

Self Introduction & Research Summary

Joseph Chuang-Chieh Lin (林莊傑)

Seth Technologies Inc. (塞特科技)
Taiwan

24 September 2020

About Me

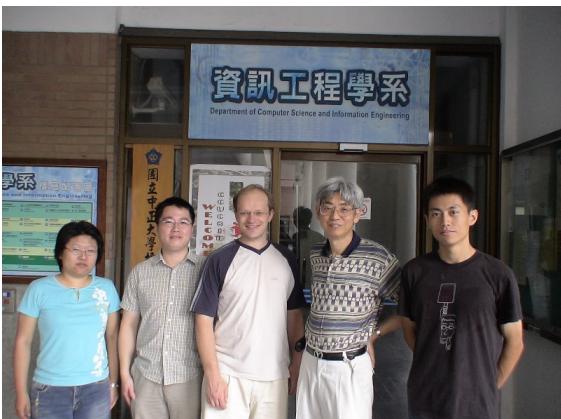
- **BS.**: Mathematics, National Cheng Kung University, 2002.
- **MS.**: CSIE, National Chi Nan University, 2004.

- Advisor: R.C.T. Lee



- **Ph.D.**: CSIE, National Chung Cheng University, 2011.

- DAAD-NSC Sandwich Program scholarship holder (2007–2008).
 - Advisors: Maw-Shang Chang & Peter Rossmanith



About Me

- **Postdoc** in Genomics Research Center (GRC), Academia Sinica (2011–2014; alternative military service).

- Bioinformatics, comparative genomics
 - Project investigator: Trees-Juen Chuang



- **Postdoc** in Institute of Information Science, Academia Sinica (2014–2018).

- Machine learning, game theory
 - Project investigator: Chi-Jen Lu



About Me (cont'd)

- **Quantitative Analyst (intern)** of Point72/Cubist Systematic Strategies (2018–2019).

- Hedge Fund; Fintech; Data Science
- US hedge fund (Taipei Branch in 2019)
- CEO & Chairman: Steven A. Cohen



- **Quantitative Analyst** of Seth Technologies Inc. (2020–present).

- High-Frequency Trading; Hedge Fund; Fintech; Data Science
- Taiwan based.



Billionaire investor Steve Cohen finalizes deal to buy New York Mets

"This is different, this is a trophy investment," one sports attorney said.



Steven Cohen, Chairman and CEO of Point72 Asset Management, speaks at the Milken Institute Global Conference in Beverly Hills on May 2, 2016.
Lucy Nicholson / Reuters file

智慧經營／塞特科技執行董事王櫻娟 創新投資
追求絕對收益

f 分享 g 分享 m 留言 t 列印 s 存

2020-06-22 02:00 經濟日報 魏興中

在台北市民生社區的花園裡，有一家很特別的新創團隊—塞特科技，在金管會攜手金融總會所指導的「FinTechSpace金融科技創
新園區」中，被歸類在智能理財，但資料裡卻寫著是高頻量化交易。

塞特科技執行董事王櫻娟表示，塞特科技其實是一家交易技術導向的科技公司，在巴塞爾銀行監理委員會（BCBS）所提出金融科
技服務類型中，歸屬在投資管理中的高頻交
易。

塞特運用現代統計理論進行行情數據訂閱與
過濾、及全棧（Full Stack）化交易，透過
低延時通信網路架構系統與節點布置，邏輯
穩定且執行高效，使用超高速的複雜計算機
系統採取自動化下單。

高頻交易 塞特科技



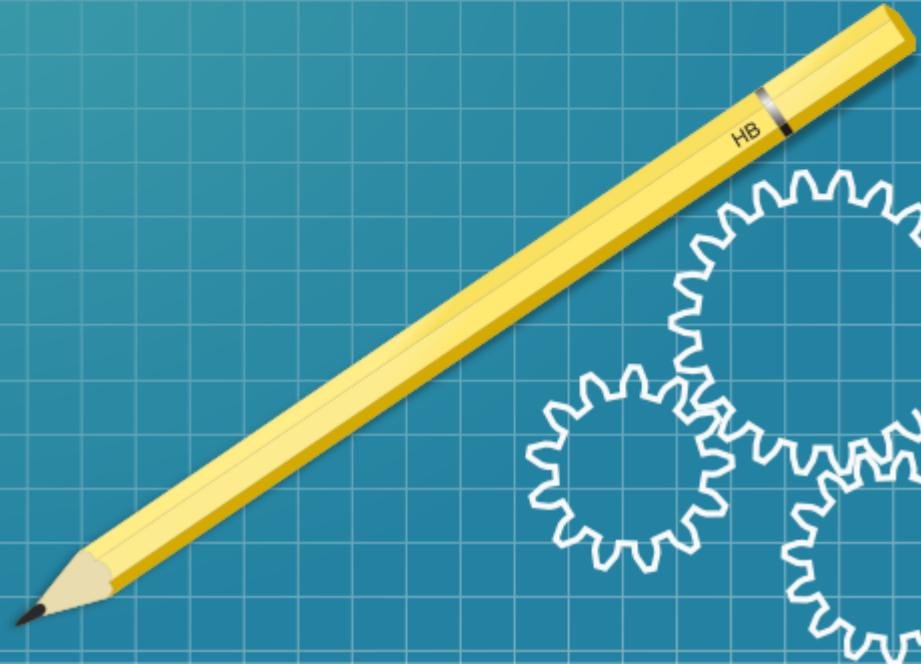
塞特科技執行董事王櫻娟表
示，高頻交易如同皇冠上的
鑽石，以強大信息技術疊加
較古法而勝，扛起獨創的能

About Me (cont'd)

