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Twitter Trending Topic Classification

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Motivation

- Information explosion
  - 200 million tweets per day*
- Twitter provides trending topics
  - Most popular topics that people tweet about
- What is this trending topic about?
  - Hashtags, name of individual, words in other language, etc
  - Is this person a musician, artist, politician, or a sport man?

Trending Topics

Trends: United States trends
Boone Logan
#MyYearofVIP
Barrett Jones
Outland
#itsalwayssunny
Ed Hochuli
Vaseline
Brett Keisel
#beyondsaredstraight
Gail Kim

* http://www.marketinggum.com/twitter-statistics-2011-updated-stats/

Extended Motivation

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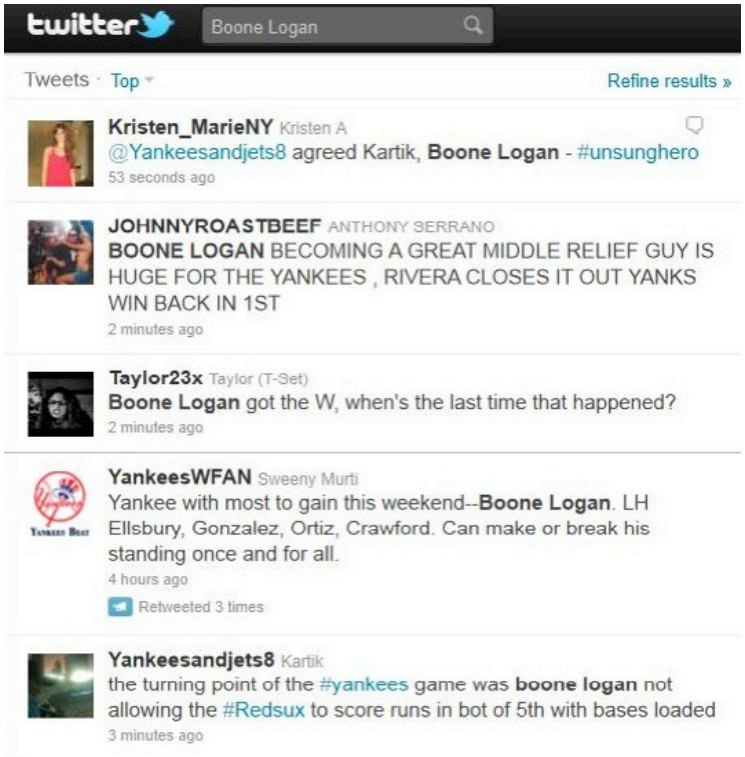

Our Goal: Classify Trending Topics

Trending Topics

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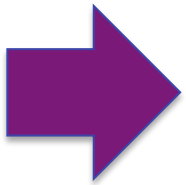

