Identifying Controversial Topics

CS 191 (Senior Project)

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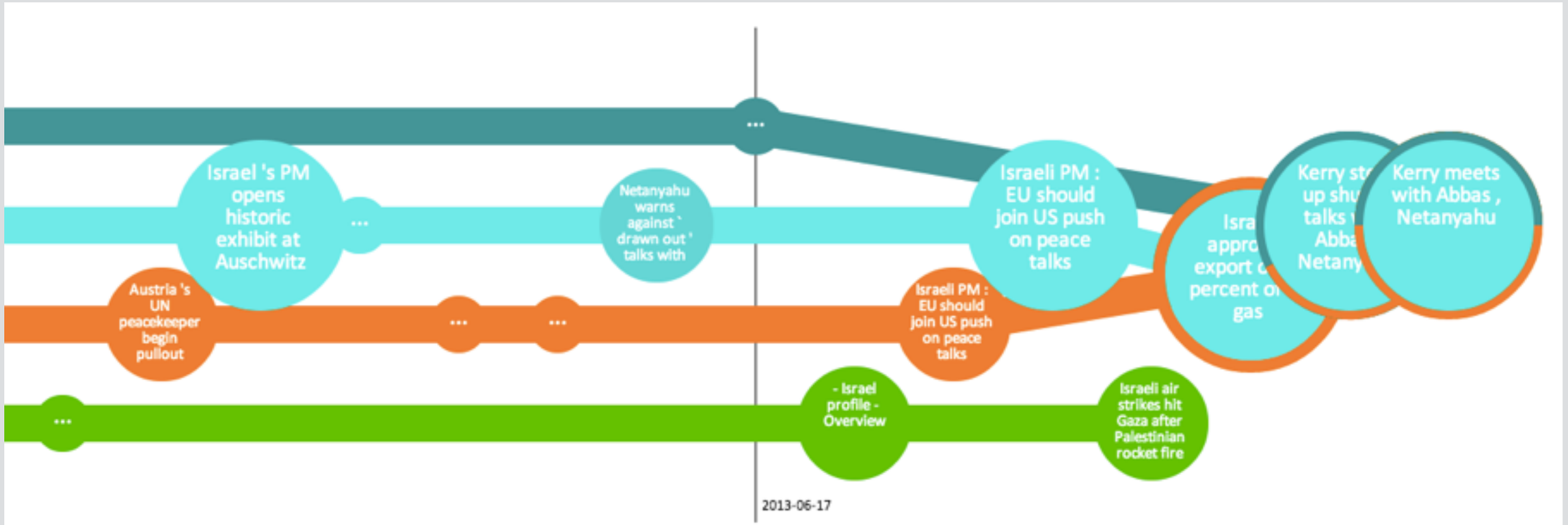
Metro Maps

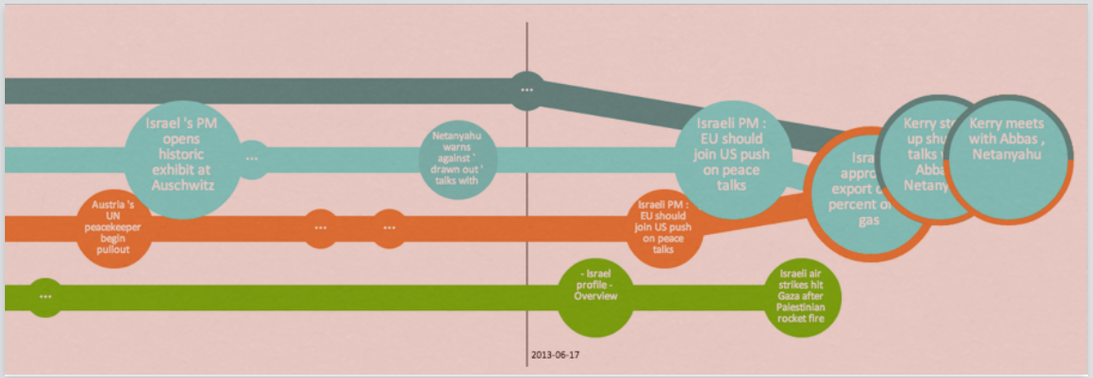


(Shahaf, Dafna. “Metro Maps of Information”)

