

# Predicting and Analyzing Language Specificity in Social Media Posts

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# Motivation

**Specific**

@similar length



I was eating a cookie over the trashcan to catch the crumbs. One of the chocolate chips jumped ship. I considered diving after it. [#Finals](#)

[← Reply](#) [↻ Retweet](#) [★ Favorite](#) [⋮ More](#)

3:33 PM - 13 Nov 18 · Embed this Tweet

**General**

@similar length



How curious that I, looking at you, am thinking exactly what you, looking at me, are thinking and yet... we both cannot understand

[← Reply](#) [↻ Retweet](#) [★ Favorite](#) [⋮ More](#)

4:26 PM - 13 Sep 17 · Embed this Tweet

# Specificity

Texts vary in their levels of detail and their involvement of particular concepts, objects and events, i.e., their *specificity*.

*The quality of belonging or relating uniquely to a particular subject.*  
-- Oxford Dictionary

# Language specificity

- Impacts reading comprehension
  - (Dixon 1987)
- Connected to several discourse relations
  - (Mann and Thompson 1988)
- Potentially linked to autism
  - (Li et al. 2017)

# NLP applications

- Dialogue generation
  - systems favor generic responses such as “I don’t know”
  - (Sordoni et al., 2015; Mou et al., 2016; Li et al 2017)
- Text summarization
  - (Louis and Nenkova, 2011)
- Text quality prediction
  - (Louis and Nenkova, 2013)
- Argumentation mining
  - (Swanson et al., 2015)
- Assessing classroom discussions
  - (Luo and Litman, 2016; Lugini and Litman, 2017)

# Specificity prediction: current state

- Training data on news corpora
- Training labels are binary (sentence is either general or specific)

# Specificity

A fine grained scale for specificity.



**1 = Very General**

@general



 Follow

Always too much.



2:48 PM - 27 Jan 2019



**2 = General**

@general



 Follow

I've been waiting all of August for tomorrow.



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**3 = Specific**

@specific



 Follow

So many people at the Turner Center. That will be over by next week.



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**4 = Very specific**

@specific



 Follow

The dance this morning on GMA with Alicia Keys made my day :)



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**5 = Extremely Specific**

@specific



 Follow

Mascara is the most commonly worn cosmetic, and women will spend an average of \$4,000 on it in their lifetimes.



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# Research Questions

Do personal traits impact one's language specificity?

1

Do temporal factors impact specificity?

2

Can language specificity be predicted accurately?

3

Is specificity prediction useful in a downstream task?

4



# Agenda

- Data
- Demographic Analysis
- Temporal Analysis
- Modeling
- Task-based evaluation: mental health (depression) analysis

# Data

We introduce a data set of tweets annotated with specificity

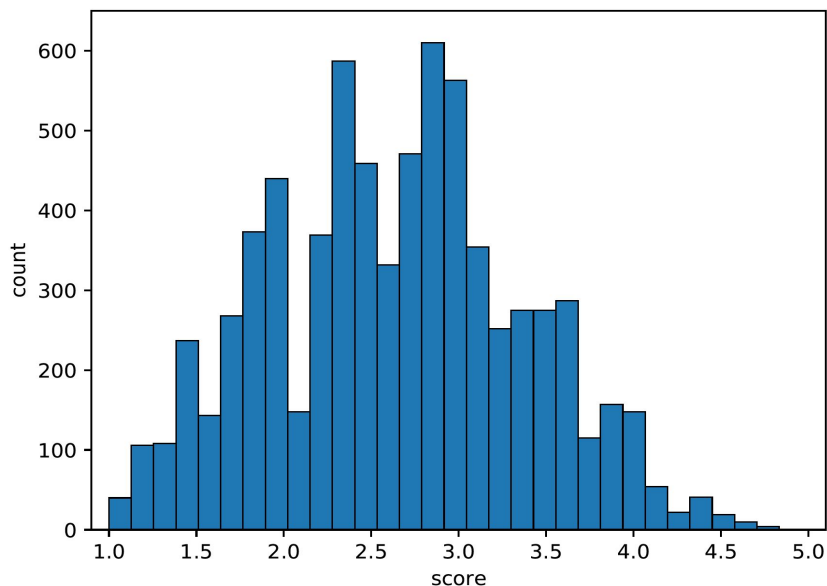
- 7267 tweets
- Sourced from 3665 users with self-reported demographic information
  - (Preotiuc-Pietro et al., 2017)
  - Gender, age, education, income level, faith, political ideology
- Corpus and code available at <https://github.com/cs329yangzhong/specificityTwitter>