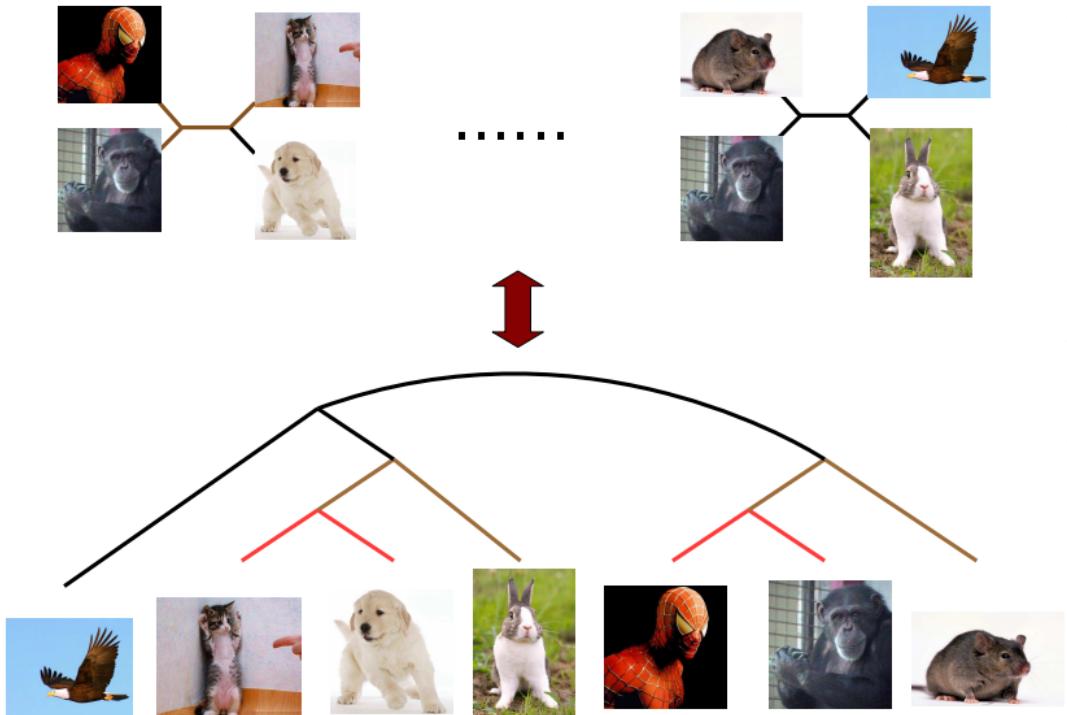
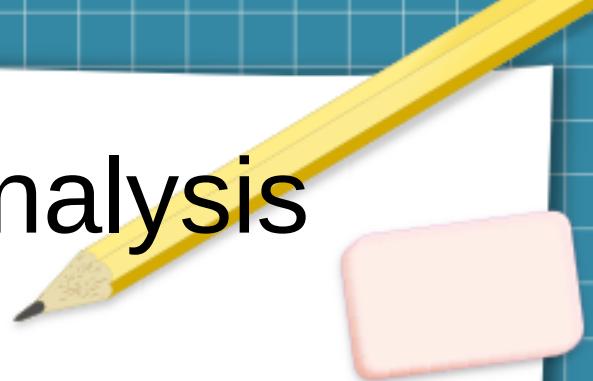
- Amateur mid-long distance runner/marathoner
 - 800m 2:05:07
 - 5000m 17:00.27
 - Half marathon 1:21:02
 - Marathon 2:56:56
- NCKU Track & Field School Team
 - Mid-long distance captain (2001)
 -
- CCU 1500m, 5000m School Record Holder (former)



Research Summary



1. Algorithm Design and Analysis



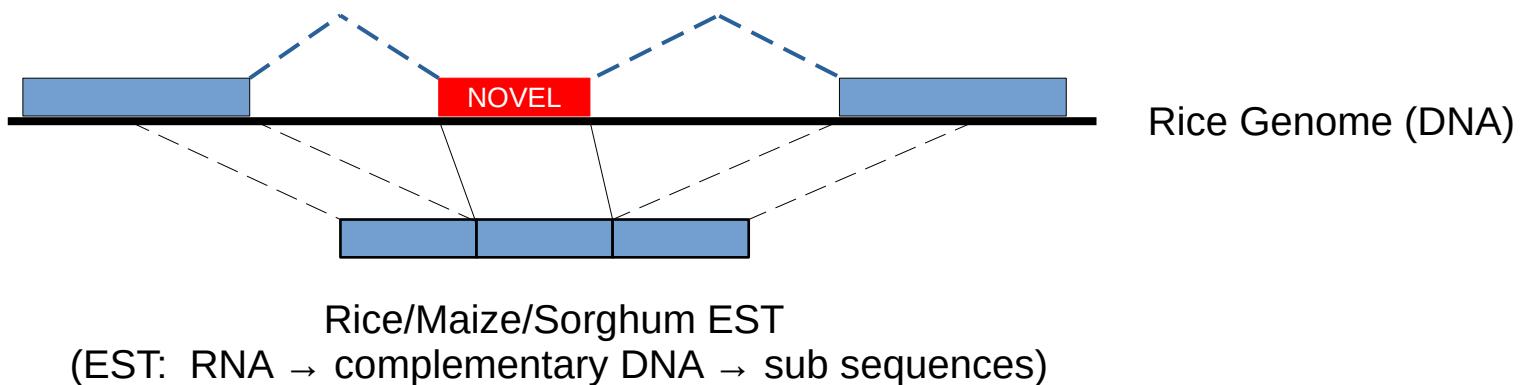
- n : # species
- Question: Does there exist an evolutionary tree T such that there are $\leq k$ incompatible small trees?
- Previous result:
 - $O(4^k n + n^4)$.
- Our result:
 - $O((1+\varepsilon)^k \text{poly}(n))$
 - $O(n^3)$ to tell w.h.p. if
 - it's true or
 - it's far from being true (very big k).

*Theory of Computing Systems (2010, 2011)

*Information Processing Letters 113 (2013)

Joint work with Maw-Shang Chang and Peter Rossmanith

2. Bioinformatics



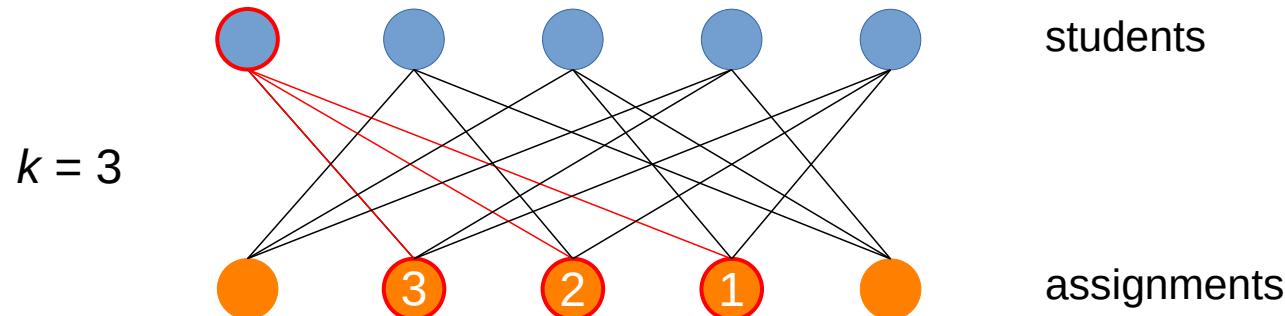
- Identification of novel coding region (exon) through cross-species EST mapping.
- Investigation of their selection pressure.
 - Whether the mutation changes protein-coding or not.

