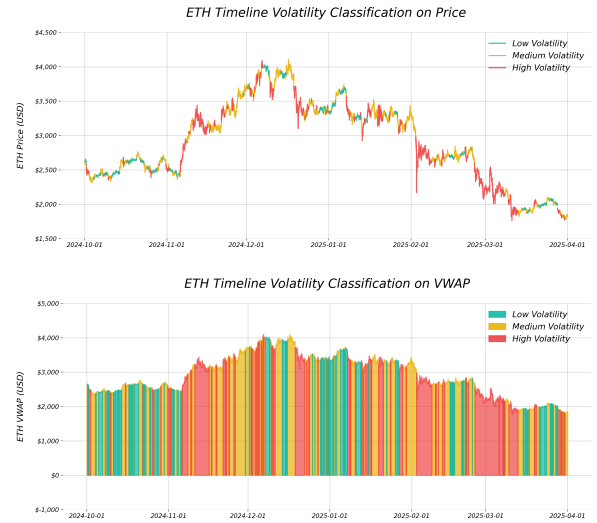
3 Backtesting Results

3.1 Period Summary

The Xtreamly volatility classification framework effectively meets its predefined statistical criteria, ensuring reliable and stable classification across diverse market conditions. Backtesting results confirm robust classification boundaries, making the model well-suited for trading strategies, risk assessment, and investment decision-making.

Symbol	Volatility	Avg. Instances Monthly	% Time Coverage	Avg. Duration Hours	Max Duration Hours	1th Quantile % Return	99th Quantile % Return
BTC	High	10.0	31.78%	23.1	158.1	-5.98%	11.45%
BTC	Low	11.7	17.63%	11.0	50.6	-1.58%	1.71%
BTC	Medium	21.8	50.49%	16.8	91.3	-5.05%	4.38%
ETH	High	11.0	29.20%	19.3	217.9	-11.67%	11.64%
ETH	Low	14.5	17.16%	8.6	38.7	-1.70%	1.94%
ETH	Medium	25.7	53.53%	15.2	91.4	-7.17%	5.61%

3.2 ETH Timeline Analysis

ETH Timeline Volatility Classification on Price

ETH Timeline Volatility Classification on VWAP

3.3 ETH Minutely % Returns

Low-volatility states exhibit minimal price changes while high-volatility states present the widest distribution, suggesting large price swings.


ETH Density of Minutely Returns
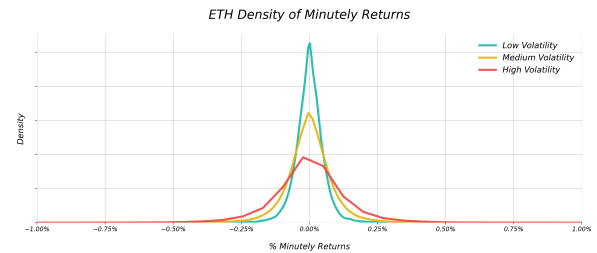
3.4 ETH Periods % Returns

Period returns are critical for evaluating expected outcomes when entering a specific market state. Understanding return distributions over different volatility periods allows traders to optimize strategies for each positions associated with classification.

ETH Density of Periods Returns
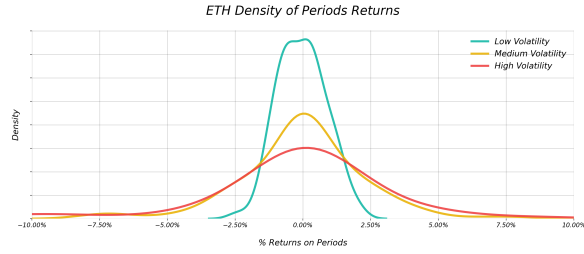
3.5 ETH Duration

The duration of each volatility period reflects how long a particular market state persists, providing insight into the frequency of shifts between volatility regimes.

ETH Density of Periods Duration Hours

ETH Periods Duration vs % Returns
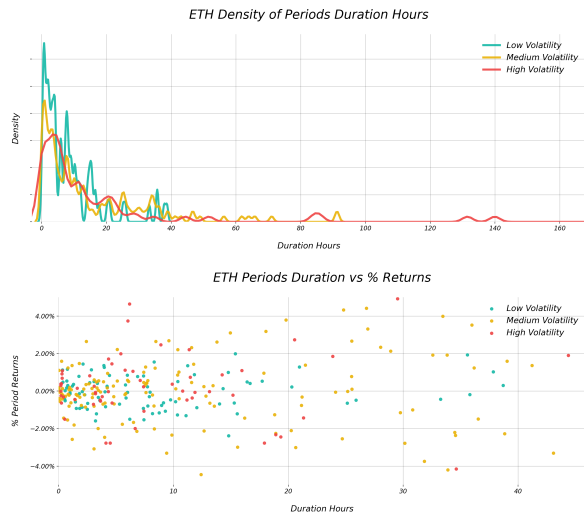
3.6 ETH Minutely Volumes

From low-volatility to high-volatility the average minutely volume is increasing. Its natural phenomenon as price changes mainly by retail users additional activity.

ETH Density of Minutely Volumes
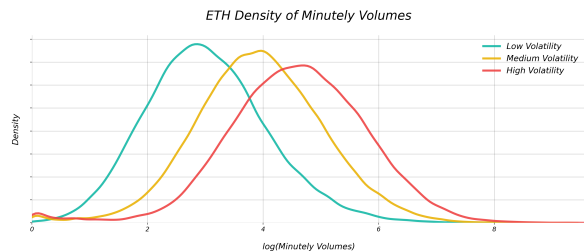
3.7 Testing codes

Testing focused on assessing predictive accuracy and robustness under varying market conditions. The evaluation framework, publicly available, ensures applicability to real-world cryptocurrency trading scenarios; and calculations are available in the link: *Xtreamly Public Repository*.

4 Implementation

4.1 API Architecture

The API uses a RESTful architecture with secure authentication. Detailed implementation is proprietary and accessible to authorized users via the Xtreamly API Documentation.

4.2 API Performance

Xtreamly's API is optimized for low-latency use cases, achieving average response times under 500 ms and 99.9% uptime. Horizontal scaling ensures reliability under high load, typical of real-time trading systems.

5 Limitations and Future Work

While Xtreamly's models demonstrate a good accuracy in identifyingmarket regime status, limitations already predifined as goal functions. Narrowing down and achieving these KPIs will be further pushed in the future. Future work will explore additional data inputs and enhanced training techniques to improve underlying models.

6 Appendix

6.1 BTC Results

Charts of results are available in the github link: *Xtreamly Public Repository*.