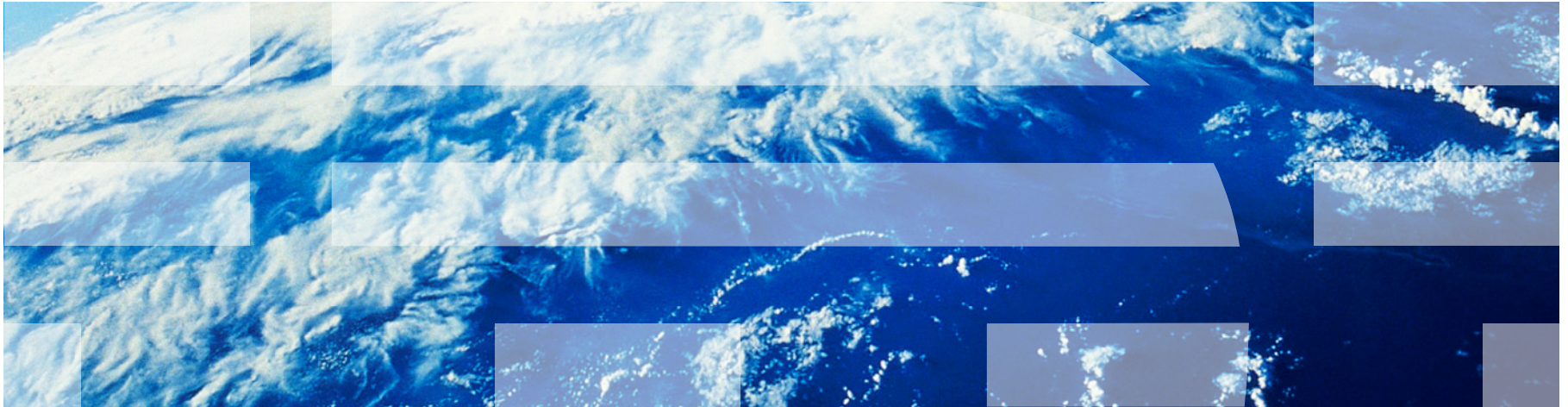


IBM Social Media Analytics and Collaboration with USC

Graham Mackintosh – IBM Corporation

Twitter, Politicians, and the Voice of the Voter

Abe Kazemzadeh – University of Southern California



Twitter Sentiment Analysis for US 2012 Presidential Elections

In Collaboration With
Signal Analysis And Interpretation Lab (SAIL)
Annenberg Innovation Lab (AIL)
IBM

Our Collaborative Environment

- SAIL – USC Viterbi School of Engineering
 - Signal processing
 - Speech and natural language processing
 - Emotion research and behavioral informatics
- AIL – USC Annenberg School of Communications and Journalism
 - Social media analysis
 - Domain knowledge: policy, politics, news, and entertainment
- IBM
 - Cognos Consumer Insight
 - InfoSphere Streams
 - Cloud Computing
 - Big Insights & Big Sheets

Challenges

- What is sentiment and how to measure it?
- In politics, fact and opinion can be blurred.
 - It can be difficult to distinguish low annotator agreement from partisanship.
- Sarcasm can reverse the surface polarity of sentiment.
 - Sarcasm can be difficult to detect, even for humans.
 - Poe's Law
- How can sentiment analysis be used in politics?
- Deal with high-volume, real-time events.

Approach

- We experimented a mix of data-driven and knowledge-based approaches.
- The data-driven component involved supervised (annotated) machine learning.
- Knowledge-based approaches were used in both curation of keyword matching patterns and rule-based sentiment analysis.
- Different use cases: analysis and entertainment.

Annotation

- Approximately 17,000 annotations of 14,000 tweets.
 - Mainly Mechanical Turk, but also online corrections from our dashboard.
- Domain specific: political tweets about the US 2012 presidential election.
- Tweets were labeled “positive”, “neutral”, “negative”, or “unsure” (multiple choice selection).
- Also, they were labeled as sarcastic or humorous (checkboxes).
- Agreement was low, 56%
 - When annotators disagreed about sarcasm, 48%
 - Excluding sarcasm, 59%

Example Annotation

The tweet is:

Can't you just imagine Romney standing over you with a large knife?