*BMC Plant Biology (2015)

Joint work with Trees-Juen Chuang, Min-Yu Yang, Ping-Hung Hsieh, and Li-Yuan Hung

3. Peer Grading Mechanism

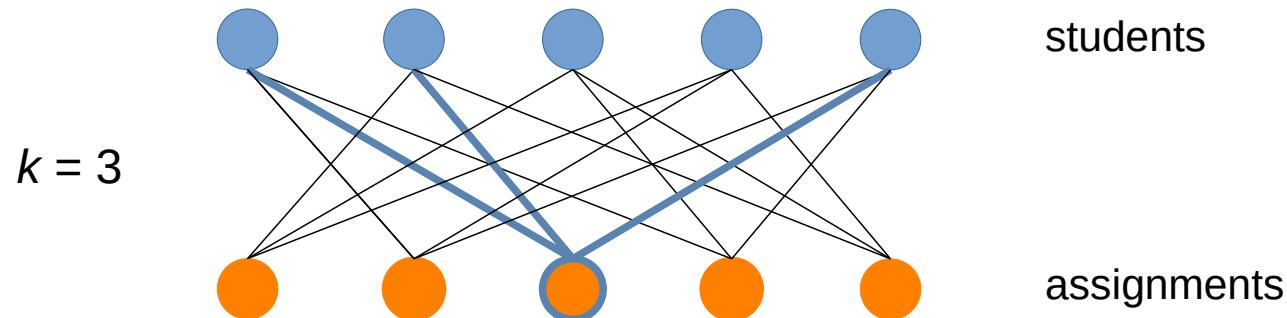
- MOOC (Massive Online Open Courses)
- Every student has an assignment.
- The teacher cannot grade them all by herself.
- ☞ Every student is asked to 'grade' (rank) assignments (randomly) of k other students, and every assignment is (randomly) graded by k other students. Then aggregate the results.



*ACML (2018)
Joint work with Chi-Jen Lu

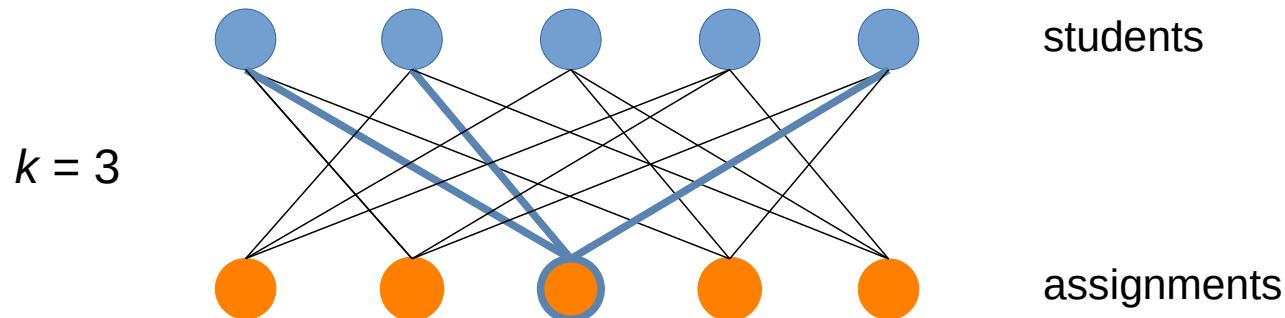
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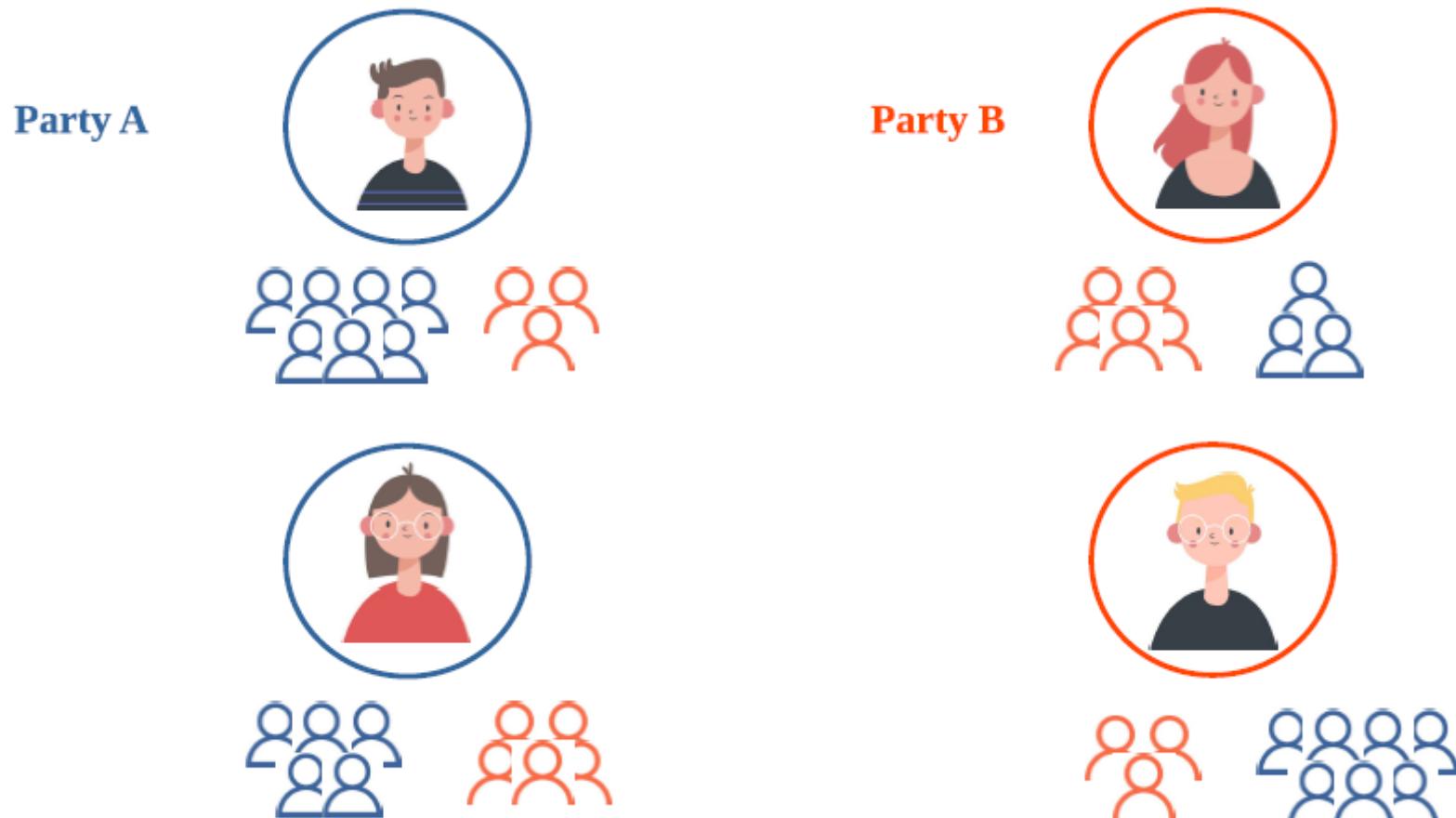
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- Every student is asked to 'grade' (rank) assignments (randomly) of k other students, and every assignment is (randomly) graded by k other students. Then aggregate the results.
- Ratio of wrong pairwise orders is $O(1/k)$.