General Categories

- Business
- Health
- Music
- Politics
- Sports
- Science
- Technology

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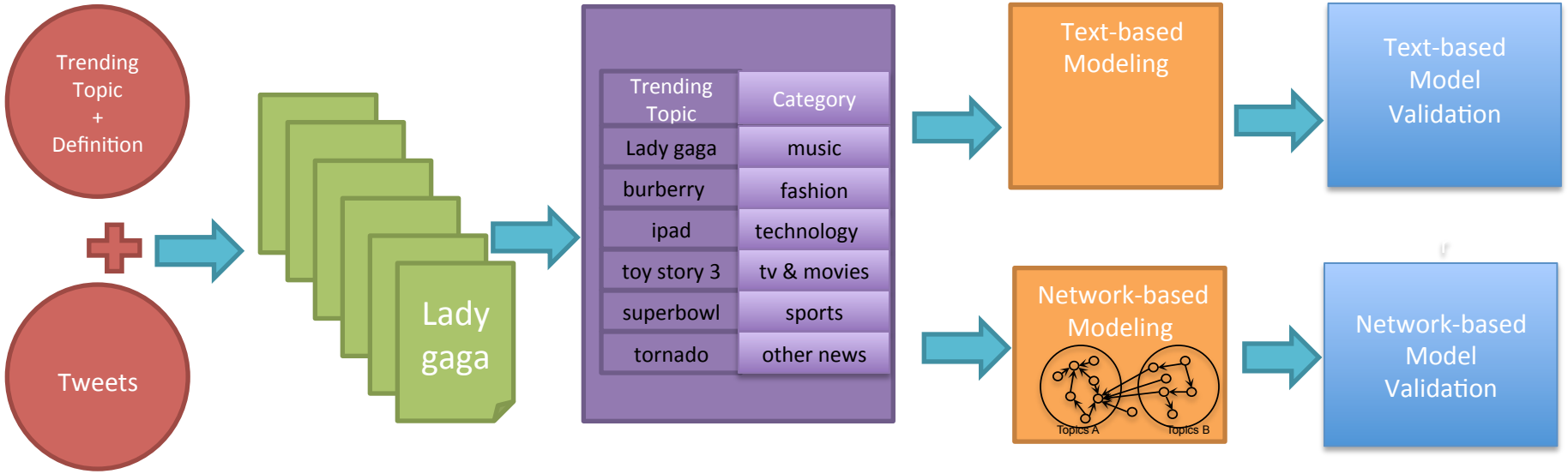
- Motivation
- **Method Overview**
- Data Set
- Methods
- Results
- Conclusion