What sentiment does this tweet express toward the candidate it references?.

Positive

Negative

Neutral

Unsure

Is this tweet
sarcastic?

Yes

Is this tweet funny?

Yes

Submit

Sarcasm

- The presence and effects of sarcasm were strongly felt:
- Smiley emoticons were as correlated with positive tweets as with negative tweets.
- Approximately 1/3 of the data was labeled sarcastic.
- Sarcasm was correlated with lower annotator agreement, especially when the annotators disagreed with about the sarcasm.

Experimental Methodology

- Our goal was not only to achieve accurate classification but also to not be biased.
 - Predicting the majority class, “negative”, results in ~56% accuracy.
- Performance statistics were averaged over 10 random 90%/10% splits of the data.
- Evaluate the effects of
 - Machine learning model (naïve Bayes vs. maximum entropy),
 - Features (unigrams vs. bigrams),
 - Tokenization (simple vs. twitter-aware),
 - Sarcasm,
 - Humor.
- Model x Feature x Tokenization ± Humor ± Sarcasm

Results

- Unigrams performed better than bigrams.
- Maximum entropy performed better than naïve Bayes on negative tweets, and thus performed better in overall accuracy.
- Naïve Bayes was less biased toward negative.
 - We chose naïve Bayes for displaying highly negative and positive tweets.
- Removing sarcastic data in training produced a better model for classification of positive tweets.

Unigrams

Table 1: F-Scores and Accuracy for unigrams.

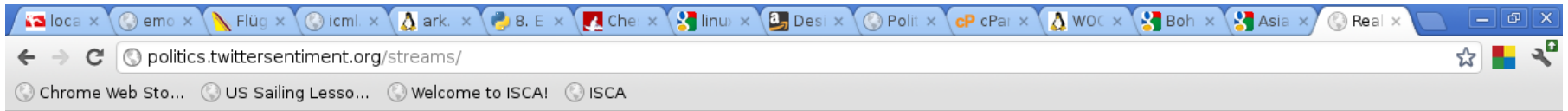
Experiment	Neg.	Pos.	Neu.	Uns.	Acc.
$M_{ME}F_1T_0$	0.74	0.33	0.14	0.10	0.58
$M_{ME}F_1T_0 - \{H\}$	0.72	0.34	0.19	0.12	0.57
$M_{ME}F_1T_0 - \{S\}$	0.67	0.36	0.25	0.15	0.51
$M_{ME}F_1T_0 - \{S, H\}$	0.66	0.37	0.24	0.14	0.49
$M_{ME}F_1T_1$	0.74	0.35	0.17	0.11	0.59
$M_{ME}F_1T_1 - \{H\}$	0.73	0.37	0.23	0.13	0.58
$M_{ME}F_1T_1 - \{S\}$	0.67	0.38	0.28	0.13	0.51
$M_{ME}F_1T_1 - \{S, H\}$	0.65	0.37	0.28	0.16	0.49
$M_{NB}F_1T_0$	0.64	0.39	0.25	0.16	0.48
$M_{NB}F_1T_0 - \{H\}$	0.65	0.39	0.24	0.15	0.49
$M_{NB}F_1T_0 - \{S\}$	0.64	0.39	0.26	0.16	0.49
$M_{NB}F_1T_0 - \{S, H\}$	0.65	0.39	0.25	0.15	0.49
$M_{NB}F_1T_1$	0.67	0.40	0.23	0.16	0.51
$M_{NB}F_1T_1 - \{H\}$	0.68	0.40	0.24	0.15	0.52
$M_{NB}F_1T_1 - \{S\}$	0.67	0.41	0.26	0.16	0.51
$M_{NB}F_1T_1 - \{S, H\}$	0.68	0.40	0.26	0.16	0.52

Bigrams

Table 2: F-Scores and Accuracy for bigrams.