*ACML (2018)
Joint work with Chi-Jen Lu

4. Two-Party Election Game



*EC (2020) Poster Main Session; submitted to a journal.
Joint work with Chi-Jen Lu and Po-An Chen

Two-Party Election Game (cont'd)

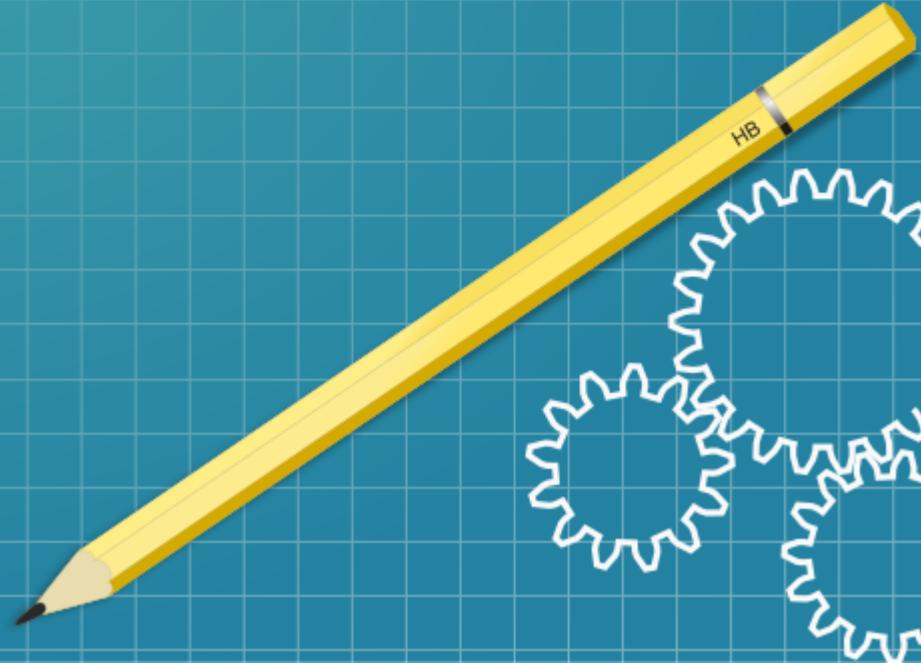


*EC (2020) Poster Main Session; submitted to a journal.
Joint work with Chi-Jen Lu and Po-An Chen

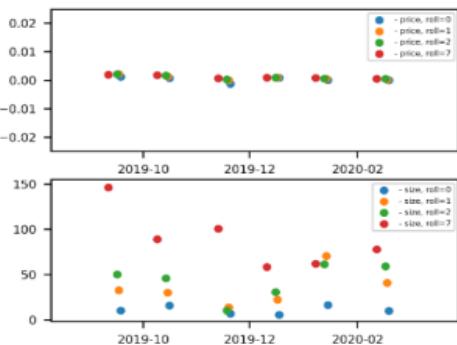
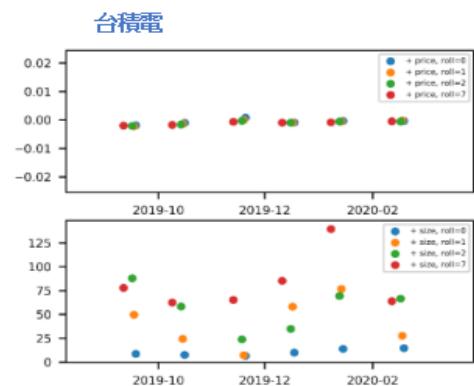
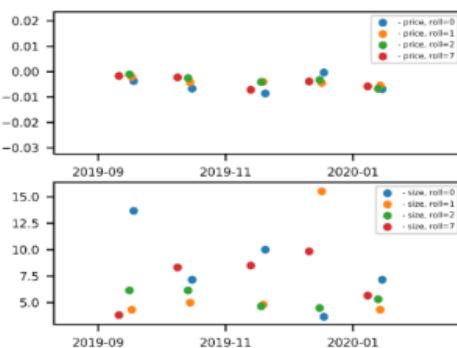
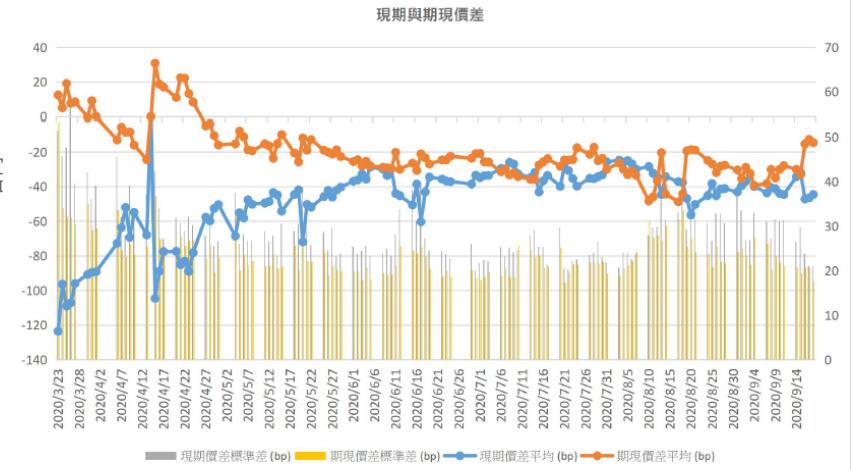
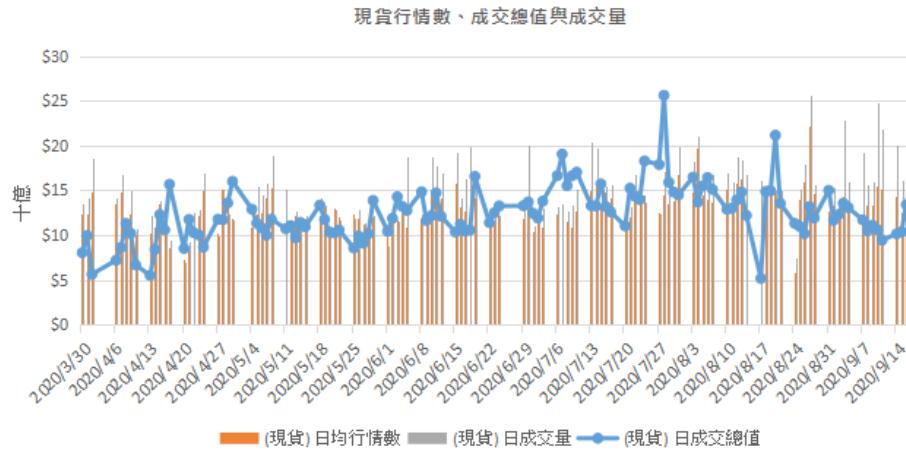
- Pure Nash equilibria exist?
- Price of Anarchy?

