

# Modeling financial analysts' decision making via the pragmatics and semantics of earnings calls

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## Summary

- **Overall motivation:** Examine financial analysts' decision making as it pertains to the language content of earnings calls.
- We correlate analysts' pre-call recommendations (buy/sell) with the questions they ask during calls and find *bullish analysts* tend to be called on earlier, ask questions that are more positive, more concrete, and less about the past.
- Our prediction task indicates the textual content of earnings calls is moderately predictive of changes in analysts' price target forecasts and more predictive than market features alone.

## Background

### What is an *earnings call*?

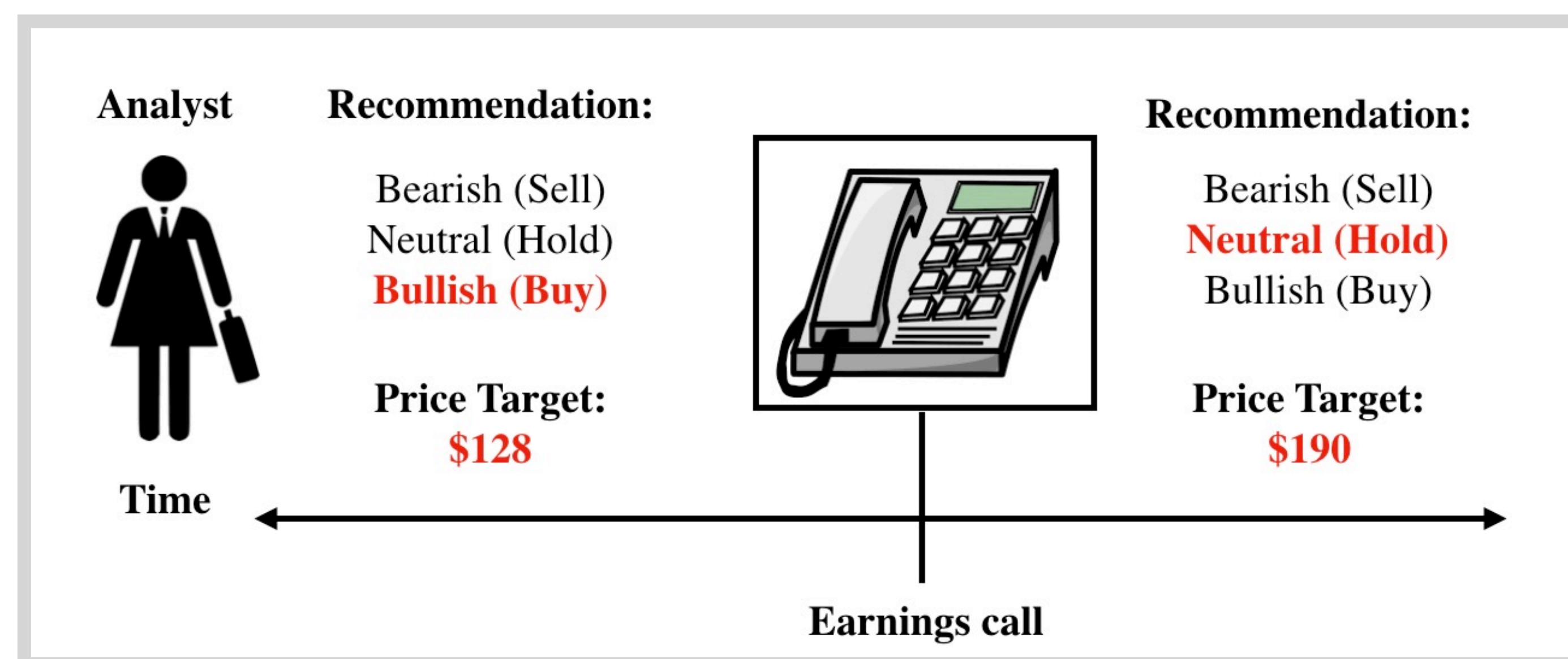
Earnings calls are quarterly live conference calls between the executives of publicly-traded companies and financial analysts. During earnings calls, executives present prepared remarks and then selected financial analysts ask questions. After earnings calls, financial analysts typically update their price targets and buy/hold/sell recommendations, which investors use to inform their decisions.