# Data

## Annotated for specificity

- 5-point Likert scale
- MTurk
- IAA - Krippendorff's Alpha of 0.507
- $\geq 5$  annotations/instance
- QC - experienced US workers; excluded annotators with  $< 0.3$  agreement with majority of others
- Specificity score - average of annotations

# Specificity distribution



- Most tweets fall in the middle of the specificity spectrum
- Shows the utility of the fine-grained rating scale

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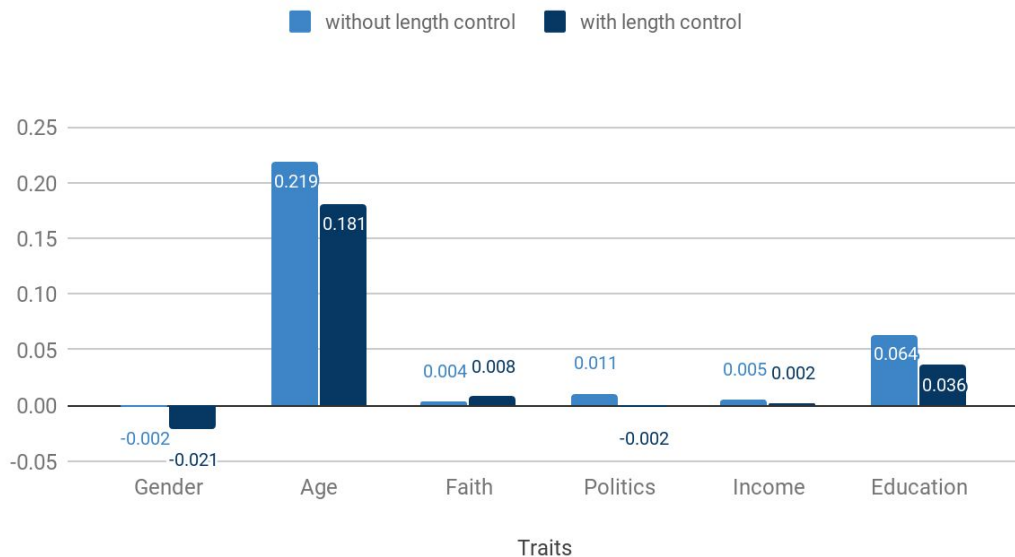
4

# Demographic Analysis

## Pearson Correlation

- Dependent variable:  
average specificity  
(per user)
- Control for gender & age
- Control for tweet length
- Bonferroni corrected for  
multiple comparisons

### Pearson Correlation



# Demographic Analysis

Specificity is correlated to:

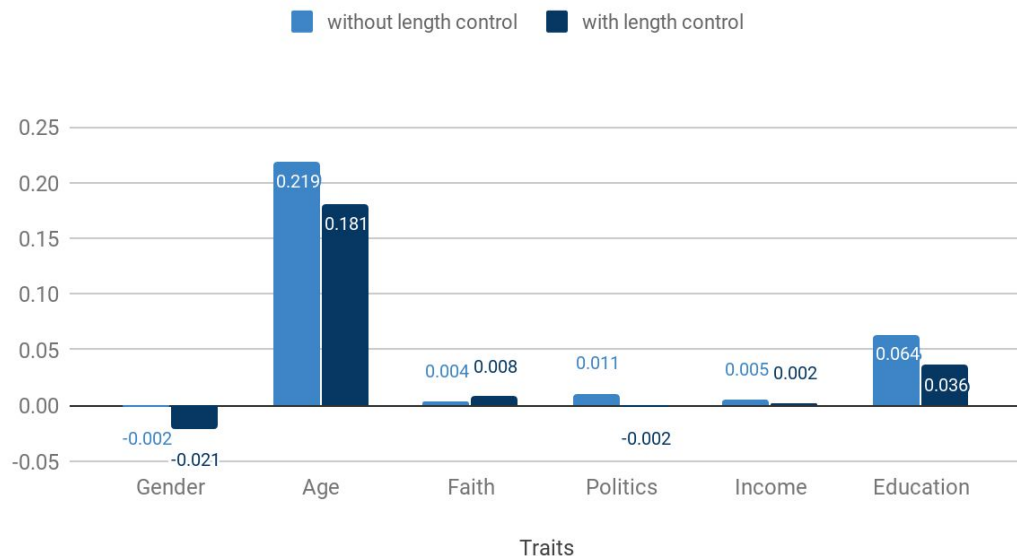
- Age

Correlation remains significant after controlling for tweet length

- Education

Even when controlled for age

Pearson Correlation



# Research Questions

Do personal  
traits impact  
one's  
language  
specificity?

1

Yes!



# Research Questions

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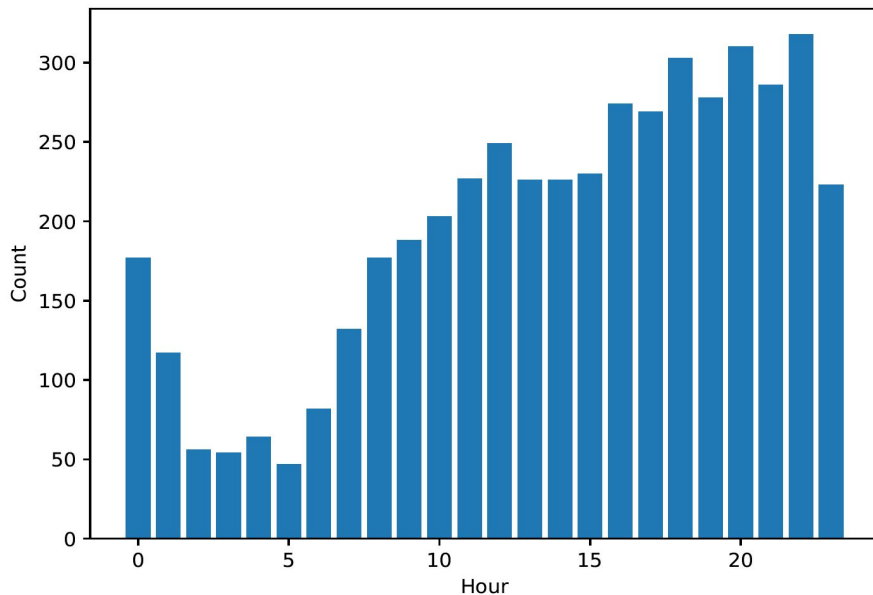
Is specificity prediction useful in a downstream task?

4

# Temporal Analysis

- Subset of 4716 tweets can be recovered to their local post time from tweet metadata.
- Example:
  - Original: Mon Dec 21 01:33:05 +0000 2015 -18000
  - Fixed: Mon Dec 20 20:33:05 +0000 2015 (Correct Local Time)