Step Into Fintech World

- Quantitative Financial Analysis

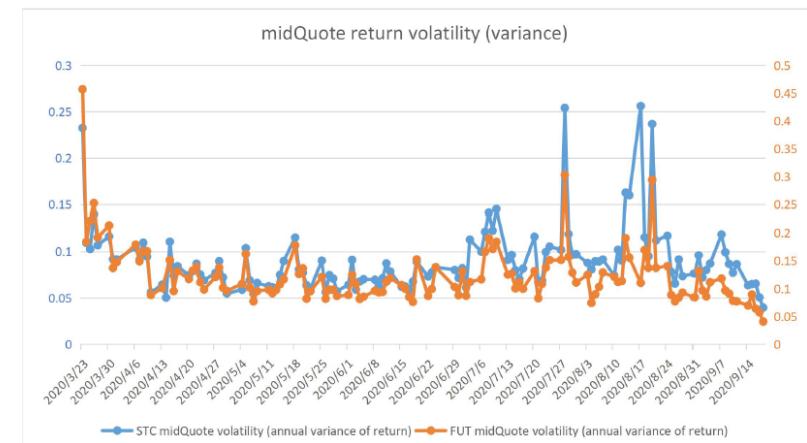


Market Microstructure



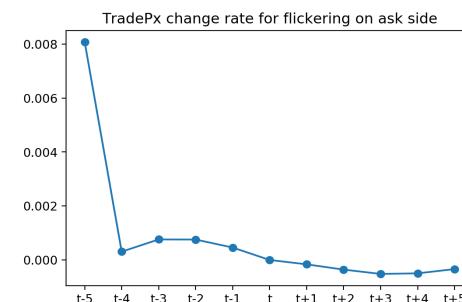
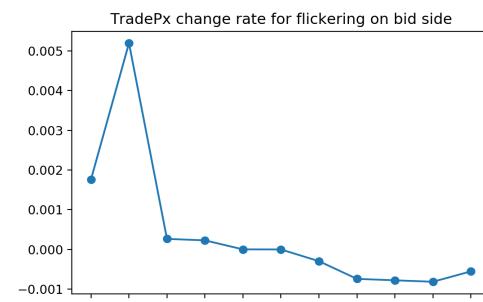
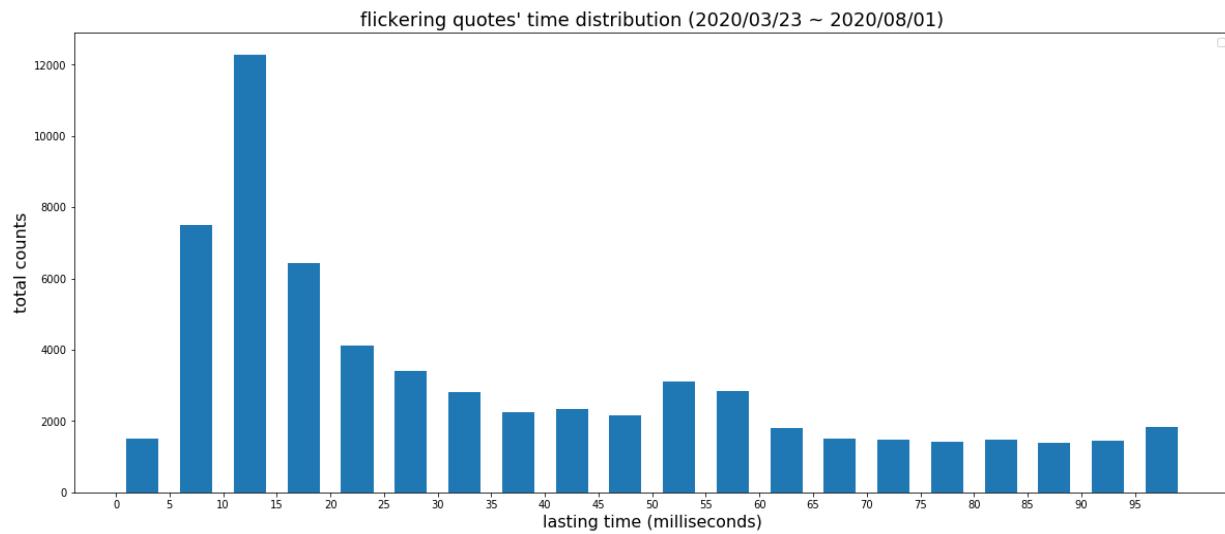
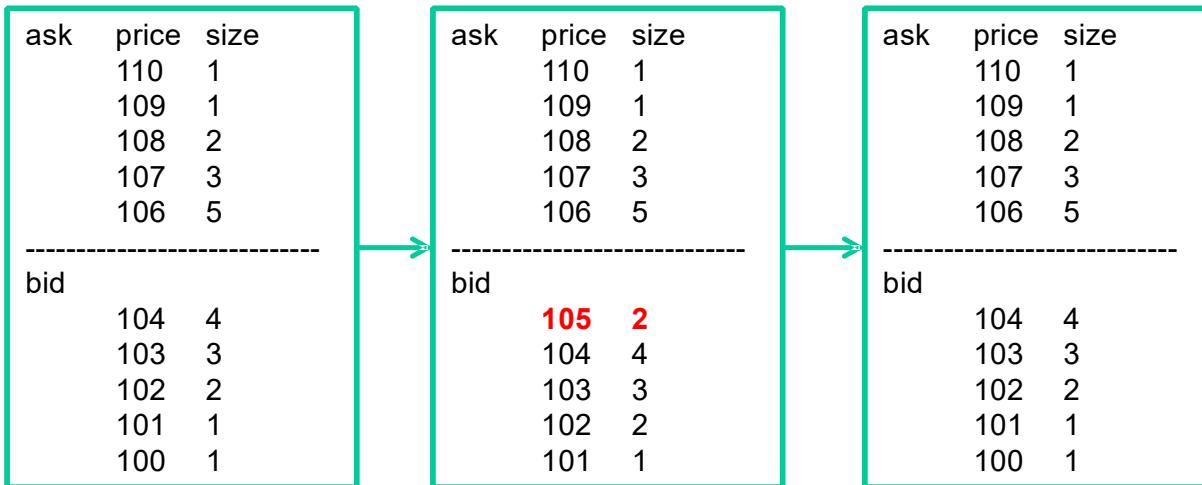
[說明]:
 ❖ 「期現價差」為期貨買一價 (futures bidPrice1) 減去現貨賣一價 (stocks askPrice1) 後之值除以現貨賣一價。
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(七) 市場波動率



Flickering Quotes Analysis

- The scenario in the orderbook (訂單簿)



Flickering Quotes Analysis (cont'd)

Emergence of Flickering Quotes After Trading Mechanism Changes in the Taiwan Stock Market

Hongsong Chou and Chuang-Chieh Lin

Abstract

With new trading mechanism introduced in the Taiwan Stock Exchange on March 23, 2020, evidences of flickering quotes in market tick data have been obtained and presented. Cross panel analysis of such flickering orders shows that, although many stocks exhibit flickering order evidences, certain stocks with unique features are more prone to the potential issue of liquidity bursting and fleeting in short periods of time. In addition, models that forecast the bursting/fleeting features of liquidity are developed with the aim of monitoring the emergence of flickering orders.