Experiment	Neg.	Pos.	Neu.	Uns.	Acc.
$M_{ME}F_2T_0$	0.73	0.33	0.18	0.11	0.58
$M_{ME}F_2T_0 - \{H\}$	0.72	0.35	0.19	0.14	0.56
$M_{ME}F_2T_0 - \{S\}$	0.68	0.36	0.25	0.12	0.52
$M_{ME}F_2T_0 - \{S, H\}$	0.67	0.36	0.25	0.14	0.50
$M_{ME}F_2T_1$	0.73	0.35	0.22	0.11	0.58
$M_{ME}F_2T_1 - \{H\}$	0.72	0.36	0.23	0.15	0.56
$M_{ME}F_2T_1 - \{S\}$	0.69	0.38	0.28	0.14	0.53
$M_{ME}F_2T_1 - \{S, H\}$	0.67	0.38	0.28	0.15	0.51
$M_{NB}F_2T_0$	0.47	0.38	0.24	0.16	0.36
$M_{NB}F_2T_0 - \{H\}$	0.52	0.38	0.24	0.17	0.39
$M_{NB}F_2T_0 - \{S\}$	0.55	0.38	0.25	0.16	0.41
$M_{NB}F_2T_0 - \{S, H\}$	0.58	0.38	0.25	0.17	0.43
$M_{NB}F_2T_1$	0.48	0.38	0.25	0.17	0.37
$M_{NB}F_2T_1 - \{H\}$	0.54	0.39	0.26	0.17	0.40
$M_{NB}F_2T_1 - \{S\}$	0.56	0.40	0.26	0.17	0.41
$M_{NB}F_2T_1 - \{S, H\}$	0.59	0.40	0.27	0.18	0.44

Example



LIVE DEMO!

USCAnnenberg
Innovation Lab

TWITTER SENTIMENT ANALYSIS

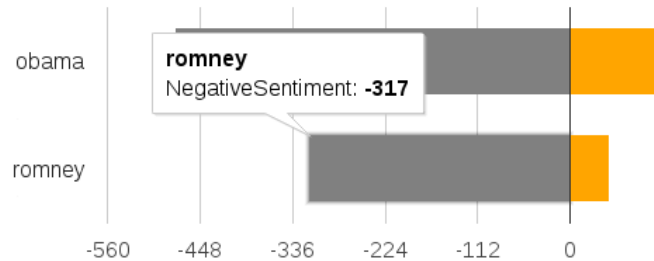


18:31
updates every 30s

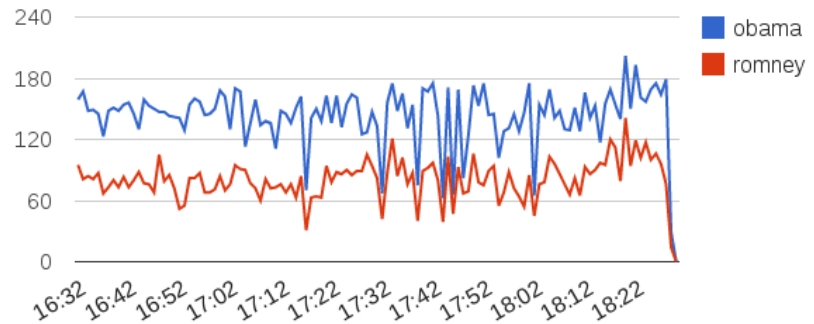
Our unique sentiment model and real-time processing infrastructure allow us to gauge live public sentiments toward the 2012 United States presidential candidates as expressed through Twitter. This live demo is work-in-progress as we continue to refine our sentiment model. [More information.](#)

Like { 7 } Tweet { 17 } +1 { 11 } Share { 69 }

Sentiment



Tweet Volumes



Statistics

Total # tweets processed 428437
System seconds elapsed 178019
Data rate (tweets/minute) 144

Trending words

18:26	18:27	18:28	18:29	18:30
set	anti-Romney	Extending	Extending	
Soak	complaint	Yorker	Middle-In	
Hinderaker	@ArlenWms	Middle-In	Yorker	
surprised	#BarackObama	Businessweek	Businessweek	
@nytimes	@i_wantyouzayn	Scam	Middle-Income	

Example

LIVE DEMO!

