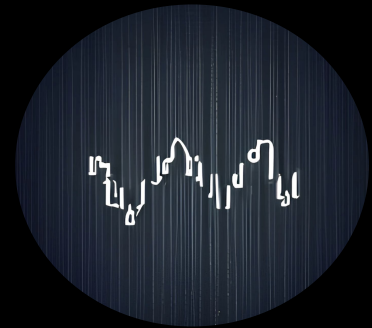




Forecasting Cryptocurrency Volatility

—

Triple Volatility Standard (TVS)



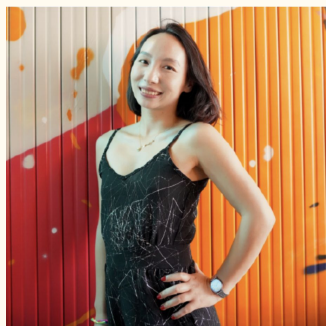
Presentation Outline

- Challenge and Idea
 - Data Engineering
 - Product Architecture
 - Platform Showcase
 - Limitations & Future Improvement
-



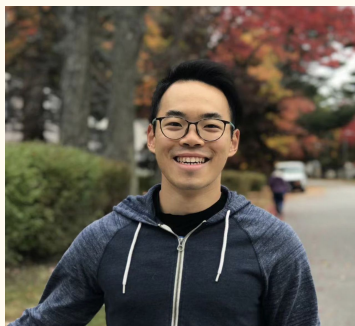


Meet the team



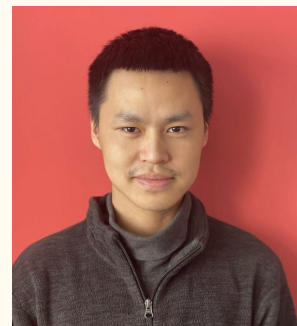
Jessica Chuh

Full Stack Developer



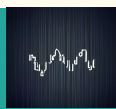
Howard Li

Product Manager

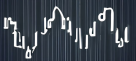


Jack Wu

Model Architect



Challenge and Idea



Scenario

Howdy!



“Everyone is talking about Bitcoin. When should I buy in?”



Chris
A confused investor
Low risk tolerance



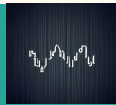
LFG!

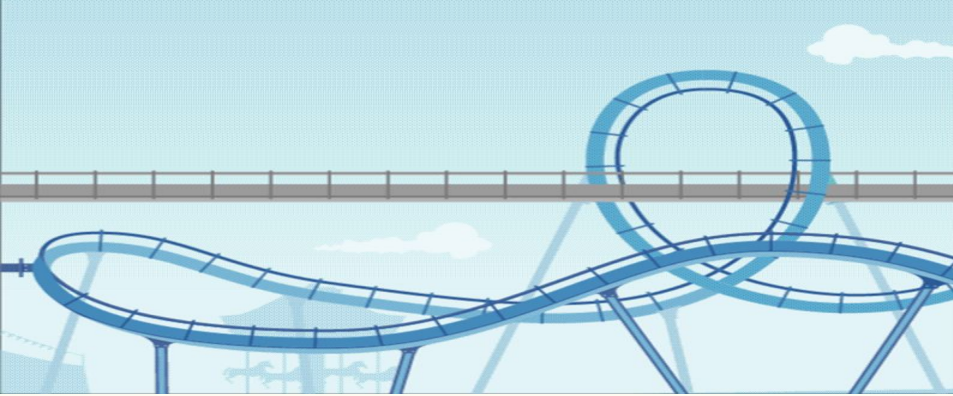


Chilling



Product Manager





Volatility

Definition:

The market volatility is the rate at which the price of an asset ascends or descends over a given time period.

Today

\$10

Tomorrow

[1]

Volatility: \$6

Potential Outcomes:

- \$16
- \$4

[2]

Volatility: \$0.5

Potential Outcomes:

- \$10.5
- \$9.5

Volatility in crypto market...



Jan 2023 - April 2023



Jan 2020 - April 2023




Product Manager



Solution



Realized
Volatility
+
Volatility Level
Alert



“Now I be more informed and
manage my risk!”



