

Overview of FinNum-3

Investor's and Manager's Fine-grained Claim Detection



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Outline



- Motivation
- Task Setting
- Dataset
- Participants
- Methods & Results
- Discussion
- FinArg: Fine-grained Argument Understanding in Financial Analysis

Motivation



FinNum-1: Understanding Numeral Itself

\$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

We

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

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%
Percentage	support or resistance	226	29	47	302	3.41%
		838	105	170	1113	12.55%
	relative	585	70	112	767	8.65%
Option	absolute	253	35	58	346	3.90%
		169	11	22	202	2.28%
	exercise price	113	5	14	132	1.49%
Indicator	maturity date	56	6	8	70	0.79%
		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%

FinNum-2: Understanding Entity Relation



- **Example**

“\$NE, last time oil was over \$65 you were close to \$8”

Attached

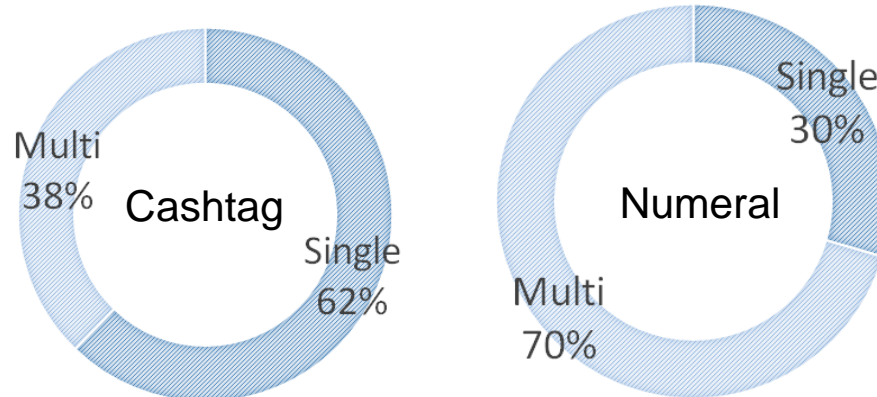
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Guess who sold off about \$800 million in \$MDLZ after losing about \$1 billion on \$VRX???

Attached

Not Attached

- **NumAttach 1.0**



FinNum-3: Understanding Semantics

- Investor's Claim: Analyst Report → About Future Price Movement/Account Title
- Manager's Claim: Earnings Conference Call → About Future Direction and Operations of Companies

Sentence	Label
We estimate that the sales growth rate may exceed 40% .	In-claim
Professional audio/visual products account for 20% .	Out-of-claim

- Link with FinNum-1: Numeral Category

Category	Train		Development		Test		Total
	In-Claim	Out-of-Claim	In-Claim	Out-of-Claim	In-Claim	Out-of-Claim	
Monetary_money	428	311	78	57	413	-	1,287
Monetary_change	3	3	-	12	362	-	380
Monetary_price	34	32	8	1	30	28	
Percentage_relative	326	335	82	67	351	452	1,613
Percentage_absolute	171	394	37	106	169	572	1,449
Temporal_date	-	1,775	-	359	-	1,847	3,981
Temporal_time	-	3	-	-	-	1	4
Quantity_absolute	36	183	19	36	40	165	479
Quantity_relative	-	4	-	-	3	16	23
Product Number	1	100	-	35	1	145	282
Ranking	-	-	-	3	-	6	9
Other	-	80	-	25	-	90	195
Total	999	3,220	224	701	1,369	3,322	9,835

Task Setting



Task Formulation & Evaluation

- Given
 - A sentence from analyst report or earnings conference calls
 - The position of target numeral
- Output
 - In-Claim or Out-of-Claim
 - (Optional) Numeral Category
- Evaluation
 - Micro-averaged F1
 - Macro-averaged F1

NumClaim 2.0



Analyst Report - Chinese



Category	Train		Development		Test		Total
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Earnings Conference Call - English