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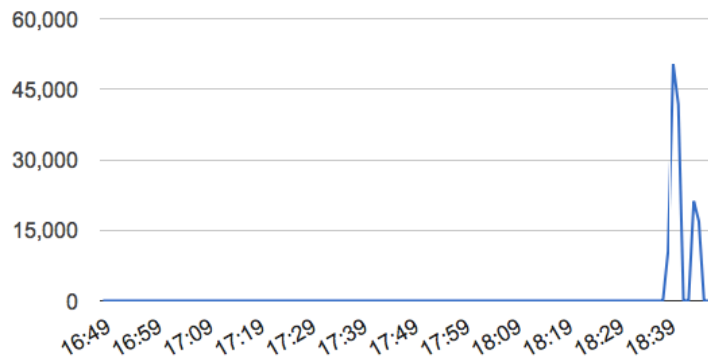
TWITTER SENTIMENT ANALYSIS



18:48

updates every 30s

Overall Tweet Volumes



Tag Cloud

!!! #Obama #Romney #debate2012 #debates @FollowMeOBAMA
 @MittRomney Bird Medicare Mitt OBAMA **Obama** Obama's
Romney Romney's WTF addressing
 amp ass back better black care class cut every face fuck gonna good
 jobs keeps look looks love needs nigga obama people plan poor
 president right romney saying shit talk talking tax trying vote voting
 wants win wins years you're

Sentiment	Most negative tweets
-99.9	RT @ChampagneLove_: Obama is like " who the hell let this wack dude in office? He dont know wtf he talking about. get him off the stage" ...
-99.9	Romney is so rude he's not even letting the poor old guy talk, you already know he ain't voting for your ass
-99.9	Romney cut Obama off or laugh at him again he should slap the liar off him .fake ass Ronald Reagan some 1 please push his wig bac like JFK
-99.9	so who else thinks romney looks like one of those crazy ass mormom cult leader... forreal he freaks me out

Sentiment	Most positive tweets
99.8	45 minutes in & the only points that landed are "Big Bird" and Obama's wedding anniversary #debate2012
99.7	Whether you agree with Obama's plans or not, he is an intelligent, down-to-earth, clear and concise speaker. Romney talks in circles.
99.7	In the Presidential Debate Obama is lost without the teleprompter. Mitt is a wonk & is wiping the floor with the community organizer.
99.7	#debates I applaud Mr Romney's preparation, command of the data, and ability to articulate in real time his ideas and plans.

Sentiment	Random neutral tweets and your tweets
0	RT @CTVMercedes: I feel like these guys are confused - Romney is defending status quo on some issues while Obama, the incumbent, is crit ...
0	RT @RetroPG: Mitt Romney changed his whole campaign in the last 24hrs
0	RT @PaulBegala: Romney draws on his vast experience shipping jobs overseas to claim there is no deduction for shipping jobs overseas. F ...
0	RT @factcheckdotorg: Romney said Obama doubled deficits. But Obama inherited \$1.2T deficit when he took office in FY2009, which ended wi ...

Count	Most frequent tweets
350	RT @BIGBIRD: WTF Mitt Romney... :(
82	RT @FollowMeOBAMA: If Obama Loses, I Say We Move To Europe... NIGGAS IN PARIS!
--	RT @OnionPolitics: Romnev: "But 75% of the 50% is paving two-thirds of the bottom 3%'s fifth of the

[Go To Main Dashboard](#)

Thanks

- USC SAIL
 - Dogan Can, Shrikanth Narayanan
- USC AIL
 - Kevin Driscoll, Melissa Loudon, Alex Leavitt, François Bar, Jonathan Taplin
- IBM
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