System Architecture



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Building Training Set

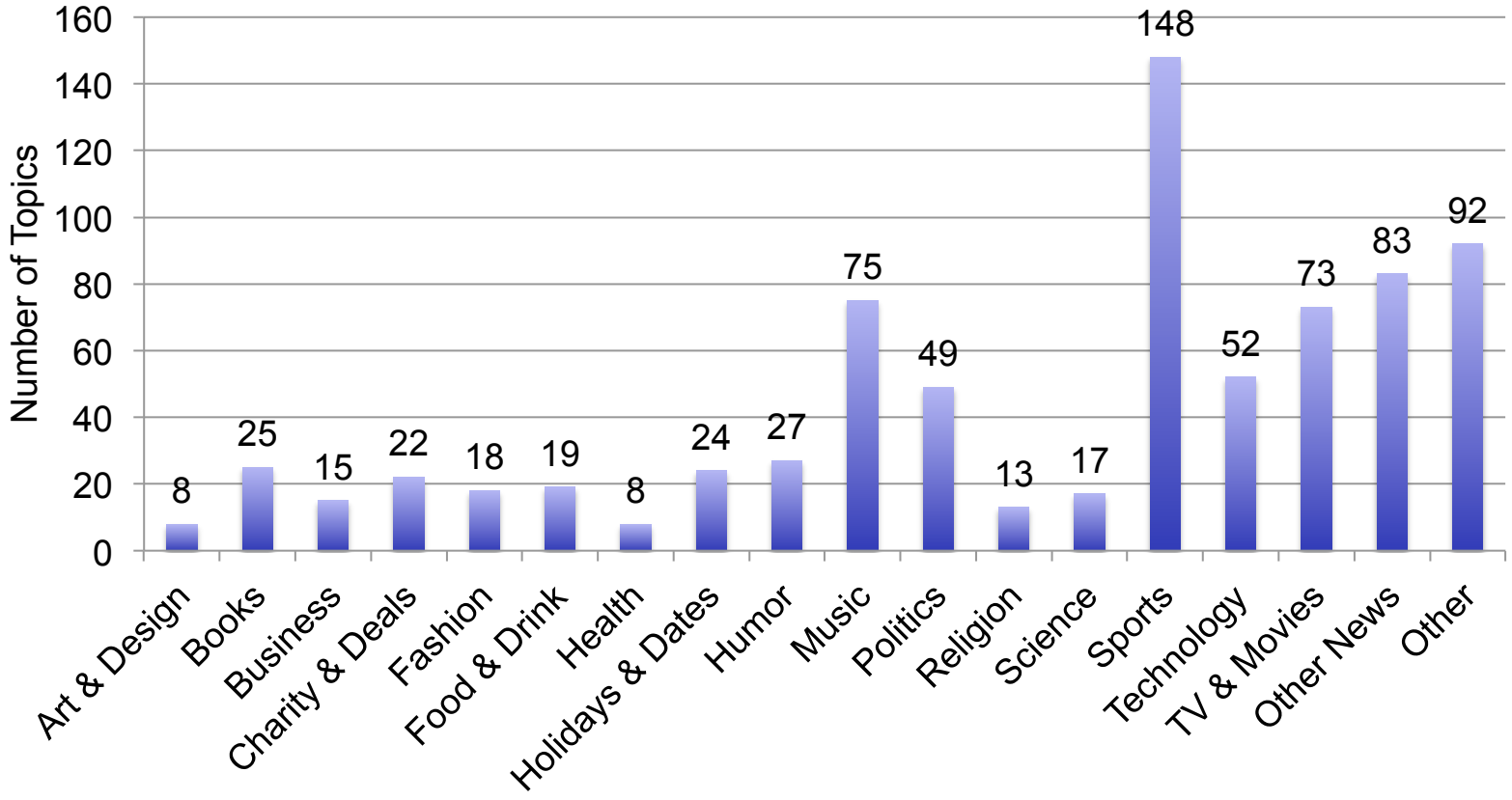
- 23000 trending topics

  (topics trended February 2010 – July 2011)
- Downloaded trend definition and tweets while each of 23000 topics was trending
- Random subset of 1000 topics
- Removed topics without trend definitions

Labeling

- 2 annotators labeled each topic
- 3rd annotator intervened in case of disagreement
- Removed topics that were labeled differently by all 3 annotators
- 768 trending topics in final training set
- Find 5 similar topics to 768 topics
- Labeled 3005 topics in total

Distribution of training data



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  - **Text-based classification**
  - Network-based classification
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Document

Text-based data classification

- Bag-of-Words Text Classification

1. Preprocessing
   - Remove hyperlinks
2. Apply string-to-word vector filter
   - Remove symbols and stop words
   - Transform tokens into TF-IDF (term-frequency inverse-document-frequency) weight
3. Apply various classification models
   - Naïve Bayes, Naïve Bayes Multinomial, and SVM

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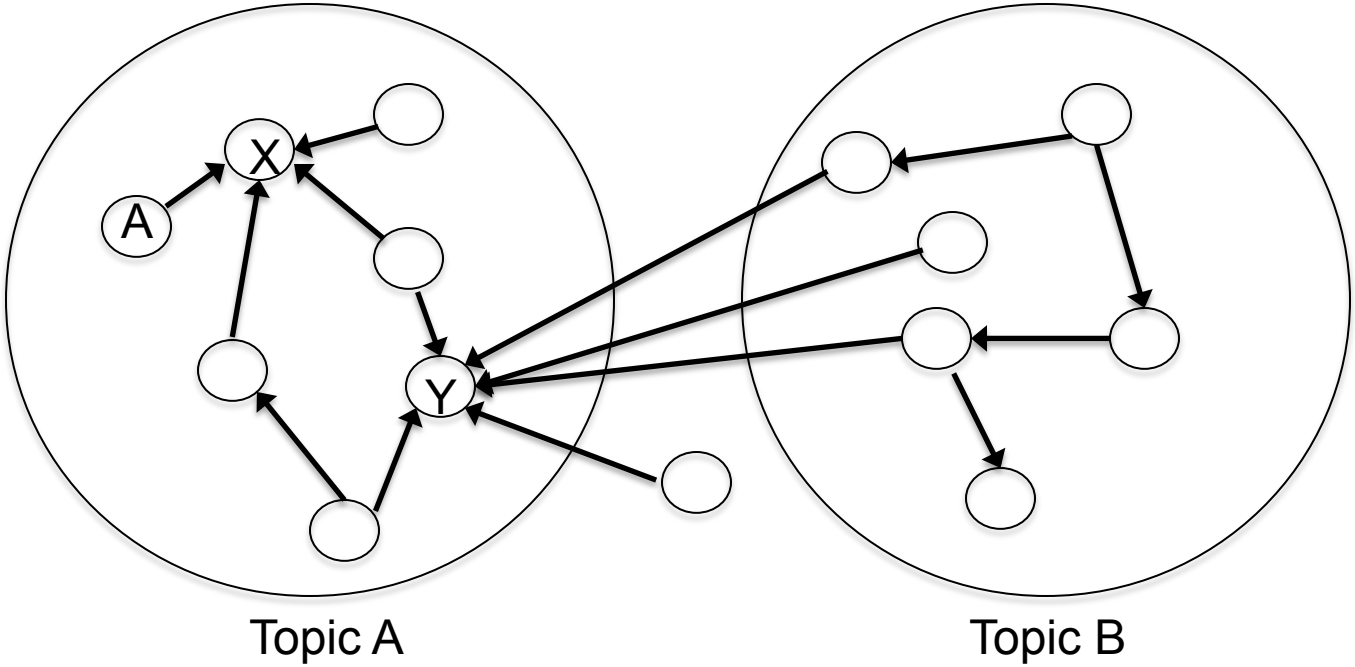
Algorithm