### Why is studying earnings calls and financial analysts' decisions important?

- Financial analysts' forecasts are of value to investors and may be better surrogates for market expectations than forecasts generated by time-series models [1].
- Previous work has shown earnings calls disclose more information than company filings alone [2] and influence investor sentiment in the short-term; however, recently company executives have questioned their value [3].
- Earnings calls are extremely complex, naturally-occurring discourses.

## Data

### Financial signals:



### Earnings call transcripts:

- S&P 500 companies from 2010-2017
- ~12,000 earnings call documents, temporal train/dev/test split
- ~ 600,000 total Q&A sets
- 10.9 average unique analysts speaking per call

## Example earnings call question-answer pair

**Brian Nowak, Analyst:** Thanks for taking my questions. One on YouTube, I guess. Could you just talk to some of the qualitative drivers that are really bringing more advertising dollars on to YouTube? And then I think last quarter you had mentioned the top 100 advertiser spending was up 60% year-on-year on YouTube, wondering, if you could update us on that? And the second one on search, it sounds like mobile is accelerating. Where are you now in the mobile versus desktop monetization gap? And, Sundar, how do you think about that long-term? Do you see mobile being higher, reaching equilibrium? How do you see that trending?

**Sundar Pichai, CEO:** On the YouTube one. Look, I mean, the shift to video is a profound medium shift and especially in the context of mobile, you know and obviously users are following that. You're seeing it in YouTube as well as elsewhere in mobile. And so, advertisers are being increasingly conscious. They're being very, very responsive. So, we're seeing great traction there and we'll continue to see that. They are moving more off their traditional budgets to YouTube and that's where we are getting traction. On mobile search, to me, increasingly we see we already announced that over 50% of our searches are on mobile. Mobile gives us very unique opportunities in terms of better understanding users and over time, as we use things like machine learning, I think we can make great strides. So, my long-term view on this is, it is as-compelling or in fact even better than desktop, but it will take us time to get there. We're going to be focused till we get there.

Earnings call from Alphabet Inc. on October 27, 2016

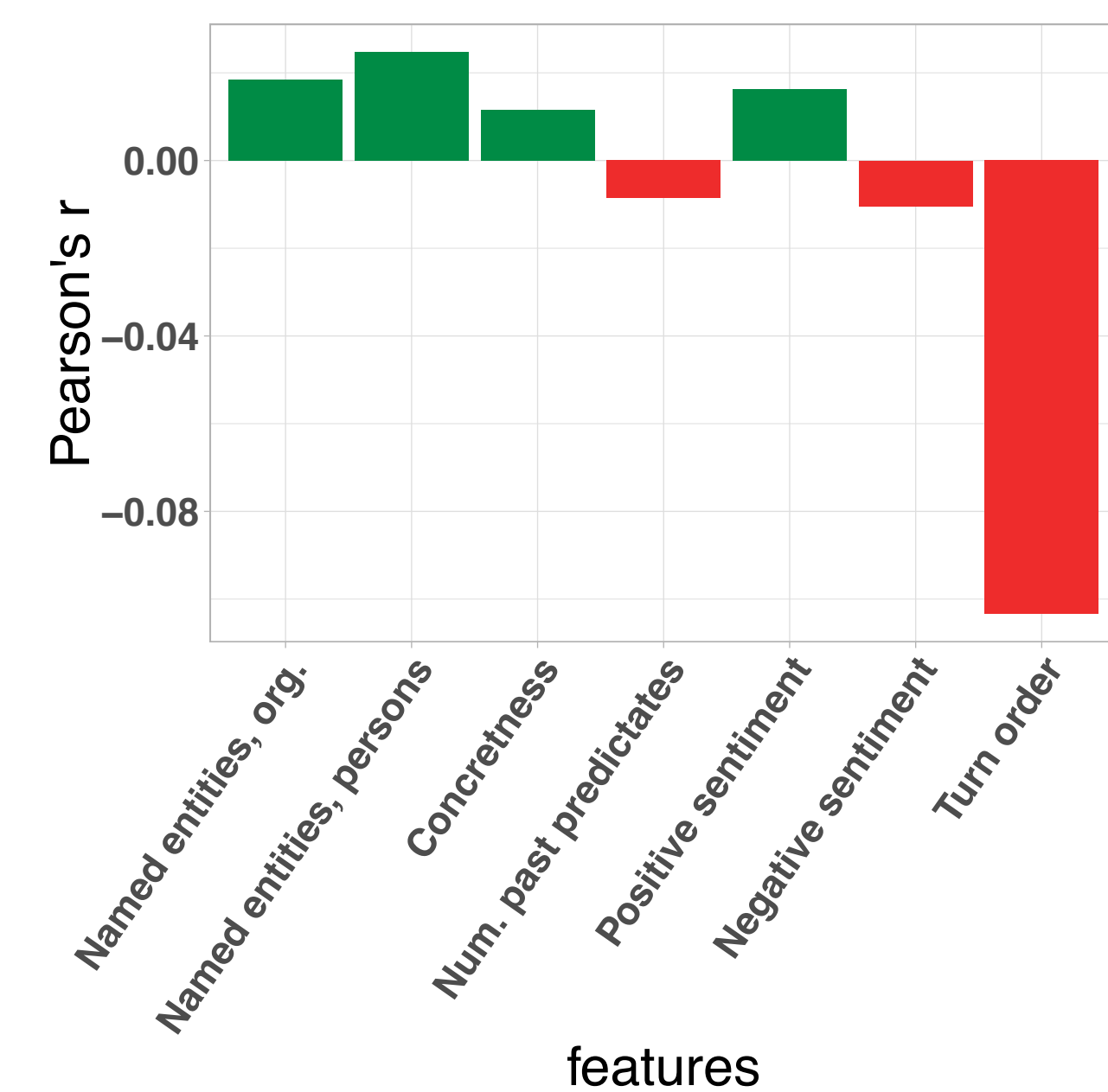
- Discourse markers
- Entities
- Temporal cues