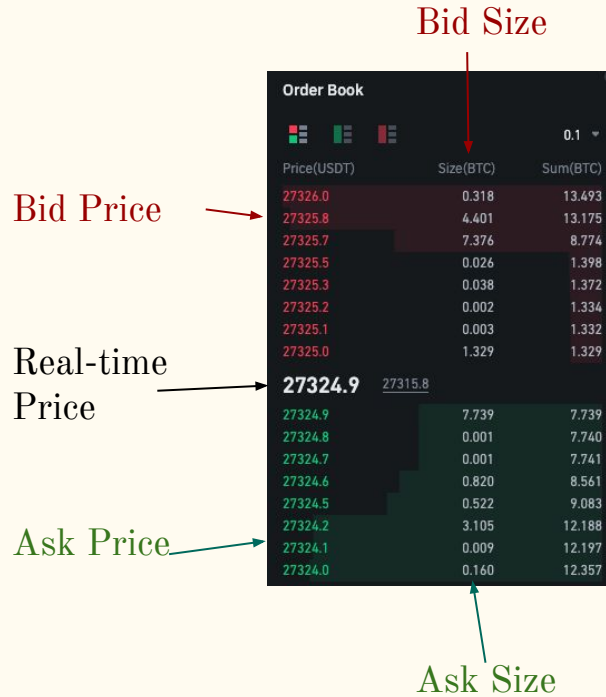
Chris can now comfortably begin his
investment journey!



Product Manager



How are we calculating realized volatility?



Weighted Average Price
(WAP)

$$= \frac{BidPrice_1 * AskSize_1 + AskPrice_1 * BidSize_1}{BidSize_1 + AskSize_1}$$

Log return

$$r_{t1,t2} = \log \left(\frac{WAP_{t1}}{WAP_{t2}} \right)$$

Realized volatility

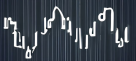
$$\sigma = \sqrt{\sum Log\ return^2} = \sqrt{\sum_t r_{t-1,t}^2}$$



Data Engineering



Product Architecture



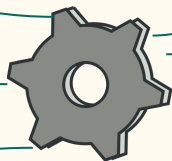
Feature Engineering

1. Top 20 Ask Price

2. Top 20 Bid Price

3. Top 20 Ask Size

4. Top 20 Bid Size



Must Have

1. Weighted Average Price
 2. Log Price
 3. Log Return
 4. Realized Volatility
-

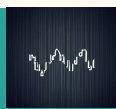
Additional

5. Bid-Ask Imbalance
6. Order Flow Imbalance
7. Total Depth
8. Price Momentum
-
-
-
30. Liquidity
31. Bid-Ask Spread Velocity
32. Order Book Density Slope
33. Time Series Indicators
(SMA, EMA, RSI)