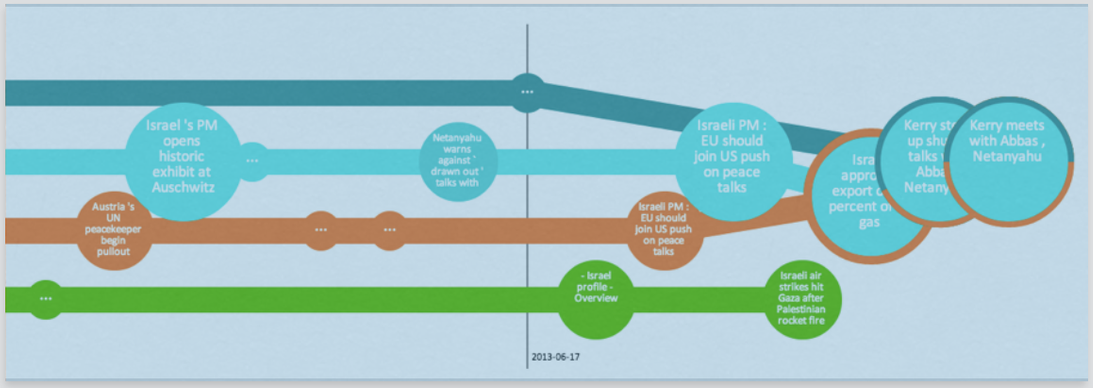
Separating Polarized Views

Obamacare

Republicans' View



Democrats' View



First Attempt: Clustering

- Clustering gives sub-topics, not points of view

Intuition: Defining Controversy

- It's all about **conflicting sentiments**!
- Examples:
  - Military involvement is a bad idea.
  - Justin Bieber is so weak.
  - Bieber is quite popular in Japan.

First Step

- **1. Identify controversial words**
- Example:
  - [“Syria”, “weapon”, “attack”, “Assad”, “rebels”]
- If we can do this…

Then we can

- **2. Represent each document as a vector of sentiment scores**

- Example:
  - [“Syria”, “weapon”, “attack”, “Assad”, “rebels”]

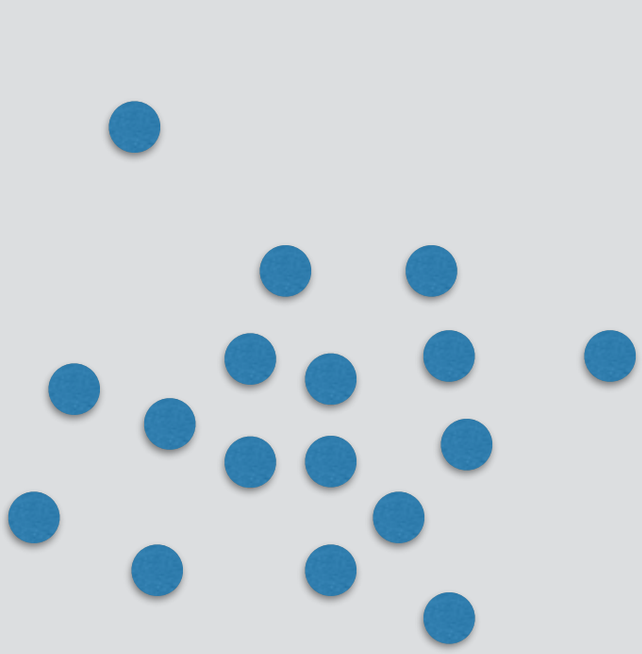
Doc 1: [-3 , **-10** , -9 , **-15** , +2]

Doc 2: [+3 , -3 , +1 , -2 , **-20**]