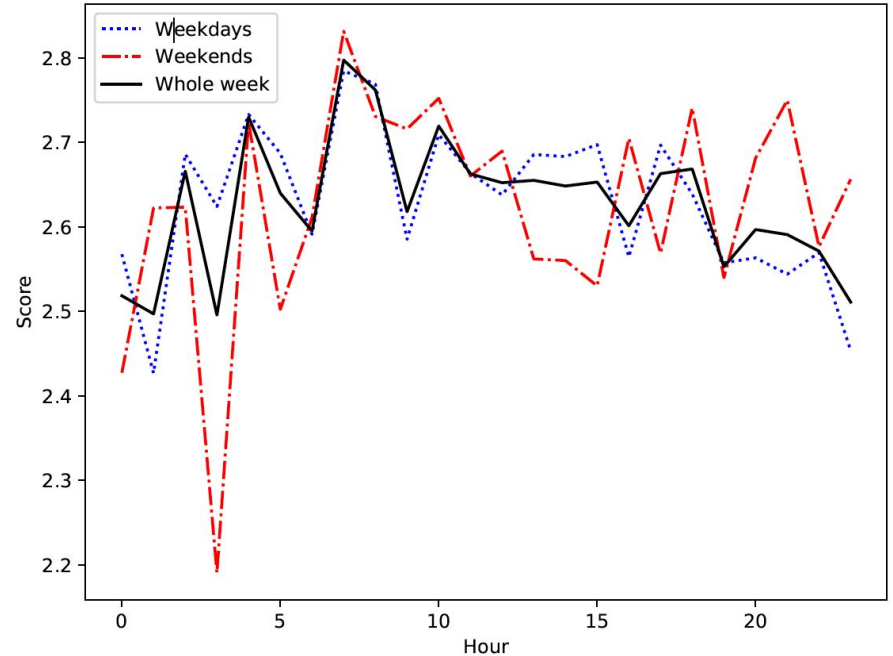
# Temporal Analysis



# tweets posted across hours of a day.

# Temporal Analysis

- Morning tweets are more specific
- Specificity decreases throughout the day
- People tweet less specifically in the evening despite tweeting more frequently



Average tweet specificity throughout the day.

# Research Questions

Do temporal factors impact specificity?

2

Yes!

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# Feature Types

- Surface and lexical features
- Tweet content
- Social media content
- Emotion features

# Surface and Lexical features

## Named Entities

- Indicators of named entities from seven categories:
  - Location, Person, Organization, Money, Percent, Date, and Time

## Part-of-speech Tag (POS)

- POS Tag count over eight categories:
  - determiners, nouns, proper nouns, pronouns, adjectives, prepositions, and punctuation.

## Concreteness Score

- Average word concreteness score using a lexicon
  - (Brysbaet, Warriner and Kuperman 2014)



# Surface and Lexical features

## String surface features

- Tweet length (number of tokens)
- Average word length
- Percent of:
  - capital letters
  - numbers
  - non-alphanumeric symbols including punctuation marks

# Tweet Content

## Word Embeddings

- Average of the embeddings of words in the tweet
  - Pre-trained GloVe word embeddings trained over 2 billion tweets
  - (Pennington, Socher, and Manning 2014)

## Brown Clusters

- Count of words in each pre-trained cluster divided by the tweet length.
  - (Turian, Ratinov, and Bengio 2010)

# Social Media Content

Captures specific Twitter behaviors:

- URLs
- Contains user mentions
- Is a reply

# Emotion Features

Emotional and subjective tweets tend to be less general

(Li and Nenkova 2015, 2016)

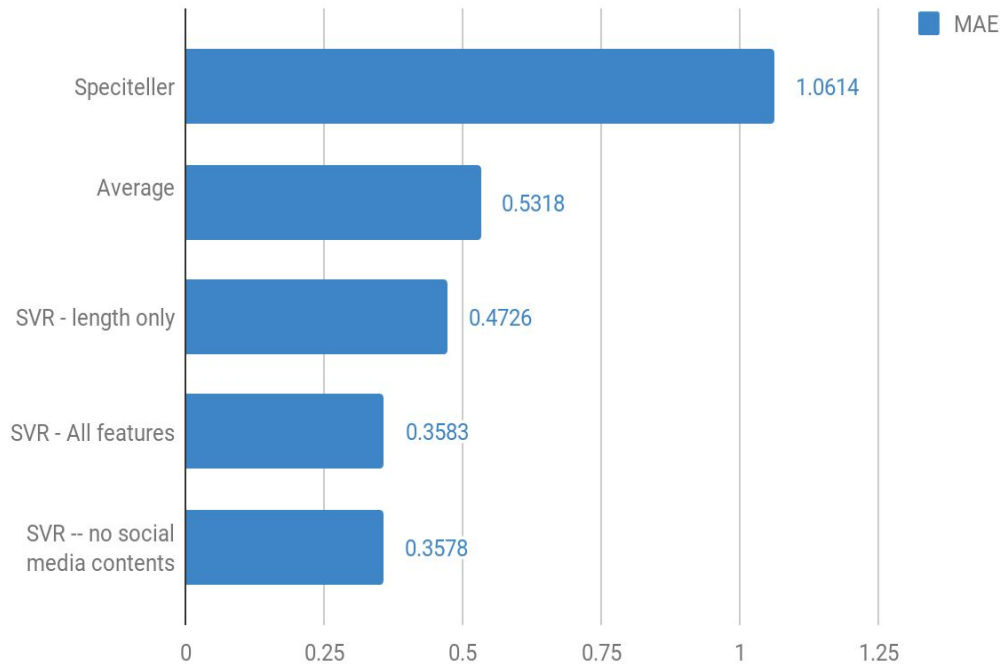
- **Indicators of positive and negative words**
  - Using a sentiment lexicon of 6,800 English words
  - (Hu and Liu, 2004)
- **The percentage of tokens that are emojis**