Key words: Market microstructure, liquidity, limit orders, fleeting orders

Hongsong Chou

- Co-founder of Seth Technologies
- Faculty of Financial Mathematics, The University of Chicago

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Hongsong Chou

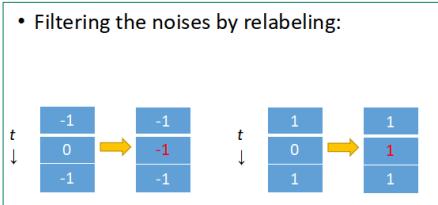
Hongsong Chou has been a finance professional for almost 20 years, holding senior positions with Lehman Brothers, Nomura and Citic Securities in New York, Tokyo, Hong Kong, and Shen Zhen, China. Hongsong co-founded Charles River Advisors, and is currently a founding partner with SETH Technologies, a fintech firm that focuses on Asia-Pacific algorithmic trading and investment practices. Hongsong is also on the advisory board of the Crypto-FinTech Laboratory of Hong Kong University of Science and Technology. Hongsong holds a Ph.D. in Astrophysics from Harvard University.



Trend Forecast (Machine Learning)

- The price goes Up, down, or flat?
 - Up: BidPrice1[t+10] > AskPrice1[t] (21.5%)
 - Down: AskPrice1[t+10] < BidPrice1[t] (21.2%)
 - Flat: else (57.3%)

Example (up)

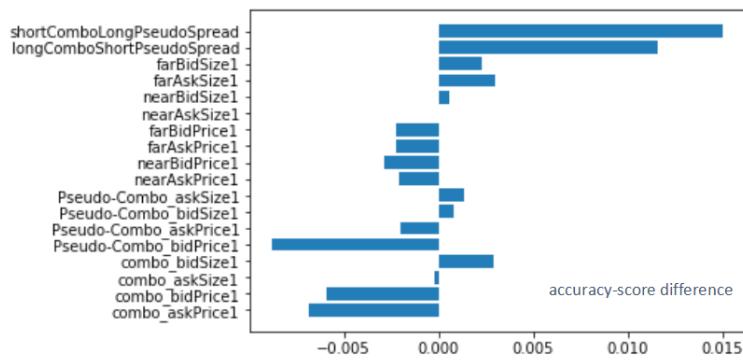


| ask | price | ask | price |
|-----|------------|-----|-------|
| | | | |
| 110 | | 115 | |
| 109 | | 114 | |
| 108 | | 113 | |
| 107 | 106 | 112 | |
| | | 111 | |

| bid | 104 | bid | 110 |
|-----|-----|-----|-----|
| | | | |
| 103 | | 109 | |
| 102 | | 108 | |
| 101 | | 107 | |
| 100 | | 106 | |

| | t | | t+10 |
|--|---|--|------|
| | | | |

Revisit by permutation importance (RandomForestClassifier)

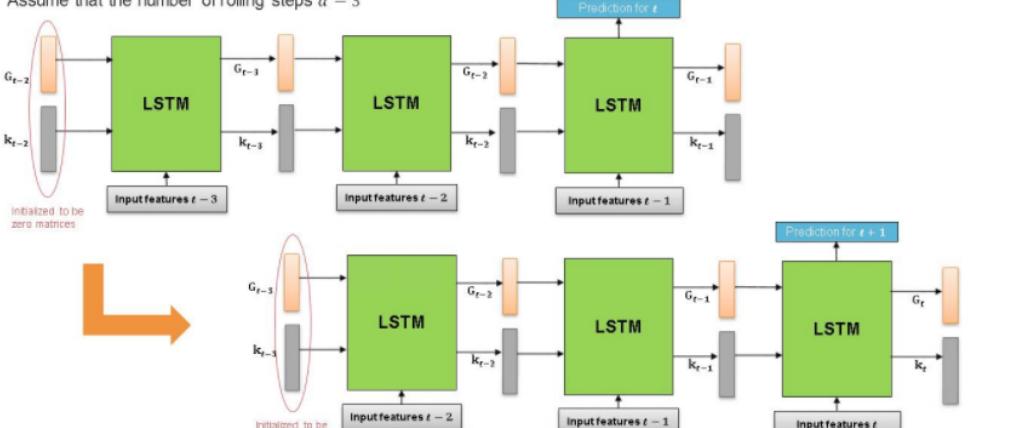


Reference: <https://explained.ai/rf-importance/>

LSTM With Rolling Steps (applied in our model)



Assume that the number of rolling steps $d = 3$



CONFIDENTIAL | 20

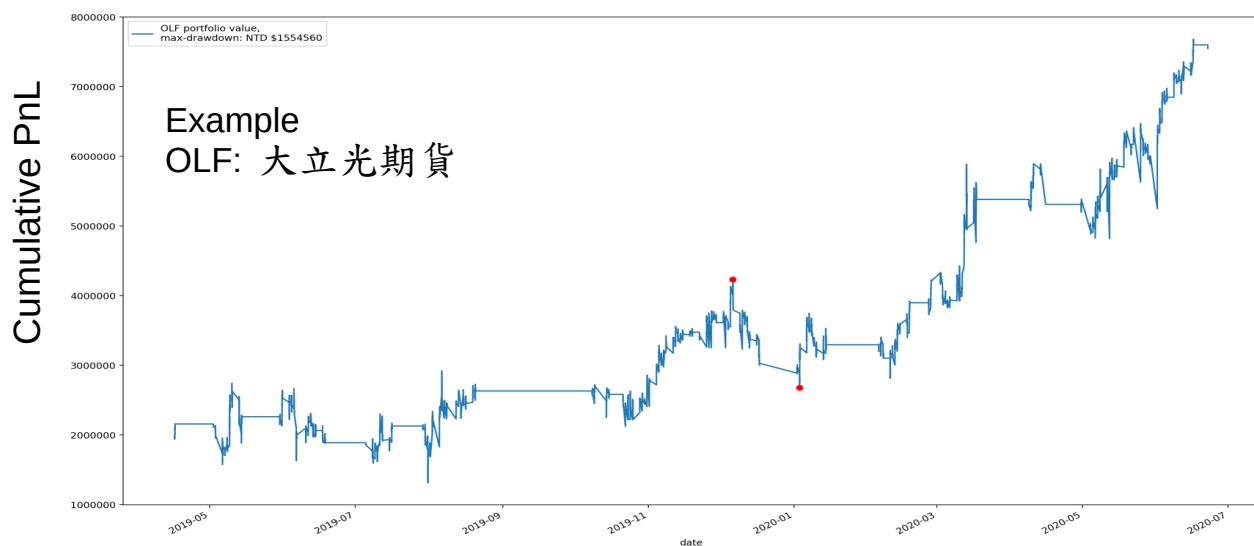
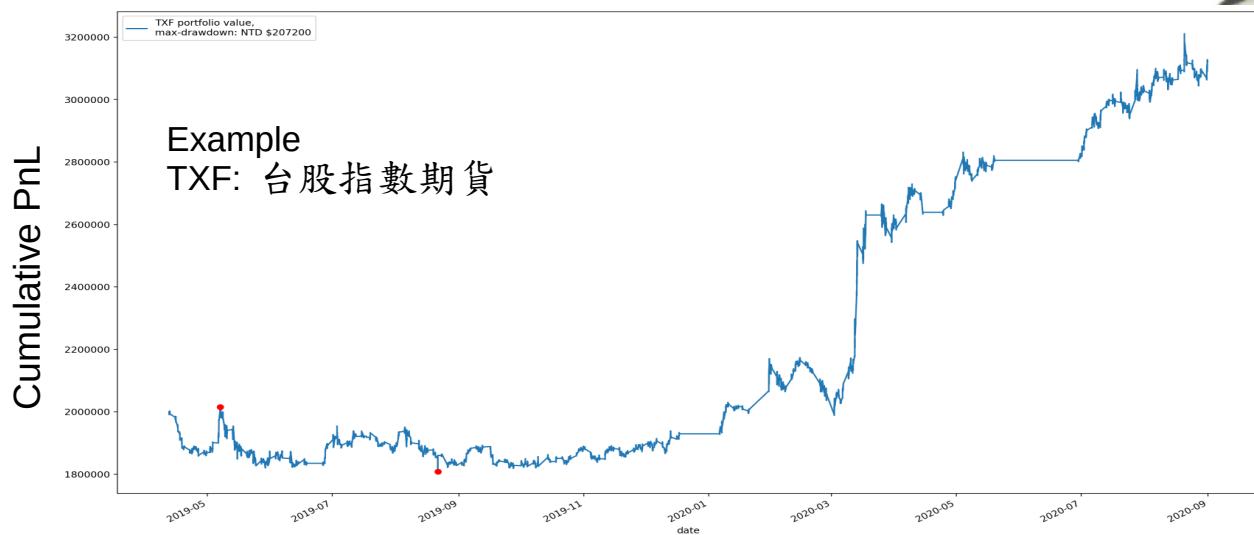
Walk-forward model building

