

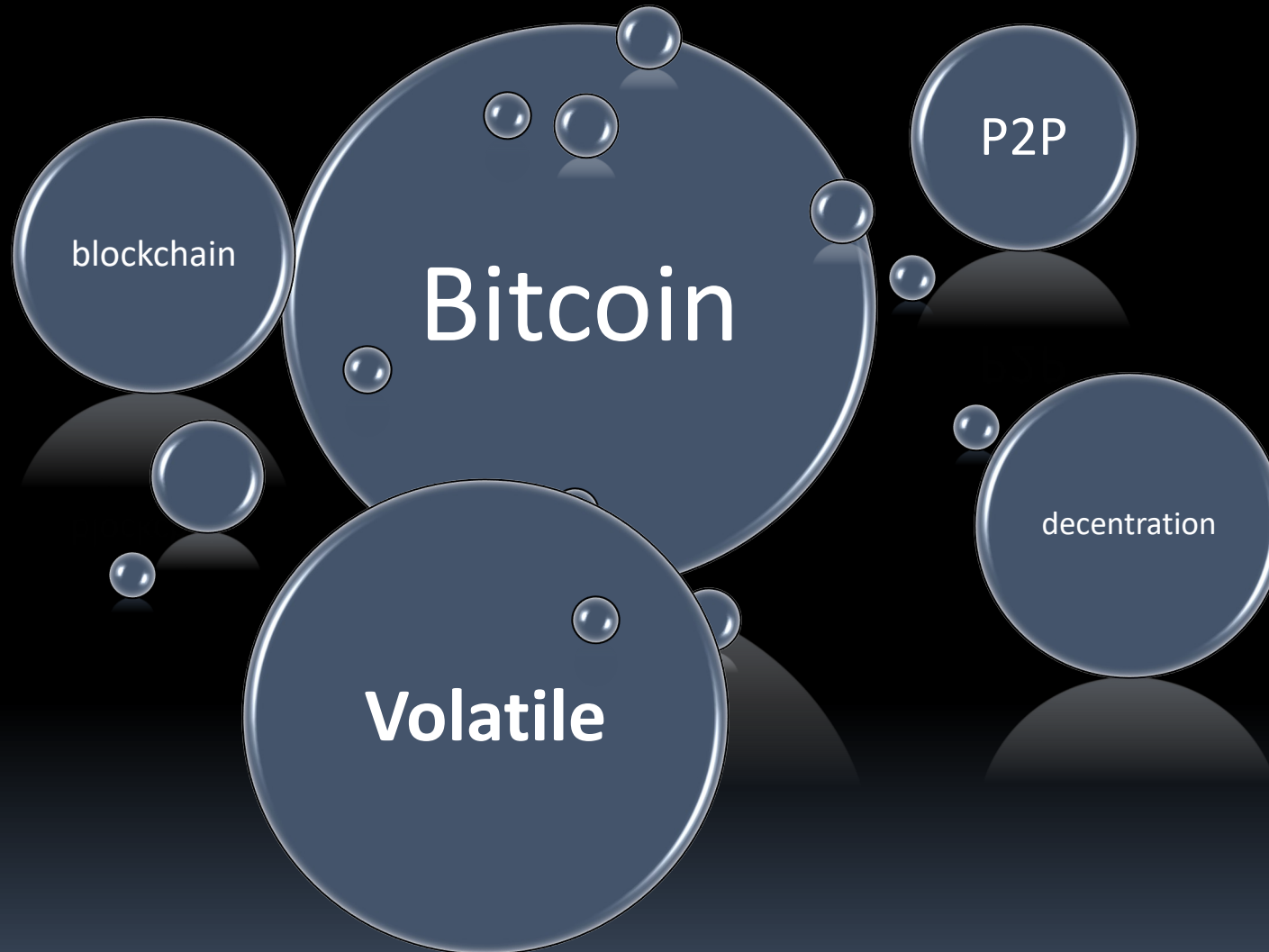
Forecasting Bitcoin Market Using XCS Classifier

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Outline

- ❖ Introduction
- ❖ Data Encode
- ❖ XCS Model
- ❖ Experiment
- ❖ Conclusion

Introduction





Data Encode

Basic Data

- Download from [investing.com](https://www.investing.com)
- 2010/07/18 ~ 2020/06/05