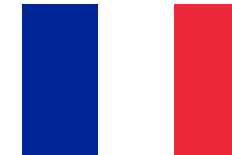
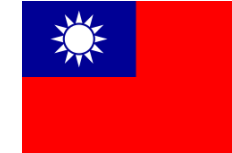
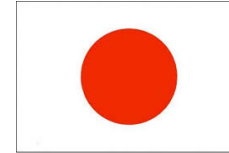


Category	Train		Development		Test		Total
	In-Claim	Out-of-Claim	In-Claim	Out-of-Claim	In-Claim	Out-of-Claim	
Monetary_money	352	1,144	45	221	24	338	2,124
Monetary_change	100	298	32	52	11	237	730
Percentage_relative	223	1,866	9	227	75	407	2,807
Percentage_absolute	193	490	18	67	36	119	923
Temporal_date	-	1,616	-	221	-	465	2,302
Temporal_time	-	8	-	-	-	-	8
Quantity_absolute	143	1,050	8	114	36	364	1,715
Quantity_relative	17	161	1	44	5	74	302
Product Number	9	226	1	25	-	14	275
Ranking	-	35	-	-	-	8	43
Other	2	404	-	106	-	170	682
Total	1,039	7,298	114	1,077	187	2,196	11,911

Participants



7 Teams from 11 Institutions and 6 Countries



Methods & Results



Methods



- Data Augmentation
- Numerical Representation
- Numeral Encoder
- Knowledge-Based Approach
- Decision Tree, SVM, Naive Bayes, LSTM, and CNN

Team	Subtask	Pre-Trained Language Model	Method
IMNTPU [16]	Chinese & English	XLM-RoBERTa	Data Augmentation (Translation)
CYUT [11]	Chinese & English	MacBERT, RoBERTa, and GPT-2	Data Augmentation (GPT-2), and AWD-LSTM
WUST [13]	Chinese & English	RoBERTa	Numeral Encoder, and Position Representation
JRIRD [15]	English	BERT, RoBERTa, FinBERT (News), and T5	Numerical Representation
LIPI [10]	English	FinBERT (News), and BERT-base	Ensemble
Passau21 [1]	English	BERT	Decision Tree, SVM, Naive Bayes, and CNN
TMUNLP [9]	Chinese	BERT, and RoBERTa	Knowledge-Based Approach

Analyst Report - Chinese

Submission	Claim Detection		Numeral Category	
	Micro-F1	Macro-F1	Micro-F1	Macro-F1
CapsNet [4]	80.32%	69.19%	62.59%	20.99%
WUST_1	84.89%	75.70%	56.13%	17.35%
CYUT_2	91.73%	86.76%	-	-
TMUNLP_2	91.11%	87.76%	94.03%	72.99%
CYUT_3	92.16%	88.20%	-	-
CYUT_1	92.11%	88.80%	-	-
TMUNLP_1	92.82%	89.56%	94.31%	73.68%
TMUNLP_3	92.75%	89.68%	94.67%	73.89%
IMNTPU_2	94.14%	91.64%	-	-
IMNTPU_3	95.20%	92.91%	-	-
IMNTPU_1	95.31%	93.18%	-	-

Earnings Conference Call - English

Submission	Claim Detection		Numeral Category	
	Micro-F1	Macro-F1	Micro-F1	Macro-F1
CapsNet [4]	89.97%	57.36%	49.64%	26.50%
BERFIN_2	85.10%	68.26%	-	-
WUST_1	93.37%	71.72%	48.76%	24.02%
BERFIN_1	94.67%	80.26%	-	-
LIPI_2	95.17%	81.33%	-	-
LIPI_1	95.09%	82.82%	-	-
LIPI_3	95.59%	84.73%	-	-
CYUT_1	94.67%	85.53%	-	-
Passau21_1	96.01%	87.12%	-	-
CYUT_2	95.64%	87.49%	-	-
CYUT_3	96.43%	87.88%	-	-
IMNTPU_1	96.18%	88.39%	-	-
JRIRD_2	96.73%	89.55%	89.76%	72.84%
IMNTPU_2	96.73%	89.86%	-	-
JRIRD_1	97.15%	90.80%	89.68%	72.94%
JRIRD_3	97.27%	91.03%	89.26%	69.11%