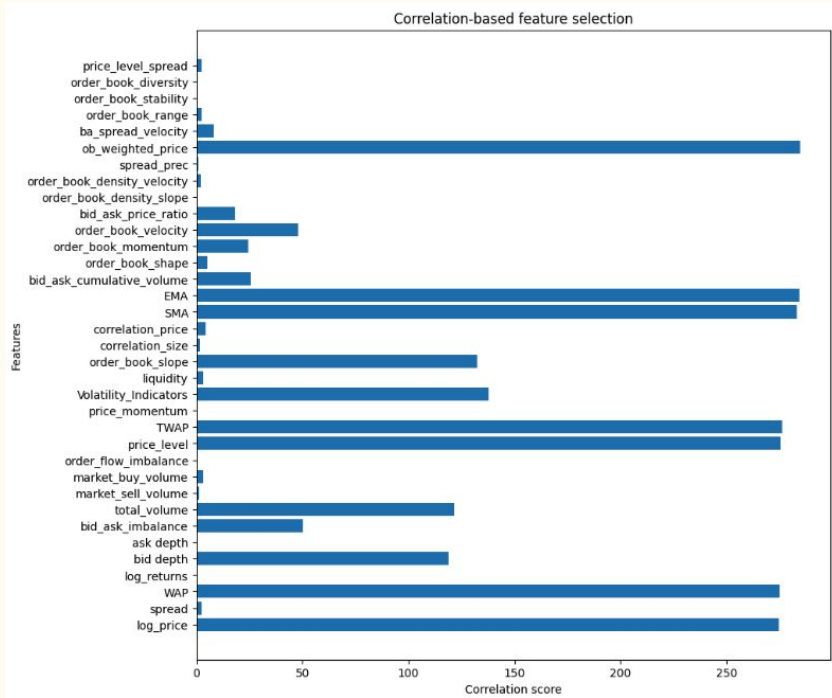


Product Manager

Source



Feature Selection: SelectKBest



Correlation-based feature selection
Calculating linear dependency based on p-values

Top 10 features:

1. Log Price
 2. Weighted Average Price
 3. Total Volume
 4. Price Level
 5. Timed Weighted Average Price
-
6. Volatility Indicators
 7. Order Book Slope
 8. Simple Moving Average (SMA)
 9. Exponential Moving Average (EMA)
 10. Order Book Weighted Price