# Predictive Baselines

- **Average**
  - Average specificity from training data
- **Tweet length**
  - Tweet length as the only feature in a SVR model
- **Speciteller**
  - The only available sentence specificity predictor
  - Trained on news corpora (Li and Nenkova 2015)

# Modeling Results

- Support Vector Regression
- Data Split:
  - Train: 5767
  - Dev: 500
  - Test: 1000
- Result:
  - Significantly outperforms all baselines



# Examples

Tweet	Gold	Spicit eller	Tweet Length	Our model
IM HYSTERICALLY CRYING IM SO PROUD OF THEM	1.86	4.91	2.33	<b>2.15</b>
It's November!!!! Crunch Time Bro!!!! Let's Do It!!!	2.43	4.92	2.96	<b>2.37</b>
just reached level 15 on Paradise Island on my Android.	3.63	3.77	2.50	<b>3.59</b>
I'm at Macadams Bar & Grill (5833 SW Macadam Ave, Portland)	4.25	4.96	2.86	<b>3.87</b>

Capital letters and symbols often go with specific info in formal writing

Length alone cannot estimate specificity well

# Research Questions

Can language  
specificity be  
predicted  
accurately?

3

Yes!



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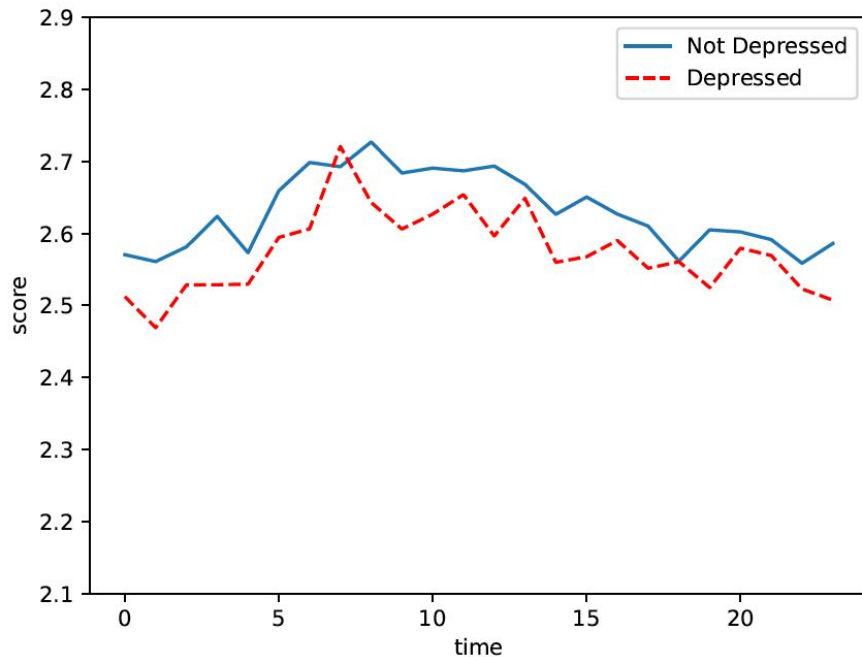
4

# Mental Health Analysis

- Does mental health impact one's language specificity?
- A subset of 538 users in our dataset took the Beck Depression Inventory-II (BDI-II) questionnaire.
  - 197 not depressed
  - 95 moderately/severely depressed
- Predict 100 tweets/user with specificity using our best model

# Mental Health Analysis

- People with moderate or severe depression tend to write less specific posts
- Regardless of the time of day



Average tweet specificity throughout the day.

Is specificity  
prediction  
useful in a  
downstream  
task?

4

Helped with Mental  
Health (Depression)  
Analysis!

# Take Aways

1

New data set and predictive model for fine-grained specificity on social media

2

Social and temporal factors impact language specificity

3

Specificity prediction is useful in downstream analyses

# Thank You!



**General Thanks**

@general



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Thank you!



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**Specific Thanks**

@specific



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Thank you for your time and attending our talk on language specificity here at [#AAAI 2019](#) :)



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