- Multiple questions in a single turn

## Descriptive study of analysts' questions

Pearson correlations of features with the type of analyst:

- bearish (sell) -1
- neutral (hold) 0
- bullish (buy) 1



Other pragmatic features we tried (that were not statistically significant):

- named entities, events
- named entities, numbers
- named entities, products
- number of present-tense predicates
- number of future-tense predicates
- hedging lexicon counts
- modality lexicon counts
- uncertainty lexicon counts
- constraining lexicon counts
- litigiousness lexicon counts
- number of tokens
- number of predicates
- number of sentences

## Predicting changes in analysts' price targets

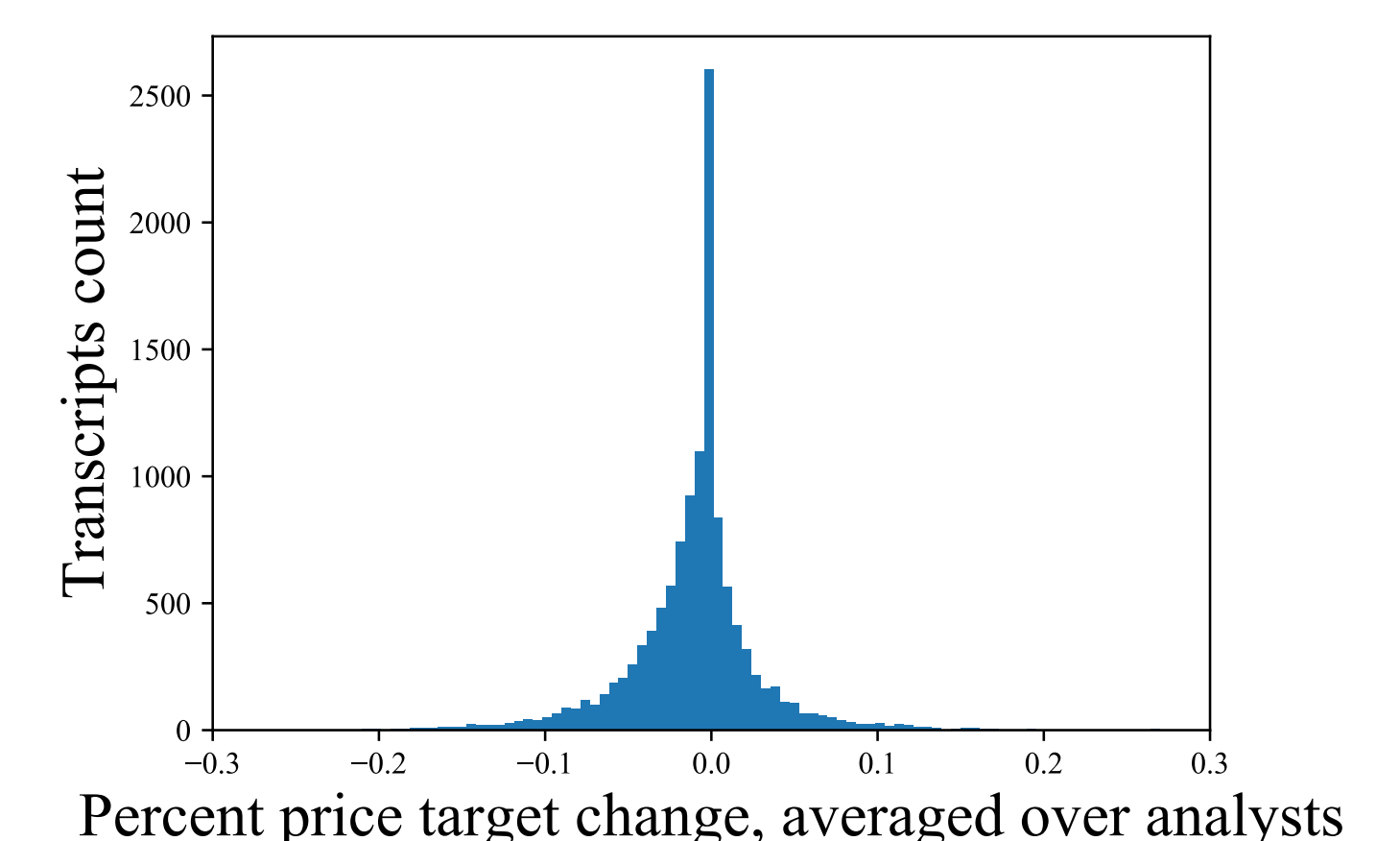
**Null hypothesis:** Earnings calls are *NOT* predictive of analysts' price target changes. *Rationale:* analysts have access to private communication with executives and current events.

**Research hypothesis:** The semantic and pragmatic content of earnings calls *ARE* predictive of analysts' price target changes.

### Classification task set-up

Y = percent change in price target averaged over all analysts

Class -1:  $Y < -1.67\%$   
Class 0:  $-1.67\% \leq Y \leq 0.0\%$   
Class 1:  $0.0\% < Y$



### Results

Feature type	Feature	Model	Acc.	F1	% err.
Baselines	Random (ave. 10 seeds)	—	0.340	0.338	—
	Predict majority class	—	0.387	0.186	0.0
Market	Market	LogReg	0.435	0.408	12.4
Semantic	Bag-of-words	LogReg	0.482	0.475	24.8
	doc2vec	LogReg	0.479	0.468	23.8
		LSTM	0.442	0.400	14.2
Pragmatic	Pragmatic lexicons	LSTM	0.415	0.368	7.2
Fusion	doc2vec + prag	LSTM	0.461	0.460	19.1
Ensemble	doc2vec + prag + market	Ensemble	0.460	0.461	18.9