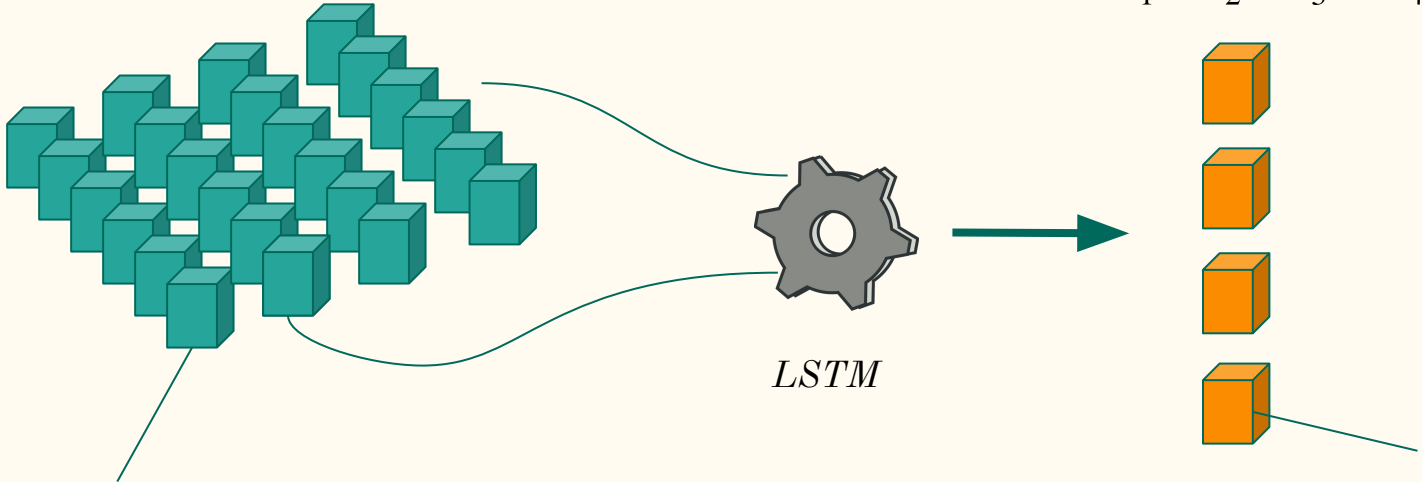
Product Manager



Model Architecture: LSTM

$X_1, X_2, X_3 \dots X_{23}, X_{24}$

Y_1, Y_2, Y_3, Y_4

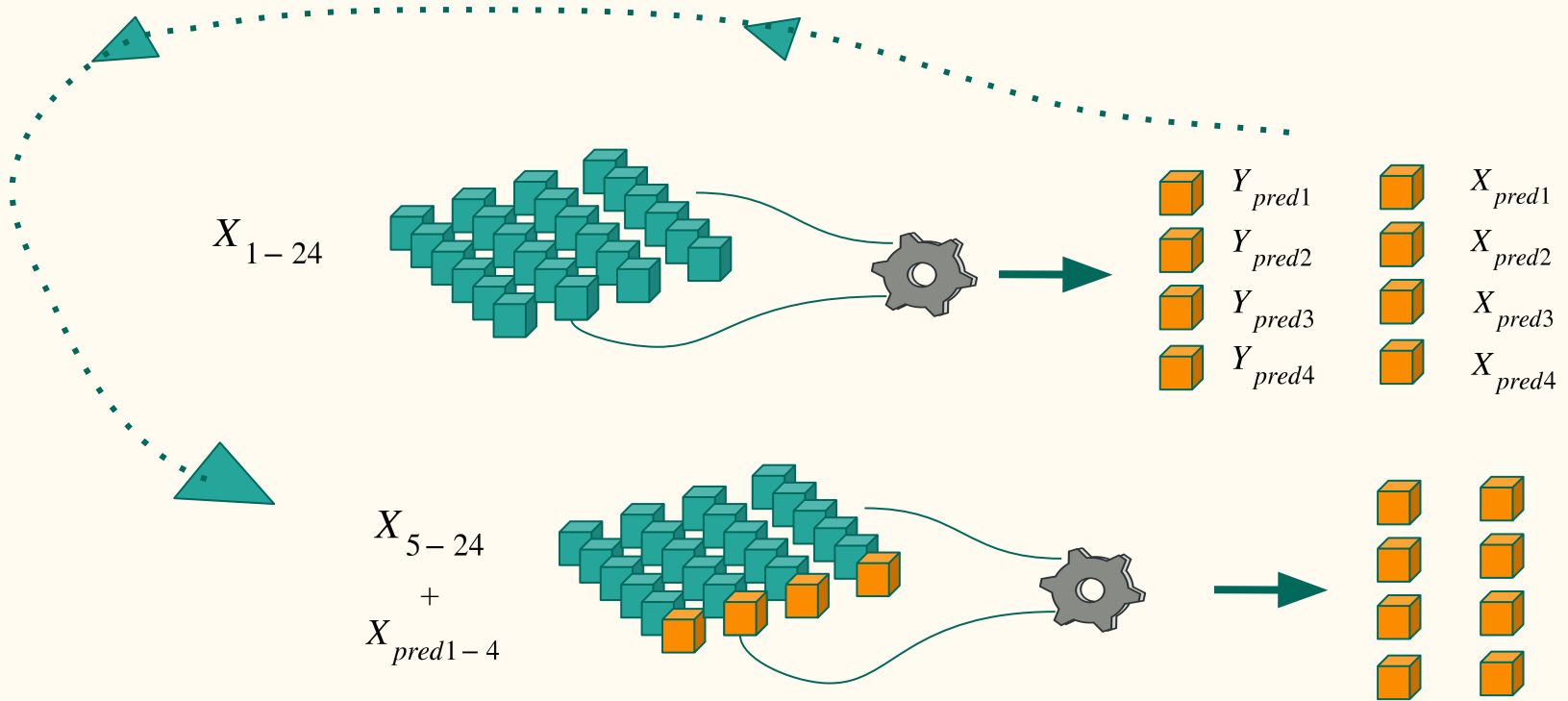


X: Top 5 features
(based on correlation-based feature selection)