Indexes

- Derived from basic data
- Help traders to realize the market trends

Data Encode - Basic

Open

Close

High

Low

Vol

Data Encode - Basic



Data Encode - Index



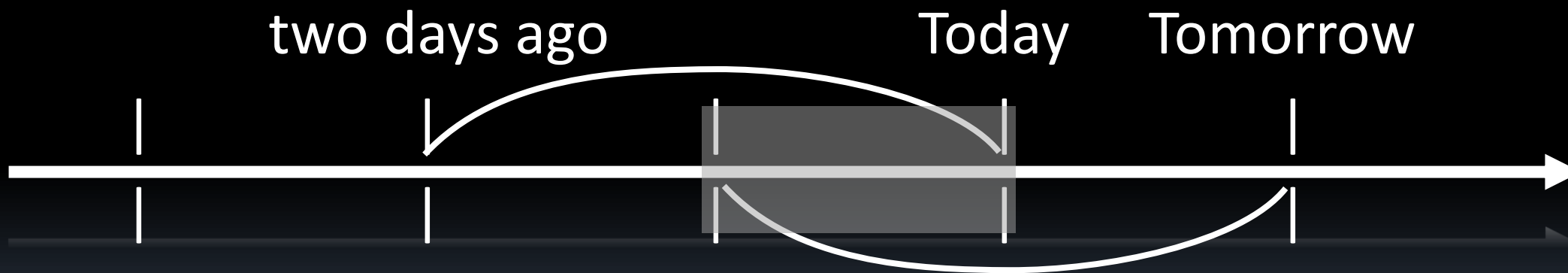
RSI: Relative Strength Index

MA: Moving Average

BIAS: Bias Ratio

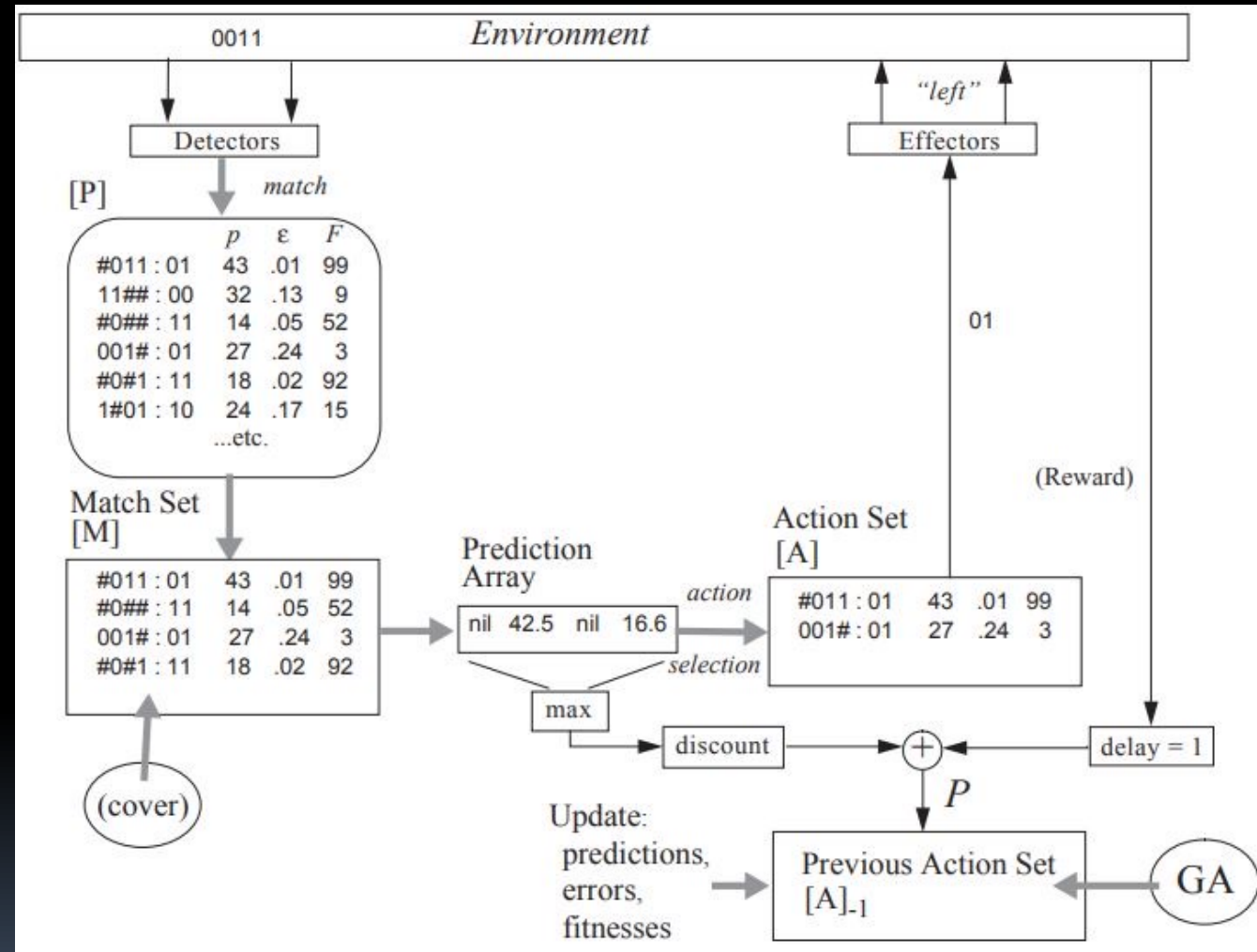
Data Encode - Output

- $MA_n(\text{目標日隔天}) - MA_n(\text{目標日})$
= 隔天收盤價 - (n-1)天前收盤價
- $MA_n = \frac{\sum \text{前}n\text{天收盤價格}}{n}$
- binary classification $\rightarrow \text{Sign}(\text{隔天收盤價} - n-1\text{天前收盤價})$