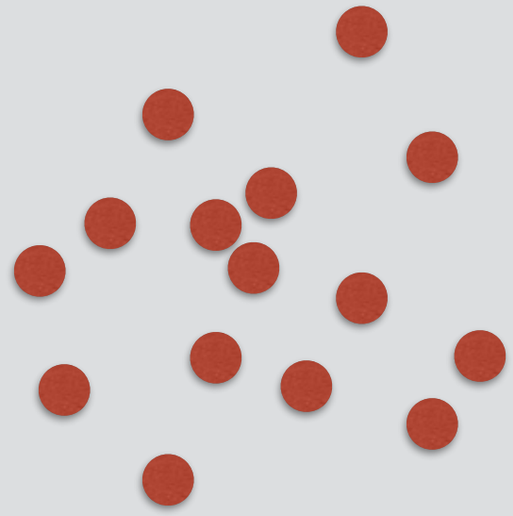
…

Then we can

- **3. Cluster the vectors into 2 groups**



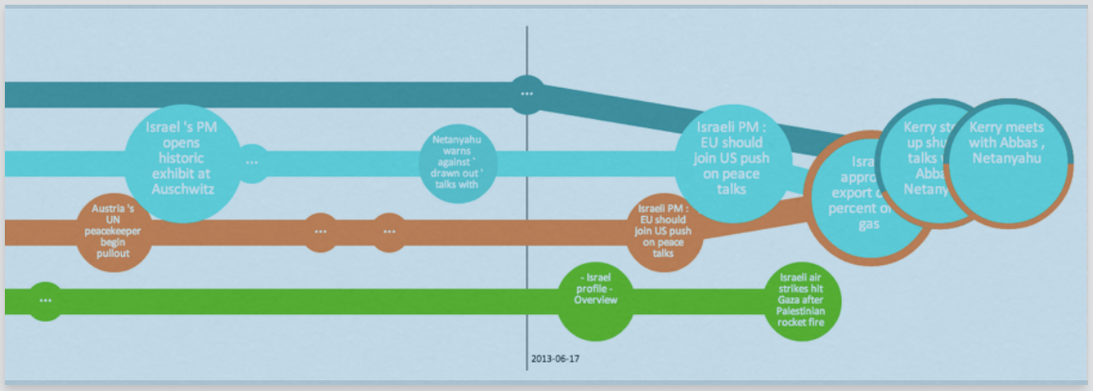
Assad is bad



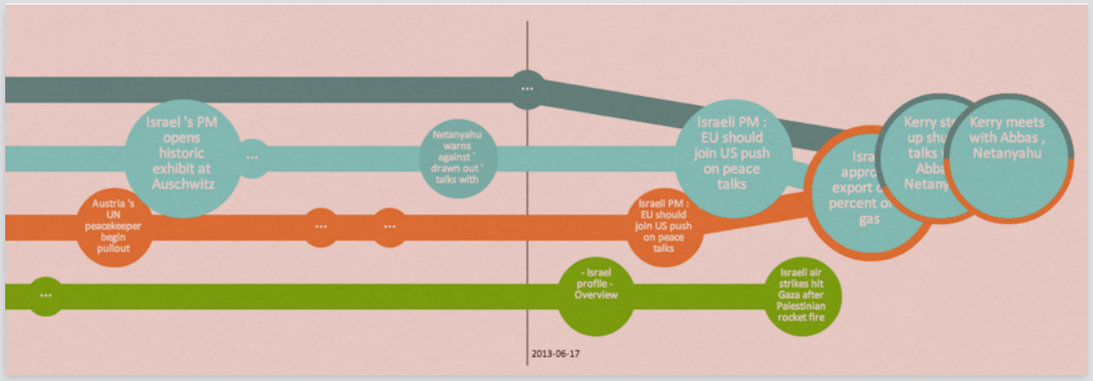
Rebels are worse

Then we can

- **4. Make 2 Metro Maps, one for each cluster**



Assad is bad



Rebels are worse

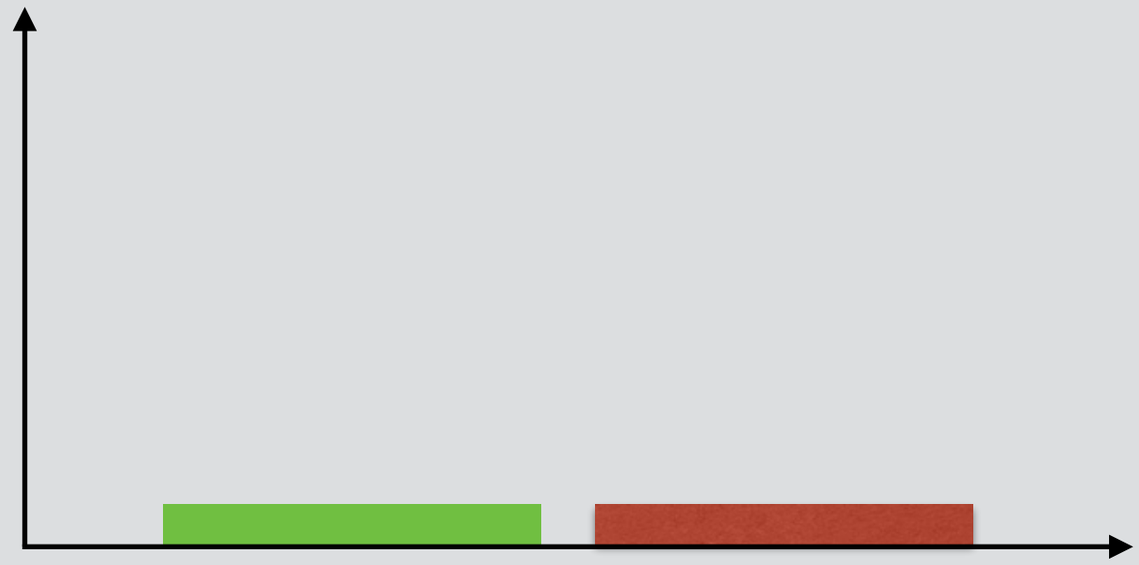
Data Sets

- Four data sets:
  - Movie Reviews
  - Celebrity News
  - Articles on the Syrian Conflict
  - Articles on UFOs
- Sources:
  - Stanford NLP group, CNN, FOX, BBC, Washington Post, …
- Toy datasets used for demonstration

