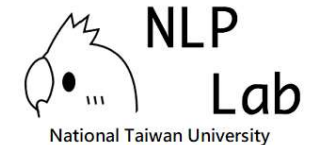
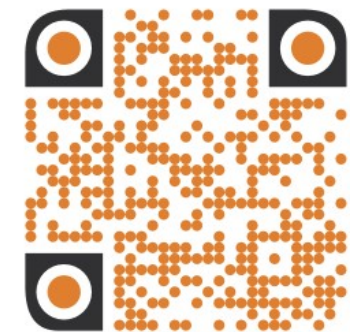


Crowd View: Converting Investors' Opinions into Indicators



Chung-Chi Chen, Hen-Hsen Huang, Hsin-Hsi Chen



<http://cjchen.nlpfin.com>



國立臺灣大學
National Taiwan University



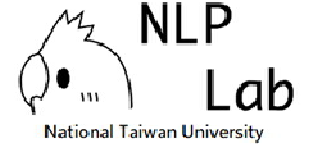
政大
NATIONAL CHENGCHI UNIVERSITY



科技部臺灣大學人工智慧研究中心
科技部人工智慧技術暨全幅健康照護聯合研究中心
MOST JOINT RESEARCH CENTER FOR AI TECHNOLOGY AND
ALL VISTA HEALTHCARE

Bloomberg
Reuters

Market Price = Analyst + **Crowd** + Algo.



Key innovations democratising wealth management



Automated Management and Advice

- Offers high-value advisory services on portfolio allocation and money management at low costs based on automated analysis
- Automates the management of a personalised investment portfolio based on individual needs
- Provides aggregated view and analysis of multiple accounts



Social Trading

- Empowers individual investors to build and share investment strategies and portfolios with other investors
- Empowers individual investors to share their opinions and gain market insights from the opinions shared by the crowd



Retail Algorithmic Trading

- Enables investors to easily build, test and execute trading algorithms with limited technical knowledge and infrastructure
- Provides platforms for sophisticated investors to share trading algorithms with others



Common characteristics of wealth management disruptions

Lower Barriers

Algorithm-Driven

Customer Empowerment

Reliance on the Crowd

Fine-Grained Opinion on Social Trading Platforms



Bullish

Apr 26th, 1:39 am
\$TSLA 256 Break-out thru 50 & 200- DMA (197-230) upper head res (274-279) Short squeeze in progress Nr term obj: 310 Stop loss:239



Bullish

Apr 12th, 7:02 pm
\$AAPL support identified \$198.8 ... next move to \$215



Bearish

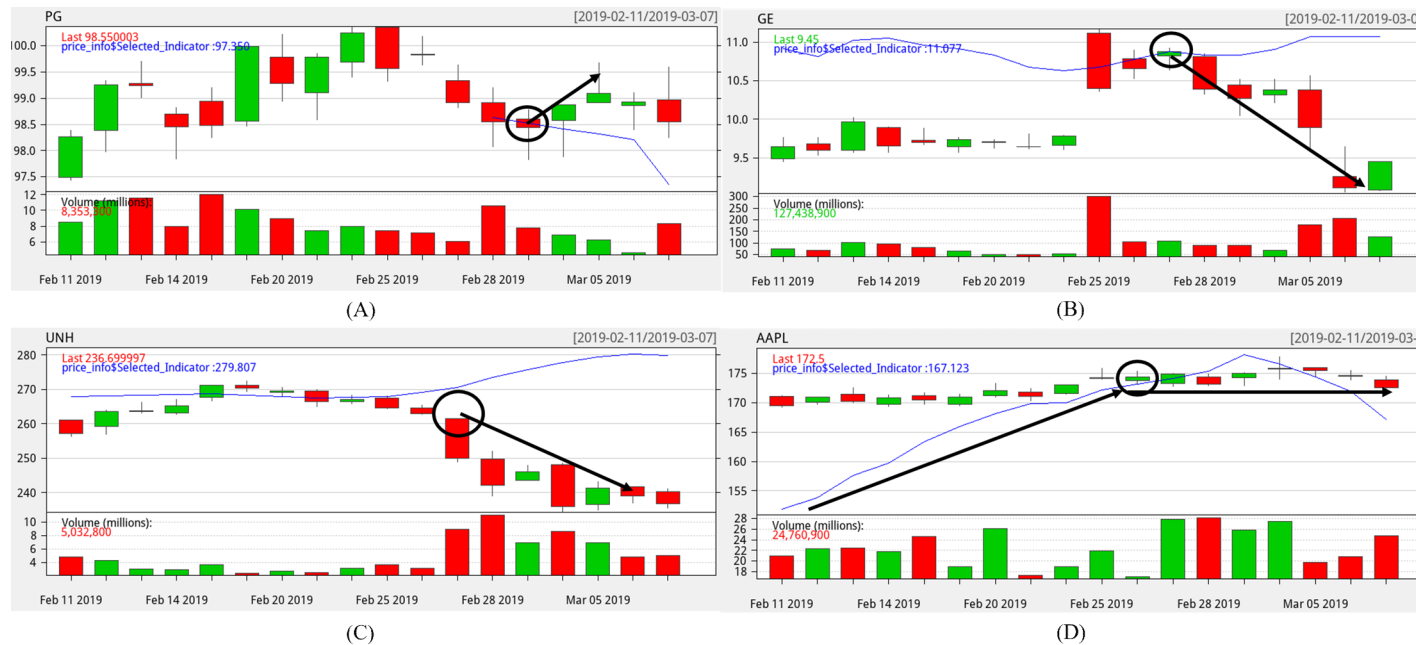
Apr 12th, 7:02 pm
\$TVIX making a new 52 week low.