- Data time-range: 2019-01-01~2020-05-31; 08:45 ~ 18:00
- Used features: (dim 200 = 20 features x 20 tick bars):

| combo askPrice1 | combo bidPrice1 | combo askSize1 | combo bidSize1 | pseudo bidPrice1 | pseudo askPrice1 | far spread |
|-----------------|-----------------|----------------|----------------|------------------------------|------------------------------|-------------|
| pseudo bidSize1 | pseudo askSize1 | near askPrice1 | near bidPrice1 | far askPrice1 | far bidPrice1 | near spread |
| near askSize1 | near bidSize1 | far askSize1 | far bidSize1 | spread longCombo shortPseudo | spread longPseudo shortCombo | |

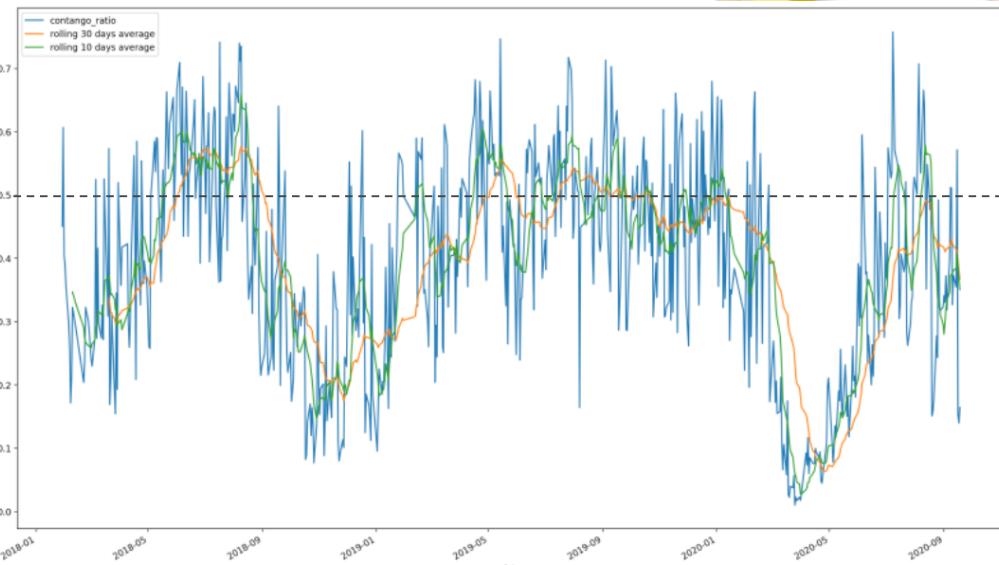
- Training and test data: 60 days for training (including ~4 days for additional validation for choosing the best model among the 3 trained ones) and 5 days for out-sample testing (total 66 models and test datasets).
- Handling data imbalance: RandomUnderSampler (ratio='not minority')
- Model used: MLPClassifier in sklearn.neural_network (+ dropout)
 - hidden layers: 128 x 8 layers
 - batch size: 128
 - solver: adam
 - activation: relu
 - dropout ratio: 0.1
 - max iteration: 200
- Model saving: using joblib package (size each model: ~ 4.4MB)

Trend Forecast (Machine Learning) (cont'd)



Trend Forecast (Machine Learning) (cont'd)

| 期貨代碼 | 標的證券 | 證券代號 |
|------|----------------|------|
| CAF | 南亞塑膠工業股份有限公司 | 1303 |
| CBF | 中國鋼鐵股份有限公司 | 2002 |
| CCF | 聯華電子股份有限公司 | 2303 |
| CDF | 台灣積體電路製造股份有限公司 | 2330 |
| CEF | 富邦金融控股股份有限公司 | 2881 |
| CFF | 台灣塑膠工業股份有限公司 | 1301 |
| CGF | 仁寶電腦工業股份有限公司 | 2324 |



Market trend:

- **Contango**
 - ✓ futures' price > stocks' price
- **Backwardation**
 - ✓ futures' price < stocks' price

- Capital for long stocks: x
- Capital for short stocks: y
- Market contango ratio: r
- Capital ratio for short stocks: θ

商品名稱 : 2330台積電期貨(CDF) 到期月份 :

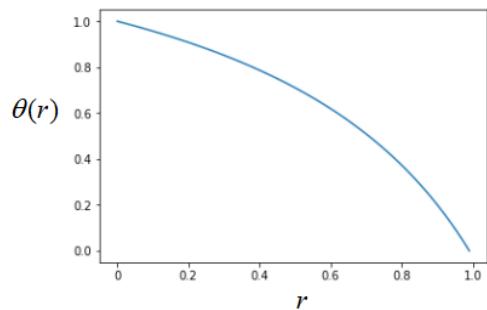
| 加權股價指數: 12,556.47(-89.04) | | 最高: | | | |
|---------------------------|--------|-----|--------|----|----|
| 商品 | 狀態 | 買價 | 買量 | 賣價 | 賣量 |
| 台積電現貨 | -- | -- | -- | -- | -- |
| 台積電期貨100 | 431.50 | 11 | 432.00 | 28 | |
| 台積電期貨110 | 430.50 | 19 | 431.50 | 28 | |