Discussion



Evaluation on In-Claim Cases



Analyst Report - Chinese

	P	R	F1
WUST_1	68.63%	54.52%	60.76%
CYUT_1	78.11%	87.88%	82.71%
TMUNLP_3	79.64%	88.98%	84.05%
IMNTPU_1	87.09%	91.76%	89.36%

Earnings Conference Call - English

	P	R	F1
WUST_1	63.06%	37.43%	46.98%
LIPI_3	72.04%	71.66%	71.85%
Passau21_1	71.30%	82.35%	76.43%
CYUT_3	76.29%	79.14%	77.69%
IMNTPU_2	73.19%	91.98%	81.52%
JRIRD_3	79.33%	88.24%	83.54%

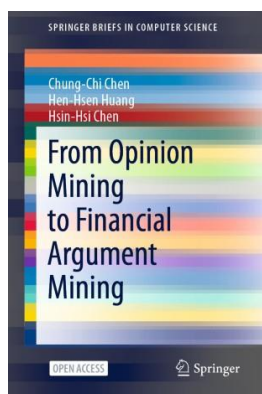
Future Directions

- **Combination of the Findings in FinNum-3**
 - Data Augmentation
 - Numerical Representation
 - Knowledge-Based Approach
 - Numeral Encoder
- **Adopting Document-Specific Language Model**
 - FinBERT (News)
 - FinBERT (ConCall)
- **Adopting the Extracted Claims in Downstream Tasks**
- **In-Depth Argumentation Analysis**
 - **FinArg: Fine-grained Argument Understanding in Financial Analysis**

FinArg: Fine-grained Argument Understanding in Financial Analysis



Short Name	Language	Source	Task
FinArg-1	English	Analyst Report	Argument-based Sentiment Analysis
	Chinese	Social Media	Identifying Attack and Support Argumentative Relations in Social Media Discussion Thread
FinArg-2	English	Analyst Report	Premise's Influence Period Assessment
	Chinese	Social Media	Claim's Validity Period Assessment
FinArg-3	English	Analyst Report	High Forecasting Skill Report Retrieval
	Chinese	Social Media	High Forecasting Skill Opinion Retrieval