\$TSLA 256 Break-out thru 50 & 200- DMA (197-230) upper head res (274-279) Short squeeze in progress Nr term obj: 310 Stop loss:239.

25 tokens 9 numbers 6 meanings 3

Convert Crowd Opinions into Indicator



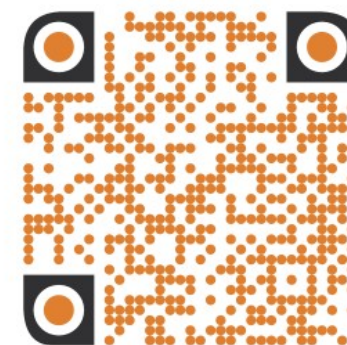
We

- propose **fine-grained numeral taxonomy** for financial social media data
- **leverage the numeral opinions made by the crowd** to mine **additional information** for trading

Numeral Taxonomy – 17 Classes

Category	Subcategory	Train	Dev.	Test	Total	Ratio
Monetary		2467	261	459	3187	35.94%
	money	589	52	95	736	8.30%
	quote	792	89	152	1033	11.65%
	change	143	8	25	176	1.98%
	buy price	319	36	60	415	4.68%
	sell price	103	10	22	135	1.52%
	forecast	270	33	52	355	4.00%
	stop loss	25	4	6	35	0.39%
support or resistance	226	29	47	302	3.41%	
Percentage		838	105	170	1113	12.55%
	relative	585	70	112	767	8.65%
	absolute	253	35	58	346	3.90%
Option		169	11	22	202	2.28%
	exercise price	113	5	14	132	1.49%
	maturity date	56	6	8	70	0.79%
Indicator		167	22	27	216	2.44%
Temporal		2364	253	401	3018	34.03%
	date	2079	223	351	2653	29.92%
	time	285	30	50	365	4.12%
Quantity		741	87	154	982	11.07%
Product/Version		114	14	22	150	1.69%
		6860	753	1255	8868	100.00%

8868 Annotations are available



<http://numunderstanding.nlpfin.com>

Analysis Results of Investors

- **Cost**
 - **Buy Price & Sell Price**
 - **Forecast**
 - **Price Target, Stop Loss, Support & Resistance**
-
- The identification of **Buy Price & Sell Price** can help us understand the performance of the writer.
 - Analysts always write down the **Price Target** in the front of their reports.
 - The concepts of **Stop Loss, Support and Resistance** are always discussed in technical analysis.

J.P.Morgan

North America Equity Research
28 March 2016

Puma Biotechnology

Neratinib NDA Delayed to Mid-2016...Data Holds up to New Analyses but Investor Patience Wearing Thin

Overweight

PBYI, PBYI US
Price: \$35.37

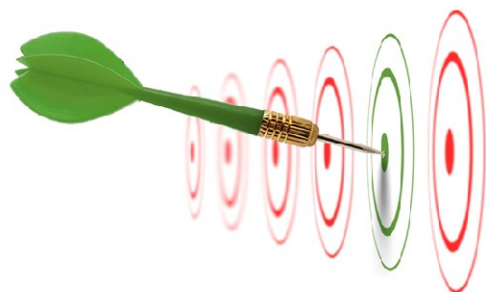
▼ **Price Target: \$89.00**
Previous: \$105.00

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State-of-the-art – 17 Classes

Method	Micro F1 (%)	Macro F1 (%)
Fusion model [1]	87.17	82.40
Hybrid NN [15]	83.03	77.90
Attentive RNN	80.24	74.11
RNN with CNN Filter [10]	79.12	72.51
SVM [14]	60.88	52.93
Unsupervised [12]	63.67	51.90
Char-based CNN [5]	43.75	31.12

Compare to Analyst – Price Target



	Crowd	Analyst
Average difference	13.17%	6.75%
Achieving rate	67.03%	74.73%
Achieving duration	3.38 months	2.46 months
Average return	4.86%	2.93%

Progressive



	Crowd	Analyst
Winning ratio	68.13%	71.43%
Max profit	52.17%	17.23%
Max drawdown	-11.82%	-14.10%
Average profit	11.08%	6.42%
Average loss	-8.43%	-8.40%

Profitable

Informativeness Test – Kolmogorov–Smirnov Test

$\alpha \backslash s$	3	5	10
0.005	66.67 / 19.23	60.00 / 29.17	40.00/ 21.74
0.010	44.44 / 35.09	29.17/ 30.19	30.00/ 24.49
0.015	14.64/ 18.18	18.92/ 22.34	18.75/ 20.00

KS-test results of support/resistance.