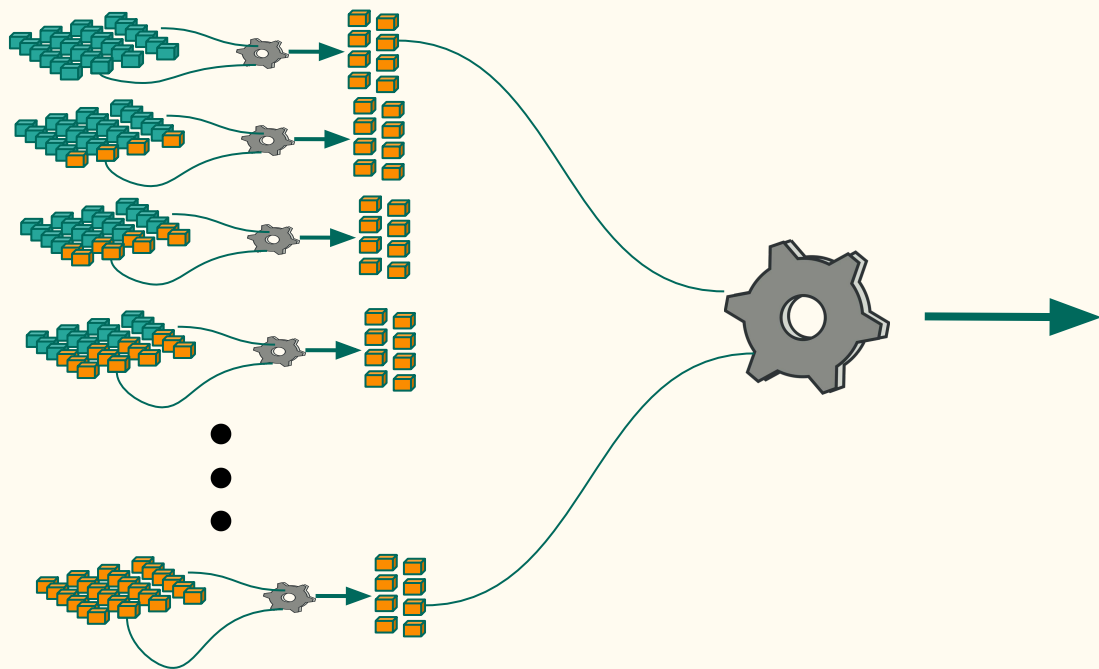
Y: Volatility in next 1 minute
(Target Variable)



Autoregressive (1)

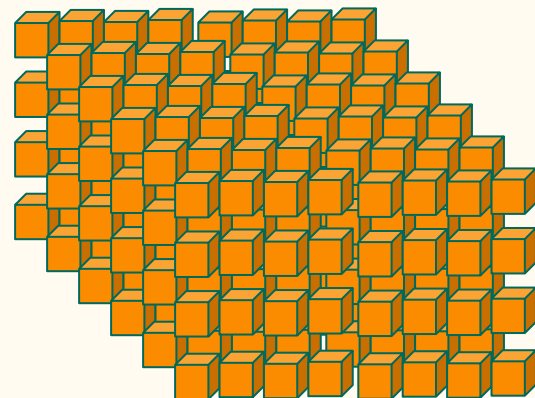


Autoregressive (2)