- $n = 3$



XCS Model

- Python XCS package
- Recap.



XCS Model

- Parameter setting

Parameter	Value/Action
Exploration prob	0.1
Discount factor	0.1
Crossover prob	0.6
Mutation prob	0.05
Action set subsumption	Enable

- Reward Function

- ✓ 1 if (predicted trend == actual trend), 0 otherwise.

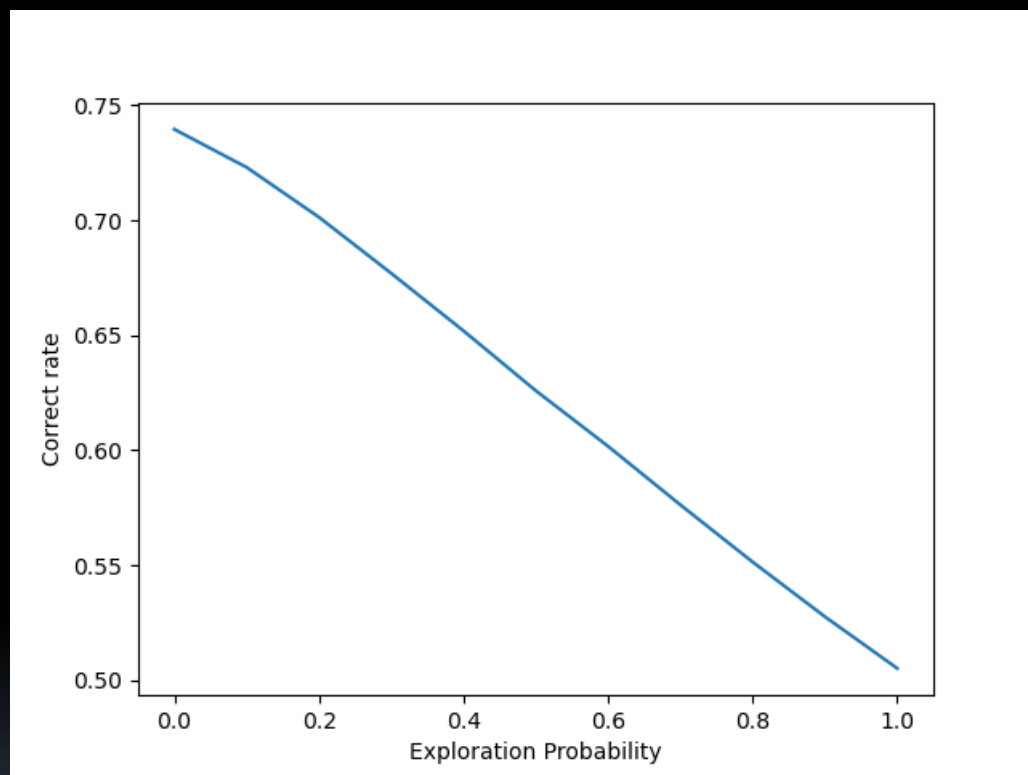
Experiment

- Bitcoin dataset:
 - ✓ Training set: first 50%
 - ✓ Testing set: last 50% (keep learning)
- Comparison method:
 - ✓ Baseline: Always Say True
 - ✓ Financial indicators: RSI, BIAS and deviation of MAP