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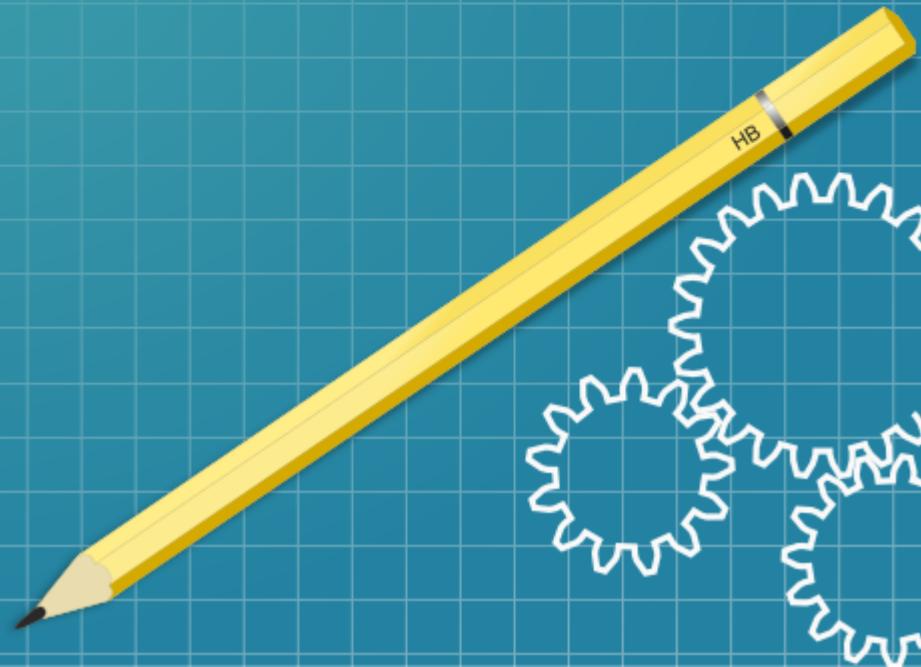
| | | | |
|----|-------|----|--------|
| 開盤 | 436.0 | 漲幅 | -1.03% |
| 買價 | 432.5 | 漲幅 | 1.49% |
| 賣價 | 433.0 | 最高 | 438.5 |
| 成交 | 432.5 | 最低 | 432.0 |

$$r = \frac{\frac{5}{2}x}{\frac{5}{2}x + y} \Rightarrow y = \frac{5}{2r}(1-r)x$$

$$\therefore \theta(r) = \frac{y}{x+y} = \frac{\frac{5}{2r}(1-r)x}{x + \frac{5}{2r}(1-r)x} = \frac{5(1-r)}{5 - 3r}.$$



Future Work

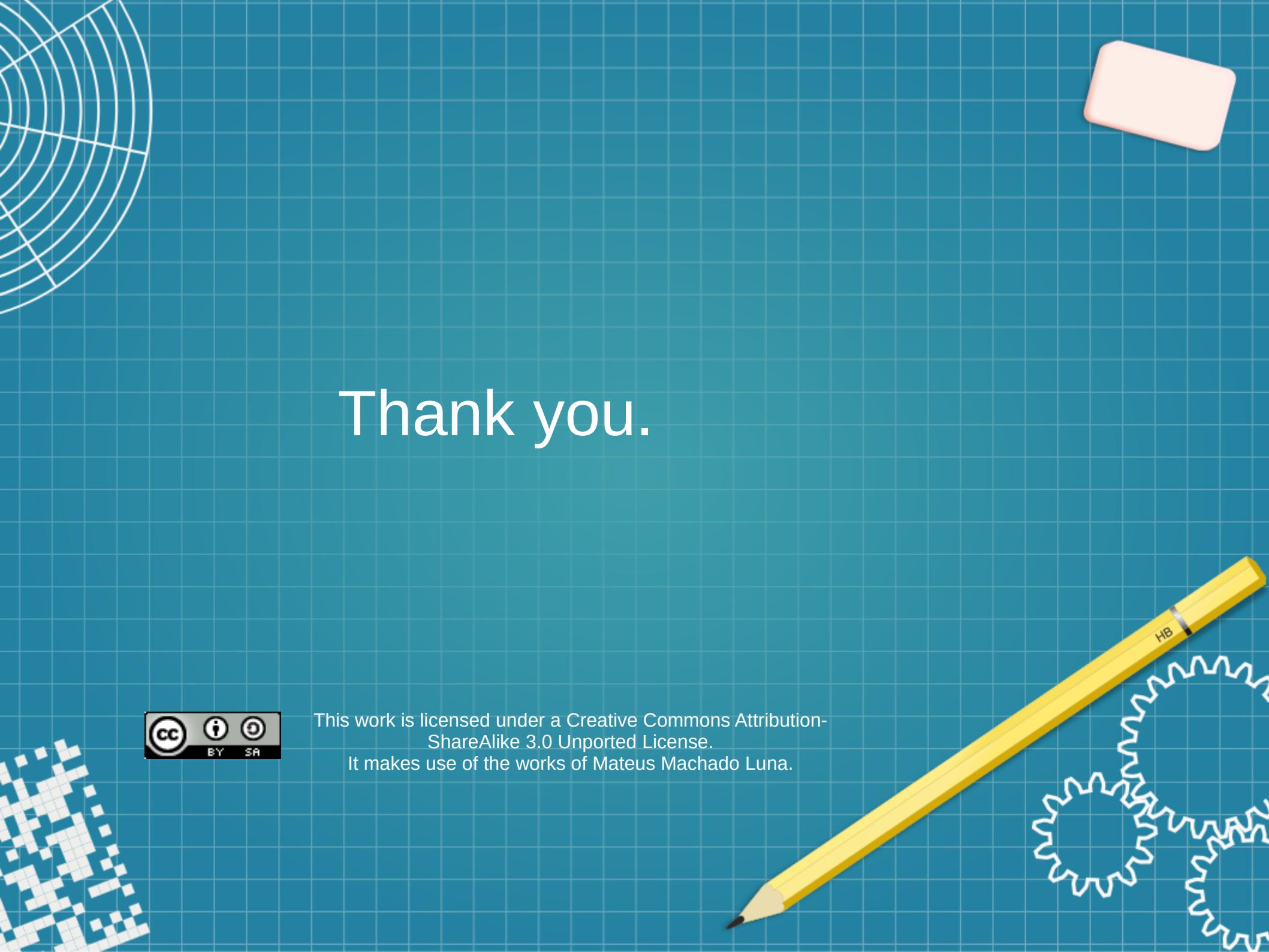


Future Work

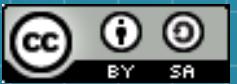
- Two-party election game:
 - Multi-agent (a.k.a. voters) simulation of strategic voting for two-party election game.
 - ☞ Cooperate with Professor Po-An Chen (NCTU) and Chi-Jen Lu (IIS, Academia Sinica)
- Market trend forecast, market anomaly detection.
 - Deep + recurrent neural network / reinforcement learning.
 - ☞ Cooperate with Seth Technologies (well established HF database).

Future Work (International Cooperation)

- Efficient algorithms for NP-hard problems on random graphs.
 - ↳ Bilateral project with Professor Peter Rossmanith (RWTH Aachen University, Germany).
 - ↳ Invitation to visit us.
- On flickering quotes of Taiwan stock market.
 - Statistics and information content.
 - A machine learning model for forecasting flickering quotes.
 - ↳ Cooperate with Prof. Hongsong Chou (The University of Chicago).



Thank you.



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