<http://springer.nlpfin.com/>

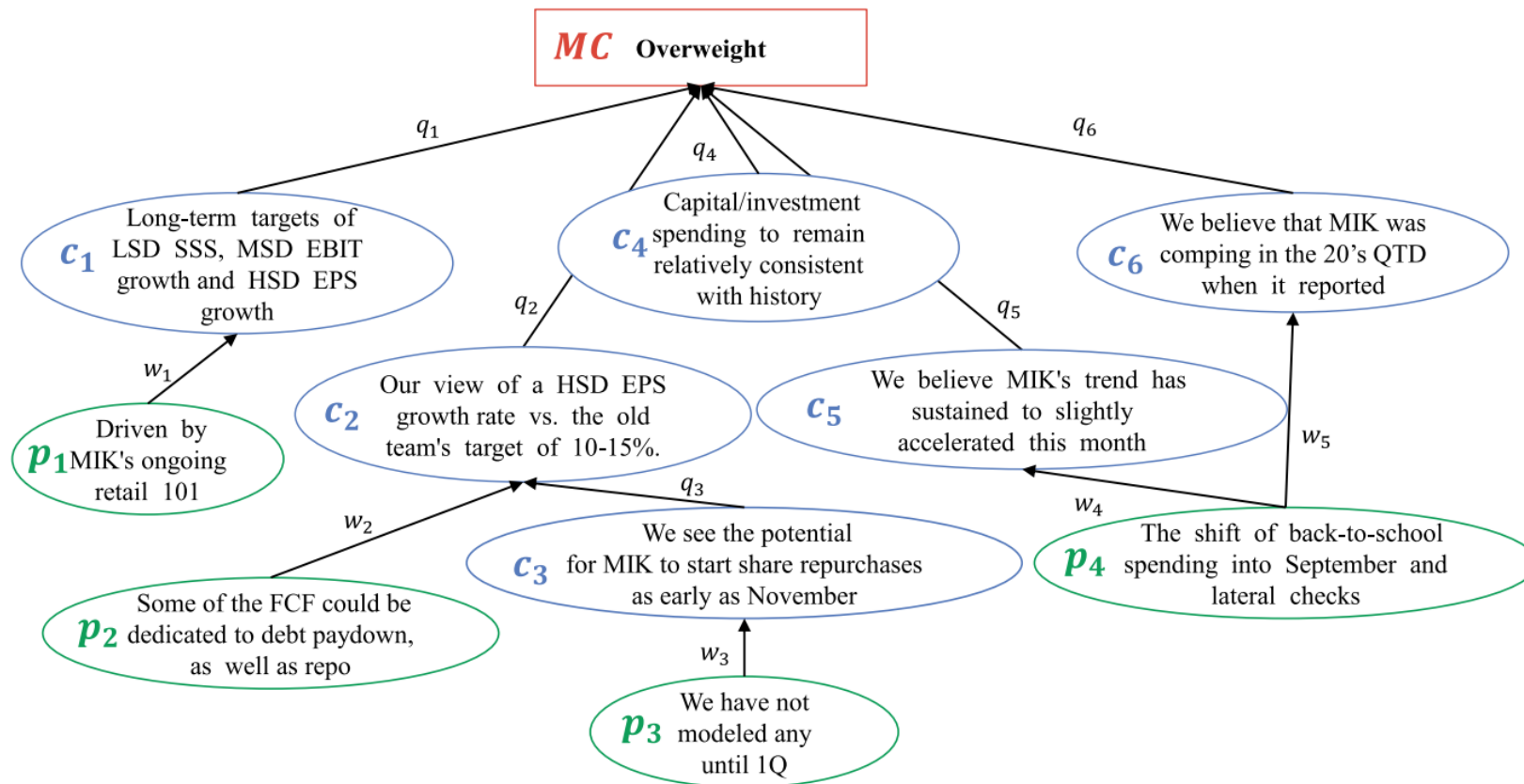


Chung-Chi Chen, Hen-Hsen Huang, and Hsin-Hsi Chen. 2021. From Opinion Mining to Financial Argument Mining. Springer Nature.

Chung-Chi Chen, Hen-Hsen Huang, and Hsin-Hsi Chen. 2021. Evaluating the Rationales of Amateur Investors. In Proceedings of The Web Conference 2021 (WWW'21)

Argument-based Sentiment Analysis

1. Argument Classification
2. Premise Sentiment Analysis
3. Claim Sentiment Analysis



Identifying Attack and Support Argumentative Relations in Social Media Discussion Thread



Original Post

TSM's PE ratio is actually only 15.7~17.4 times!!!
Folks, let me tell you more numbers to let you know that TSM is not expensive:
1. The historical average range of stock market PE ratio is 15~20.
2. The current P/E ratio of stocks is about 16-17.
3. The current P/E ratio of semiconductor stocks is about 23 to 24 times.
After 5 nanometers have also come out, it's not too much to earn 5 yuan a season, right? The EPS will easily be 20 in one year.

The stock price goes up to 500 in 3 to 5 years!

R1

I agree, I have bought TSMC for a long time, this is already a belief

Support

R2

It should be a reasonable estimate that eps is close to 20 yuan after three years

Support

R3

This time, some electronics factories have cut orders to transfer orders. SMIC has the support of the national team. All countries, large and small factories, will be a threat to TSM, and I don't think it will increase 500 in the future.

Attack

R4

It only doubles in 3~5 years. When the big crash is full of cheap premium stocks, the risk is not proportional to the recovery.

Attack

Related Events

- **FinNLP Workshop @ EMNLP-2022**
 - <http://finnlp.nlpfin.com/>
- FinNLP Workshop @ IJCAI-2022 → July 24
 - <https://sites.google.com/nlg.csie.ntu.edu.tw/finnlp-2022/>
- FinTech on the Web Workshop @ TheWebConf
- AI in FinTech Showcase – Share your work: <http://showcase.nlpfin.com/>
- Join our Mailing List for updating: <http://maillist.nlpfin.com>

Feel free to contact us if you have any questions.

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