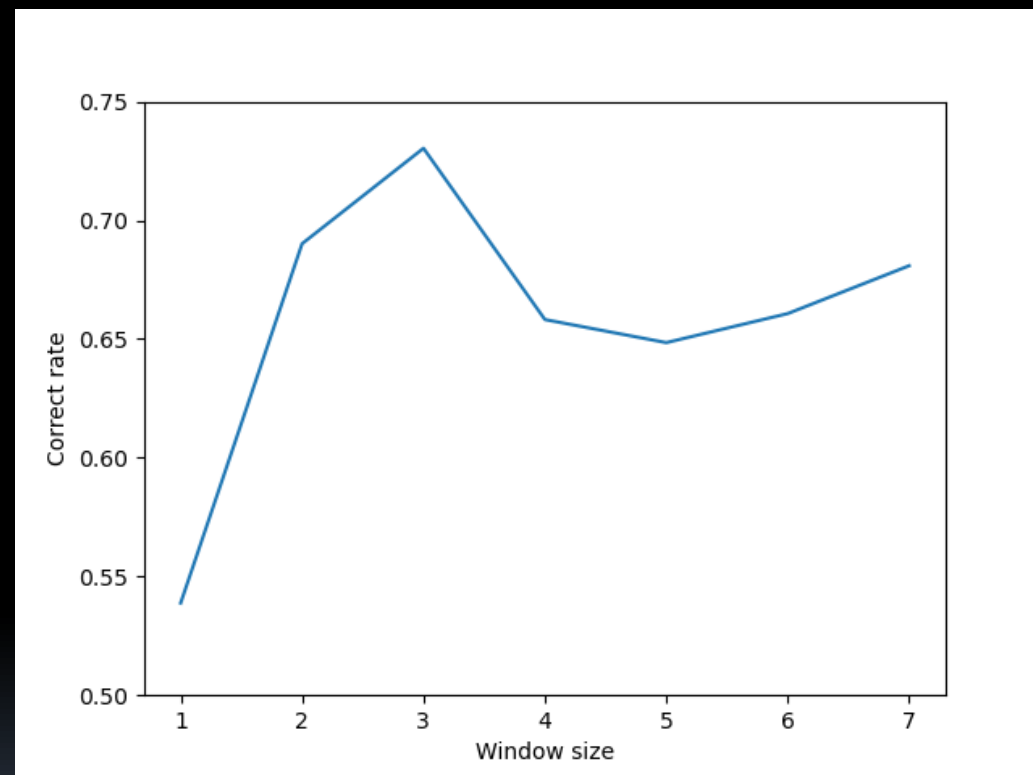
Model	Mean Correct Rate	STD
Always Say True	0.568	0
Ours (w/ Indicator)	0.616	0.019
Ours (w/o Indicator)	0.723	0.009

Experiment

Experiment on different exploration probability



Predicted MAP change with different time window size



Experiment

- Generalizability of rules
- Train on Bitcoin dataset
- Test on Ether dataset (2016/3/10~2020/6/15)