- Finds topic-specific influential users using social network information
  - Friend-Follower relationship, tweet time, number of tweets, etc
- Take top 300 influential users for each topic
- Finds 5 most similar topics using the common influential users between two topics
- Classify a topic using categories of its similar topics

Network-based Classification

Topic-specific Influential Users*

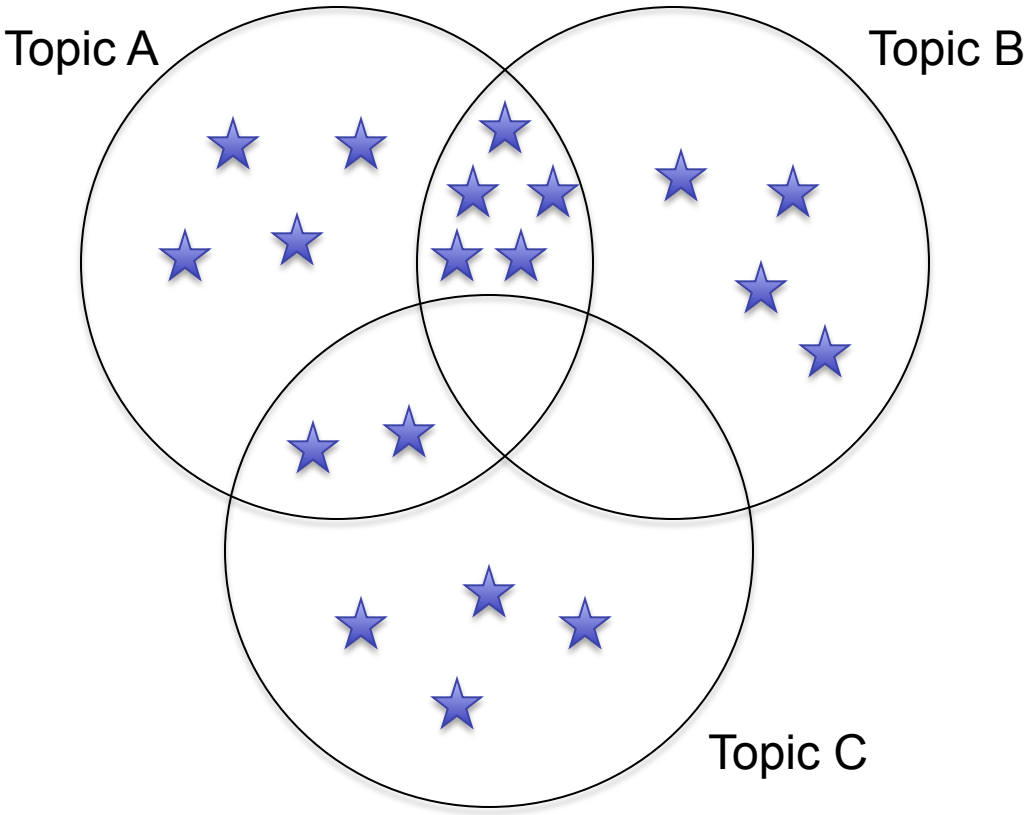


X is more influential than Y on Topic A

* R. Narayanan, “Mining Text for Relationship Extraction and Sentiment Analysis,” Ph.D. dissertation, 2010.