$G \backslash s$	3	5	10
0.03	4.82/ 3.23	8.87 / 6.23	8.33 / 5.26
0.04	8.90 / 3.58	5.68/ 5.63	8.66 / 3.86
0.05	3.13/ 2.22	7.60 / 3.18	12.50 / 5.85

KS-test results of buy-side/sell-side cost.

Provide incremental information for trading

- The indicators related to the analysis results of crowd investors (**support and resistance** price level) provide the incremental information for short-term (**3- and 5-day**) trading.
- The indicator constructed by **the cost of crowd investors** (buy-side and sell-side cost) furnish trader with additional long-term (**10-day**) information.

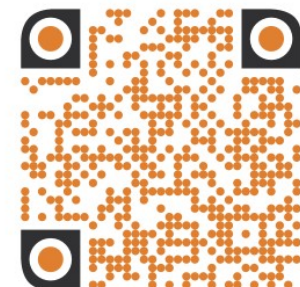
Extended Shared Task

FinNum-2: Numeral Attachment in Financial Tweets

Numeral Attachment:

\$NE OK NE, last time **oil** was over **\$65** you were close to **\$8**. Giddy-up...

- Shared task in NTCIR 2020
- Identify the relation between the cashtag and the numeral
- The pilot dataset is available now.
- More than 15,000 instances in 10,000 unique tweets will be available.
- Macro-F1 score is adopted for evaluating the experimental results.



Thanks & Welcome to our Booth

Tomorrow (8/15) 09:30 - 18:00 (Hall A)

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¹Department of Computer Science and Information Engineering, National Taiwan University, Taiwan

²Department of Computer Science, National Chengchi University, Taiwan

³MOST Joint Research Center for AI Technology and All Vista Healthcare, Taiwan

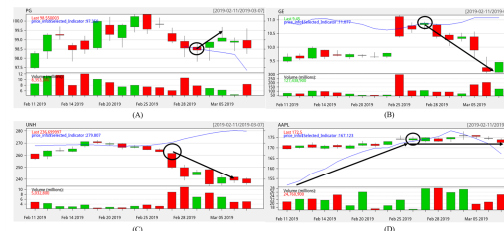
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Convert Crowd Opinions into Leading Indicator



<http://crowdview.nlpfin.com>

Numeral Attachment with Auxiliary Tasks



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²Department of Computer Science, National Chengchi University, Taiwan

³MOST Joint Research Center for AI Technology and All Vista Healthcare, Taiwan



Numeracy-600K: Learning Numeracy for Detecting Exaggerated Information in Market Comments

Chung-Chi Chen¹, Hen-Hsen Huang^{2,4}, Hiroya Takamura³, Hsin-Hsi Chen^{1,4}

¹Department of Computer Science and Information Engineering, National Taiwan University, Taiwan

²Department of Computer Science, National Chengchi University, Taiwan

³Artificial Intelligence Research Center, National Institute of Advanced Industrial Science and Technology, Japan

⁴MOST Joint Research Center for AI Technology and All Vista Healthcare, Taiwan



Task Definition

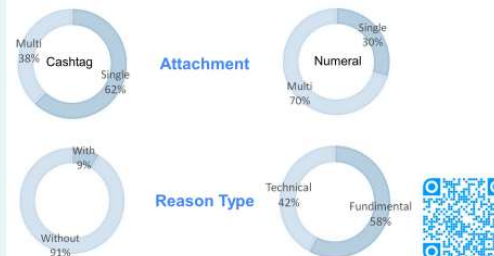
Numeral Attachment:

\$NE OK NE, last time oil was over \$65 you were close to \$8. Giddy-up...

Reasoning:

\$IBB had to ride this Train with Reversal candle. Down more than 9% from 342.50

NumAttach Dataset



<http://numattach.nlpfin.com>

Numeracy

S&P 500 <.SPX> UP 1.53 POINTS AT _____ AFTER MARKET OPEN

DOW JONES <.DJI> UP 8.70 POINTS AT _____ AFTER MARKET OPEN

U.S. Q3 GDP rises _____.



Issues of Understanding Numerals in Financial Documents

Market comment	Issue
CANADA <TRT> PCT 2014 BOND AUCTION YIELD LOW 1.110 PCT HIGH 1.121 PCT	Different contract
DOW JONES <.DJI> UNOFFICIALLY CLOSES UP <TRT> POINTS	Market Data
Disney quarterly revenue rises <TRT> pct	Past patterns
BILL BARRETT CORP <BBG.N>: BMO CUTS PRICE TARGET TO 8 FROM <TRT>	Reference to other numerals
Macris Drilling wins \$ <TRT> mln contract from Eni	Main event
OCC SAYS EXCHANGE-LISTED OPTIONS VOLUME REACHED <TRT> CONTRACTS IN MAY	Varying amounts

Numeral Understanding

Numerals in financial tweets can be extended into 17 fine-grained meanings.

Numeral Attachment

Detecting the attached target (i.e., cashtag) of the numeral