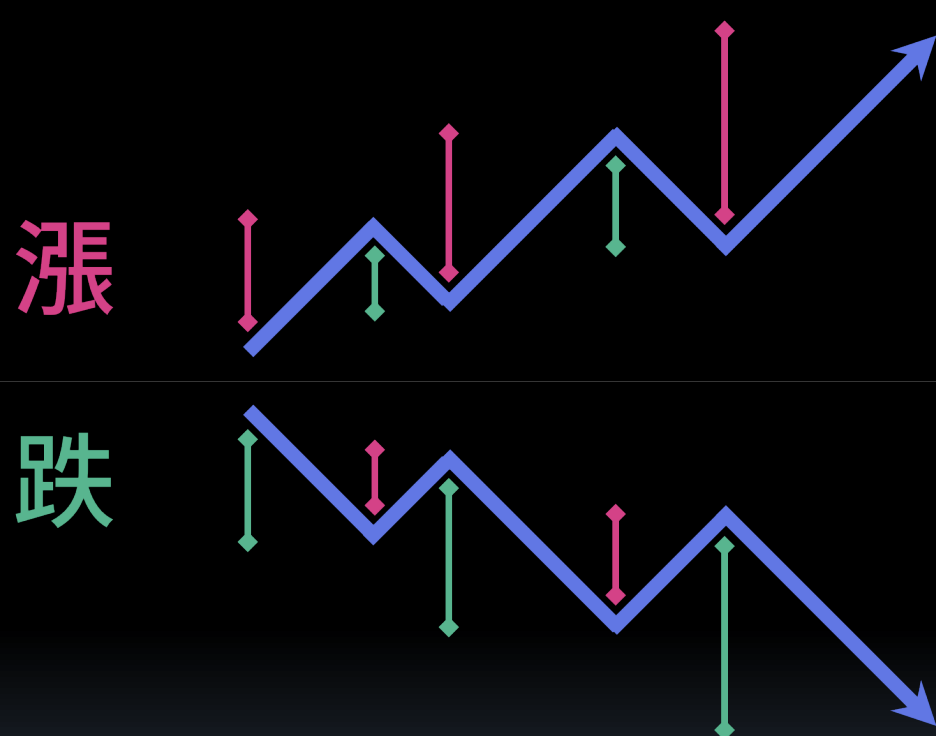
Dataset	Mean Correct Rate	STD
Bitcoin Test Set	0.702	0.014
Ether Test Set	0.704	0.009

Conclusion

- Use XCS and historical data to predict the trend of Bitcoin
 - ✓ Trend: Moving Average Price over 3 days.
- Achieve 0.723 correct rate
 - ✓ XCS can evolve a set of rules and adapt to dynamic bitcoin market.
- Result shows XCS can learn general rules about cryptocurrency.

Q&A

Data Encode - RSI



$$\frac{n\text{天內紅色總長}}{n\text{天內紅色總長} + n\text{天內綠色總長}} \times 100$$

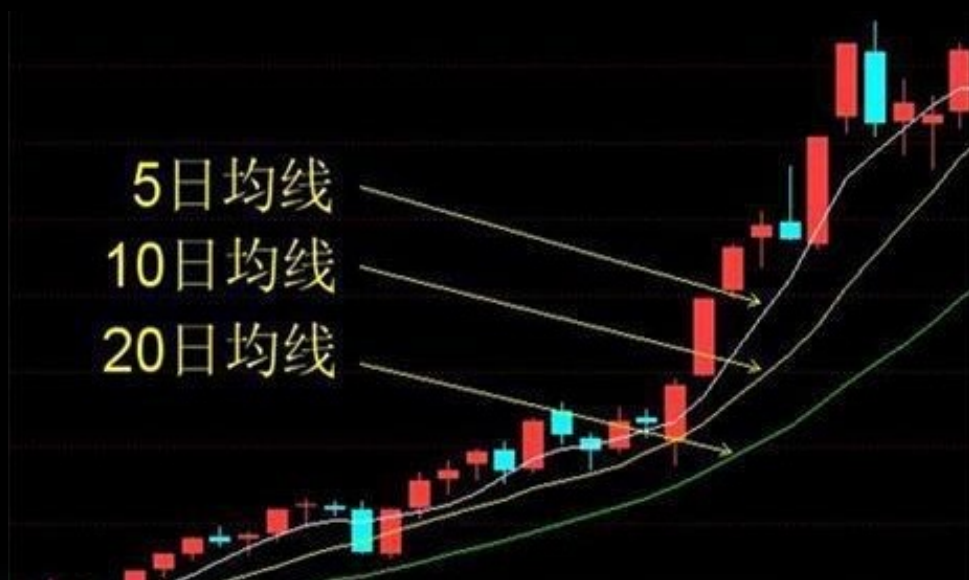
RSI > 70 : Overbought

RSI < 30 : Oversold



(RSI < 50) ? 1 : 0

Data Encode - MA



- $MA_n = \frac{\sum \text{前}n\text{天收盤價格}}{n}$
- 多頭排列 : 1
- 空頭排列 : 0
- $n = 30, 10, 5$

Data Encode - BIAS

- $\frac{\text{收盤價} - \text{均線值}}{\text{均線值}} \times 100\%$
- 正乖離 = 乖離率 > 0 , 上漲機率高 : 1
- 負乖離 = 乖離率 < 0 , 下跌機率高 : 0