Network-based Classification

User similarity Model*



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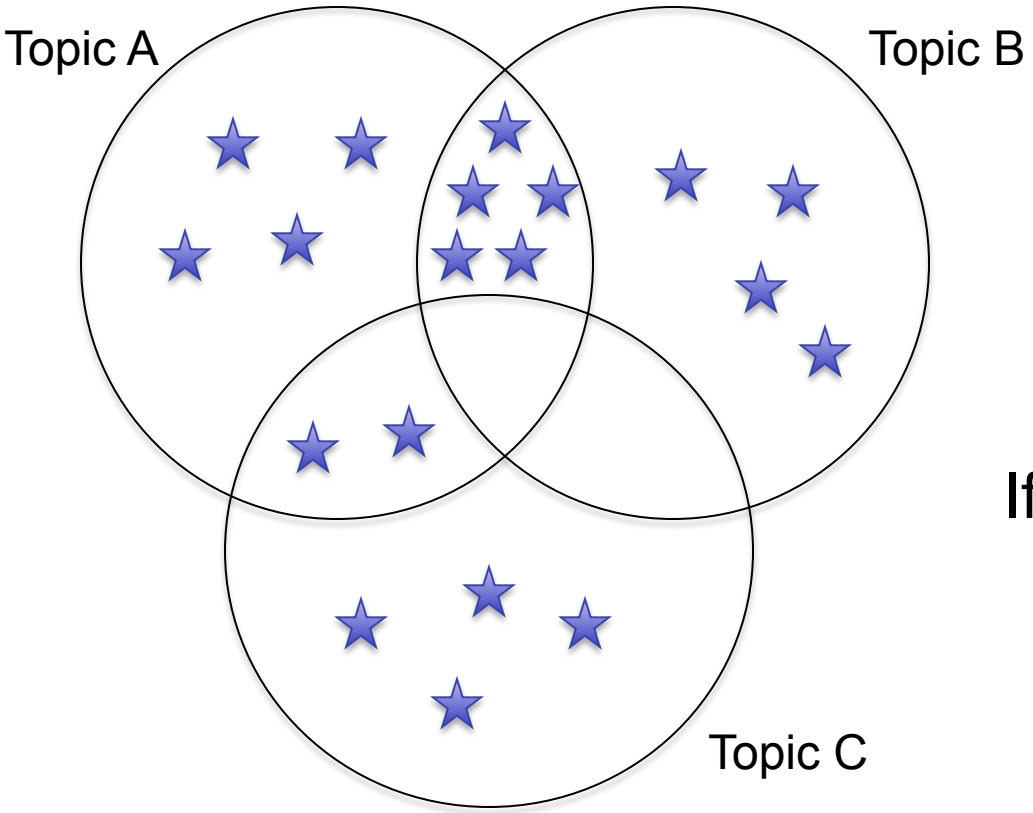
Network-based Classification

User similarity Model*



Topics A and B
are more closely related
than Topics A and C
If $|A_{infl} \cap B_{infl}| > |A_{infl} \cap C_{infl}|$