Realized Volatility in next 8 hours

$$Y_{pred\ 1 - pred\ 480}$$



Platform Showcase



Real-Time Volatility Dashboard

In 1 minute

1.0275

↑ 0.0319%

In 2 minute

1.0086

↓ -0.0188%

In 5 minutes

1.0269

↓ -0.0019%

In 10 minutes

1.0297

↑ 0.0032%

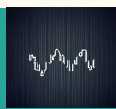
In 30 minutes

1.0127

↑ 0.0055%



Full Stack Developer

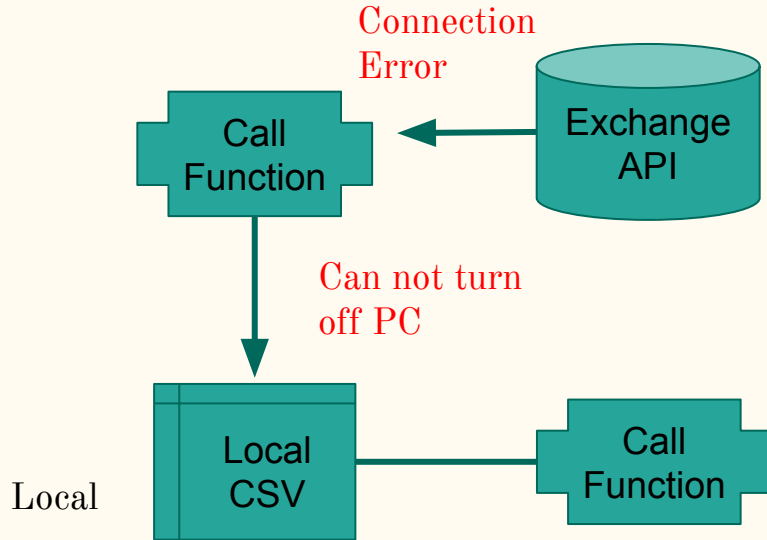


Future Improvement & Limitations

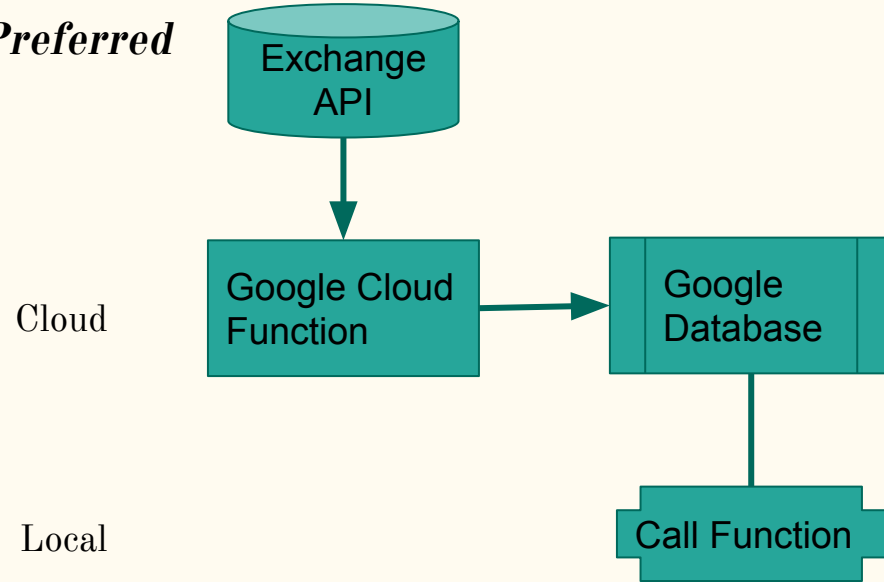


1 Refining Data Extraction ...

Current

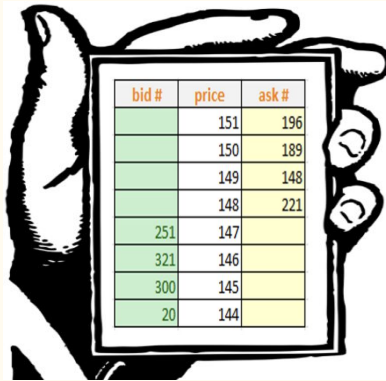


Preferred



2 Diversify Feature Engineering input ...

Current



bid #	price	ask #
	151	196
	150	189
	149	148
	148	221
251	147	
321	146	
300	145	
20	144	

- Solely depend on the bid/ask price/ask (80 total for each interval)
- Hard to capture influence outside the Order book

Preferred



- Diversified Feature input for Feature Engineering:

Derivatives Market OB, Market Volume, On-Chain transaction, Sentiment Analysis (Social Media)

- Able to capture more influence and produce higher model accuracy.



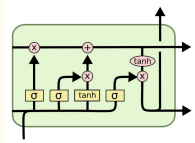
Product Manager



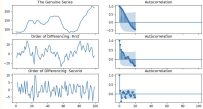
3 Improving Model ...

Current

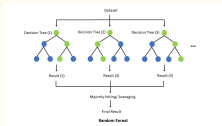
LSTM



ARIMA



Random Forest



Preferred

- Hyperparameters tuning and regularization
- More Feature creation and Feature Selection
- Attempt on more models and combined models:
 - GBRT - Gradient Boosting with Regression Trees
 - LightGBM - Efficient GBRT with feature building
 - Elastic Net Regression - Lasso + Ridge Penalty
- Exchange ideas with professions



Product Manager



Thank You

Triple Volatility Standard (TVS)