**Interesting finding:** Semantic textual features moderately outperform market features!

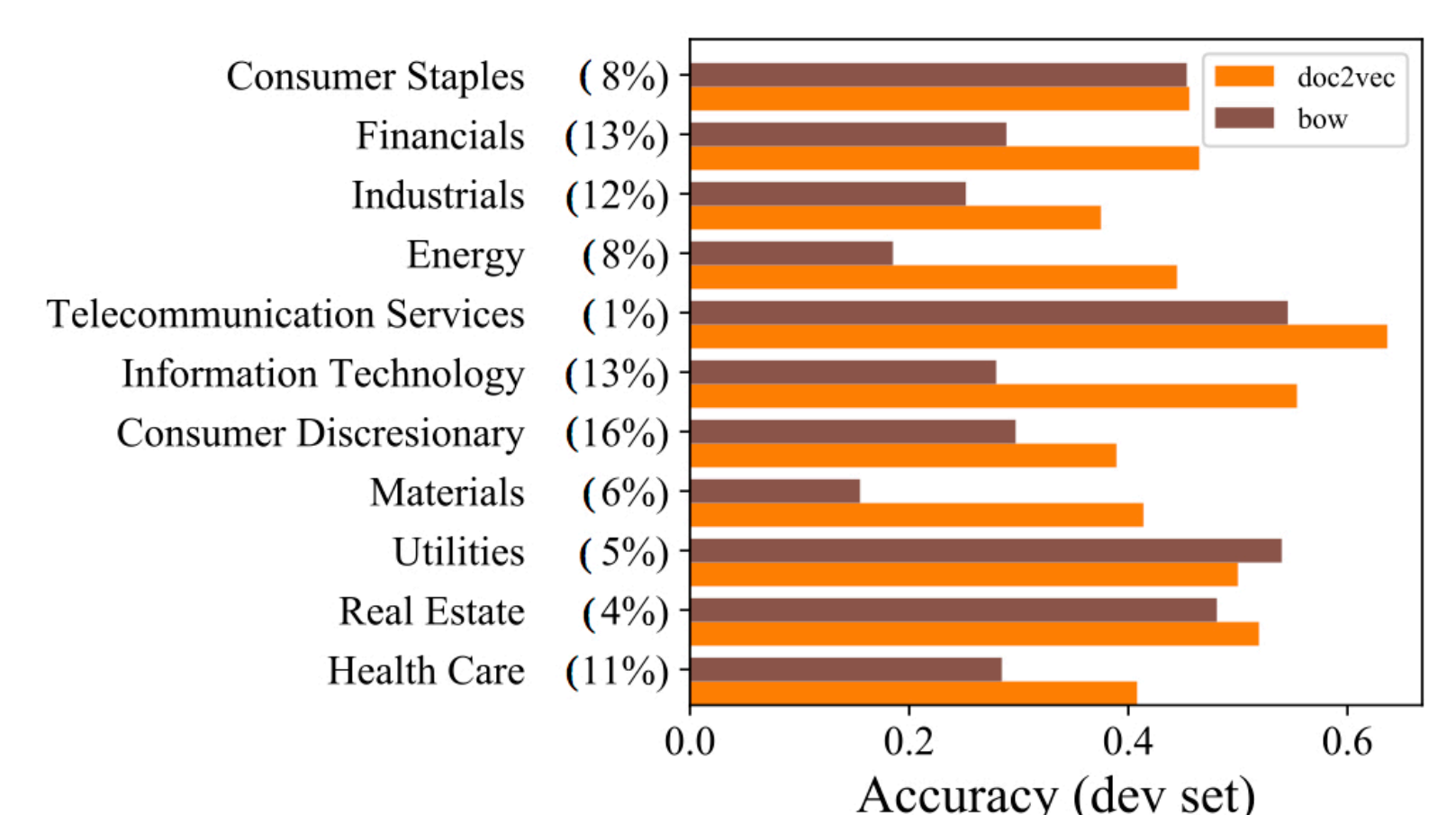
**Market features:** For the trading day prior to the call, we find the company's (1) opening price, (2) high price, (3) low price, (4) volume of shares, (5) 30-day volatility, (6) 10-day volatility, (7) price/earnings ratio, (8) relative price/earnings ratio, (9) earnings before interest and tax (EBIT) yield, and (10) earnings yield.

### Other experiments not shown:

- (1) Regression task — 17% error reduction over training mean baseline
- (2) Q&A only versus whole document — whole document performs better

### Error analysis

Per-industry breakdown of errors on the validation set for 11 GICS industries



## References

- [1] Dan Givoly and Josef Lakonishok. 1980. Financial analysts' forecasts of earnings: Their value to investors. *Journal of Banking & Finance*, 4(3):221–233.
- [2] Richard Frankel, Marilyn Johnson, and Douglas J Skinner. 1999. An empirical examination of conference calls as a voluntary disclosure medium. *Journal of Accounting Research*, 37(1):133–150.
- [3] Robert M Bowen, Angela K Davis, and Dawn A Matsumoto. 2002. Do conference calls affect analysts' forecasts? *The Accounting Review*, 77(2):285–316.