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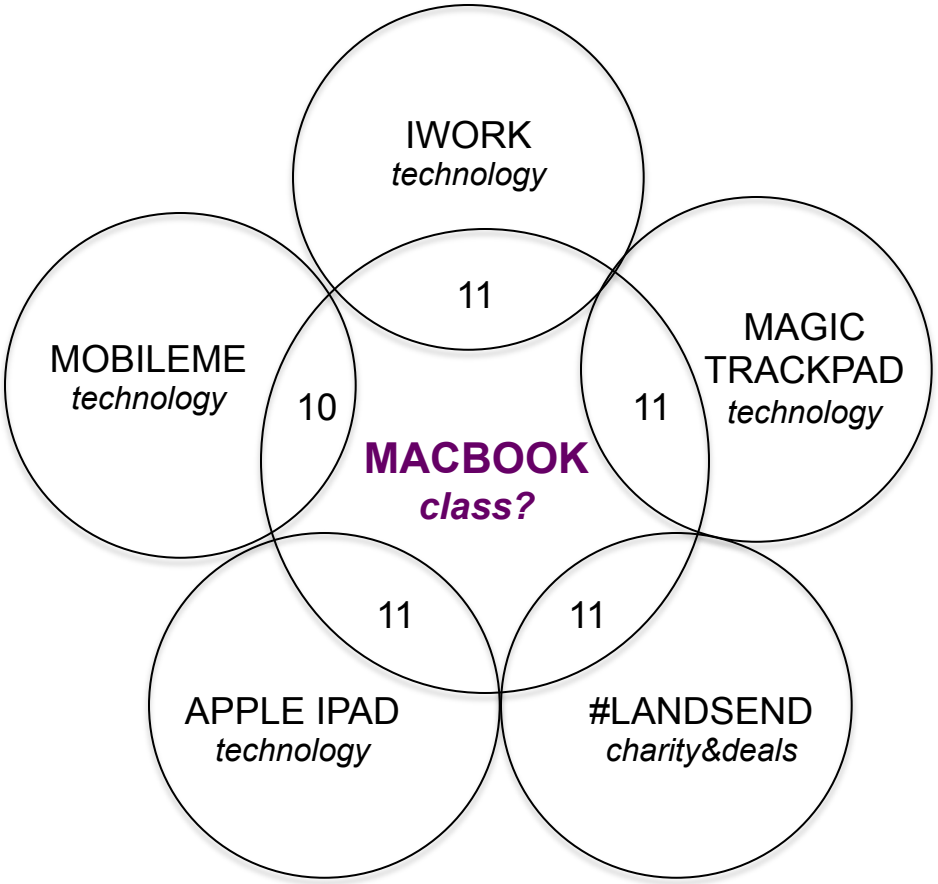
Network-based Classification

Topic "macbook" and 5 similar topics



Numbers in diagram **: number of common influential users** between topic "macbook" and the similar topic

Similar Topic	Class of Similar Topic	# Common Influential Users
iwork	technology	11
magic trackpad	technology	11
#landsend	charity & deals	11
apple ipad	technology	11
mobileme	technology	10

technology = 11 + 11 + 11 + 10 = 43
charity&deals = 11

Input to classifier

Topic	technology	charity &deals	books	music	fashion	tv &movies	…	Class
macbook	43	11	0	0	0	0	…	**?**
queen_rowling	0	0	30	0	0	10	…	**?**
lady_gaga	0	0	0	40	0	0	…	**?**

Table with 768 rows and 19 columns

- Run various classifier
  - C5.0, K-Nearest Neighbor, SVM, Logistic Regression

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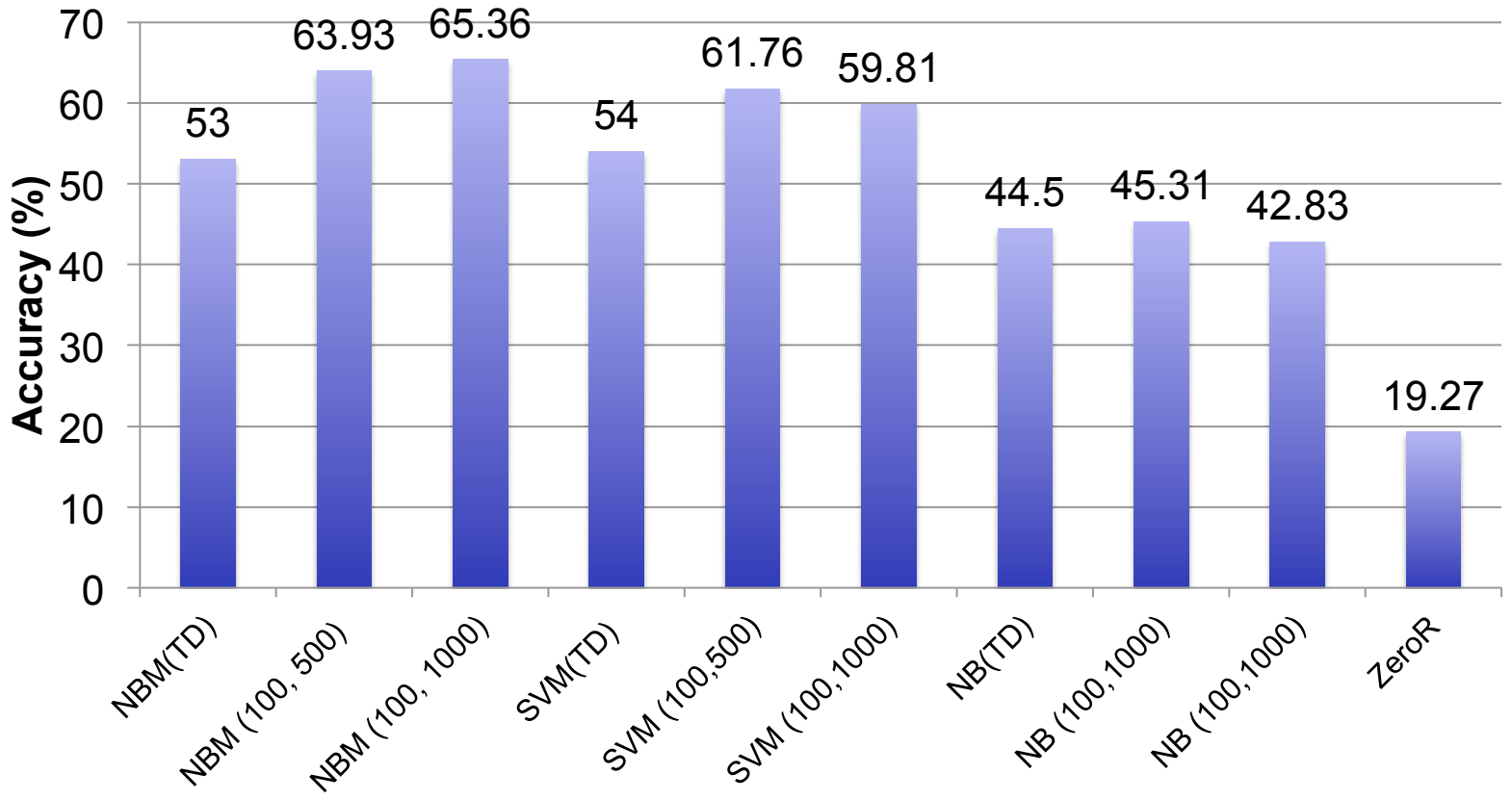
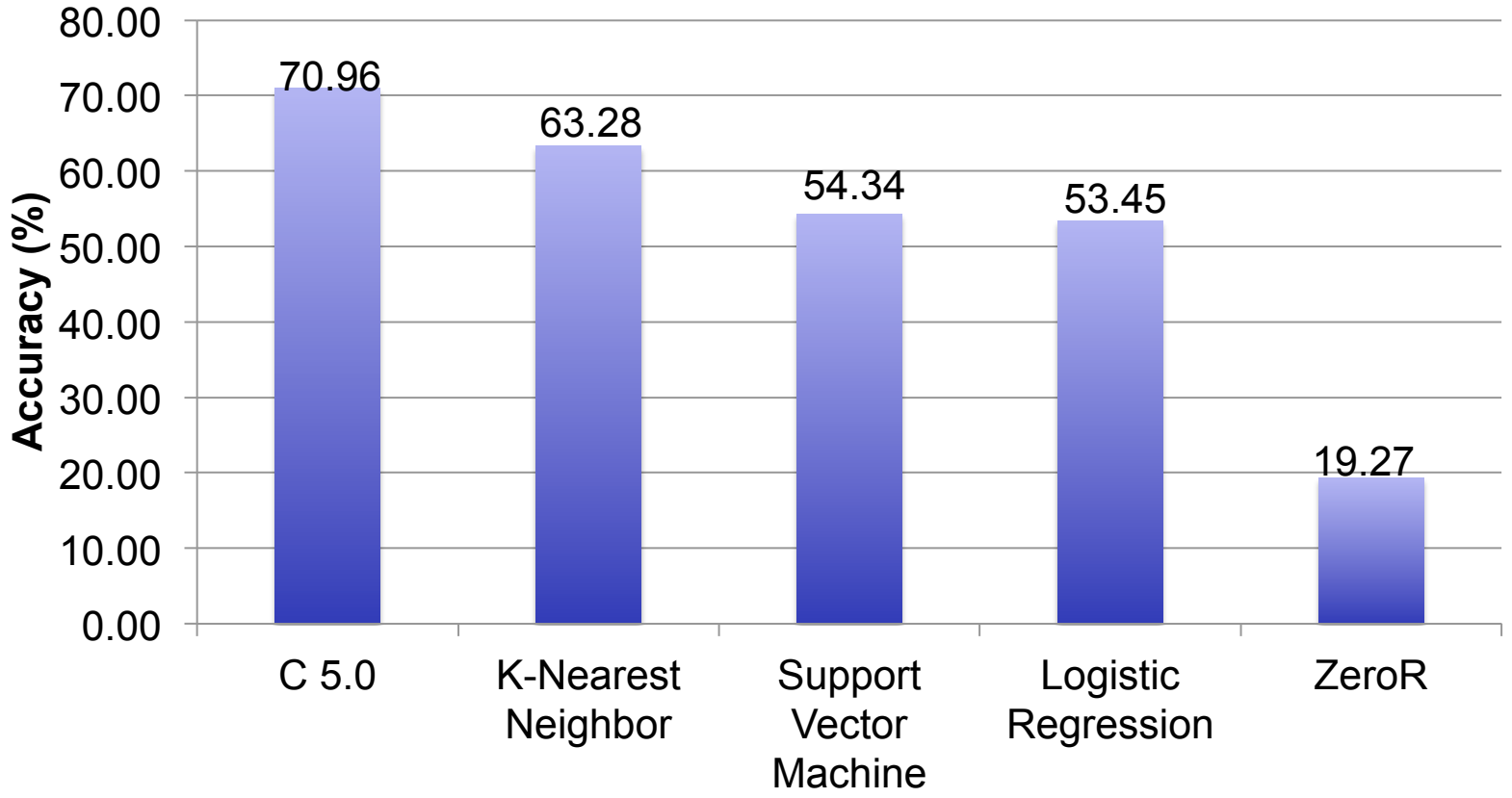
Experimental Setup

- TD: Trend Definition
- Model(x, y): classifier model used to classify a document consisting of x number of tweets per topic using y top frequent terms
  - e.g., NBM(100,1000)
    - Naïve Bayes Multinomial classifier
    - Document containing 100 tweets using
    - 1000 top frequent terms
- WEKA and SPSS modeler for classification
- 10-fold cross validation

Text-based Classification Results



Network-based classification results



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Key Contributions

- Use of social network structure for topic classification
- Good accuracy (65%) on Text-based classification
  - tweets are not grammatically structured (noisy)
- Network-based classifier (71%) outperforms text-based classifier

Future Work

- Integrate text-based classification and network-based classification
- Multi-labeling
  - topics could fall under more than one category
  - e.g., news about a famous actor's biography

Questions?

Thank you !