Intuition: Controversy Score

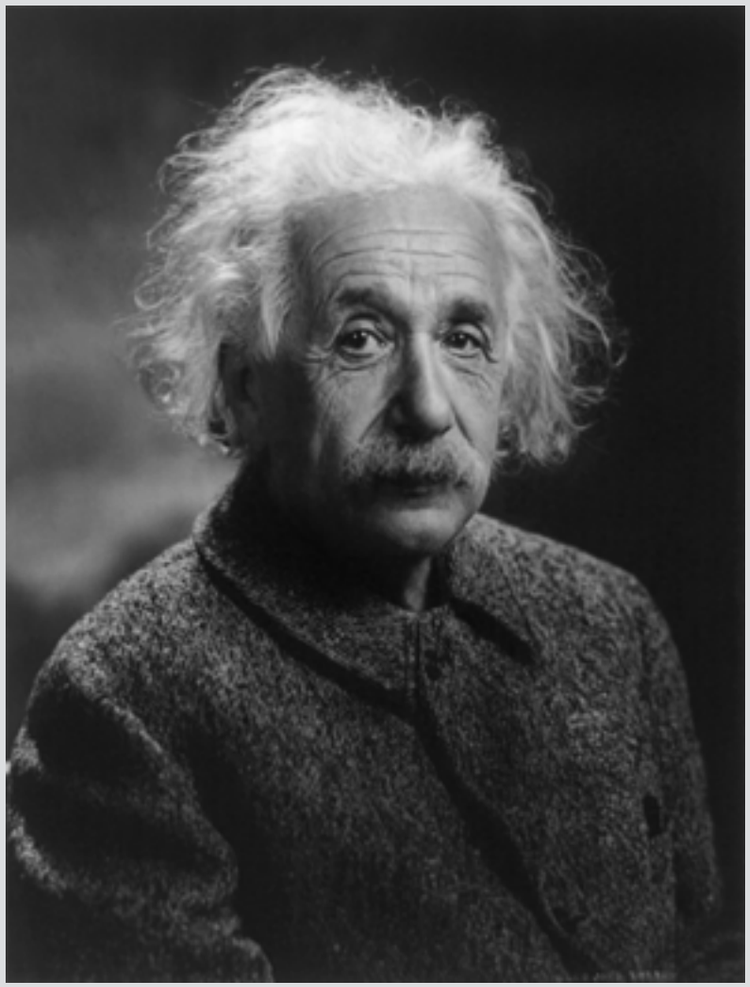
# of positive sentiments: few

# of negative sentiments: few



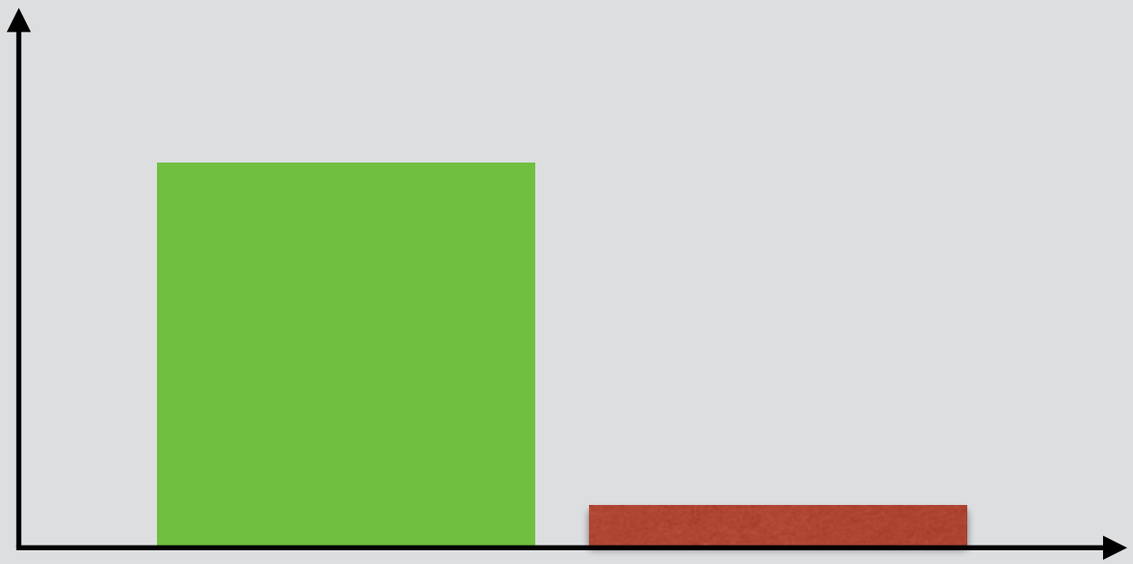
Not Controversial

Intuition: Controversy Score



# of positive sentiments: **many**

# of negative sentiments: few

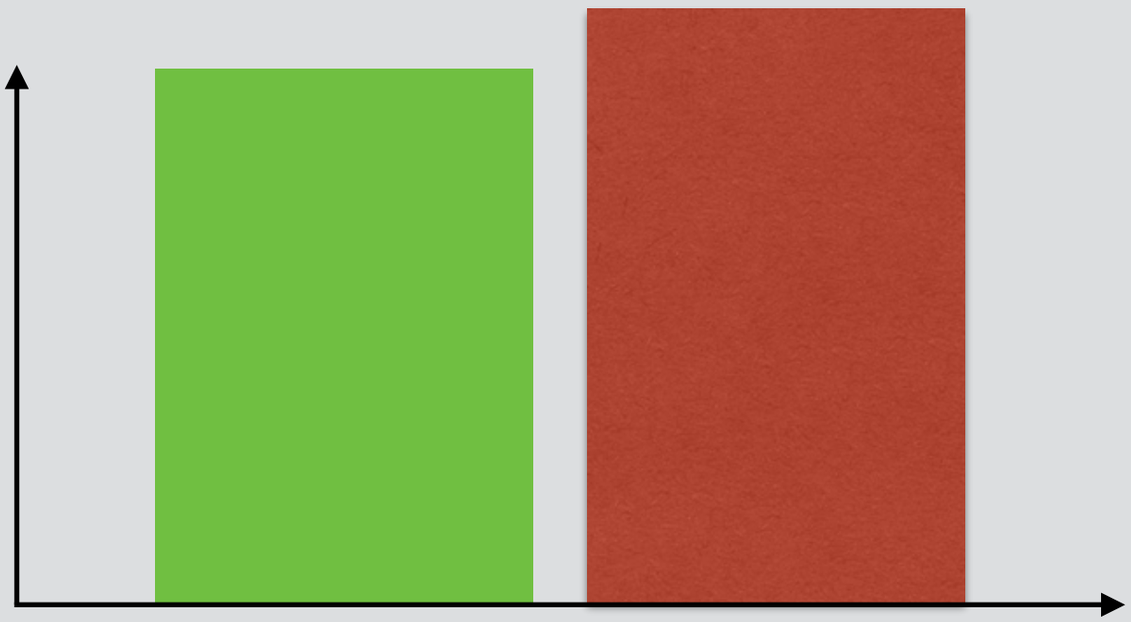


Not Controversial

Intuition: Controversy Score

# of positive sentiments: **many**

# of negative sentiments: **many**



Controversial

Controversy Scoring Function

- Parameters:
  - # of positive sentiments: pos
  - # of negative sentiments: neg
- **sum** = pos + neg + 1
  (add 1 to make the value strictly positive)
- diff = |pos - neg|
- **diffRatio** = diff / sum
  (~ 0 means very controversial, ~1 means not controversial)

Controversy Scoring Function

	diffRatio is small	diffRatio is large
sum is small	*not controversial*	*not controversial*
sum is large	***controversial***	*not controversial*

- controversyScore = *f* (**sum**, **diffRatio**)
  - (need to come up with a good function for *f*)

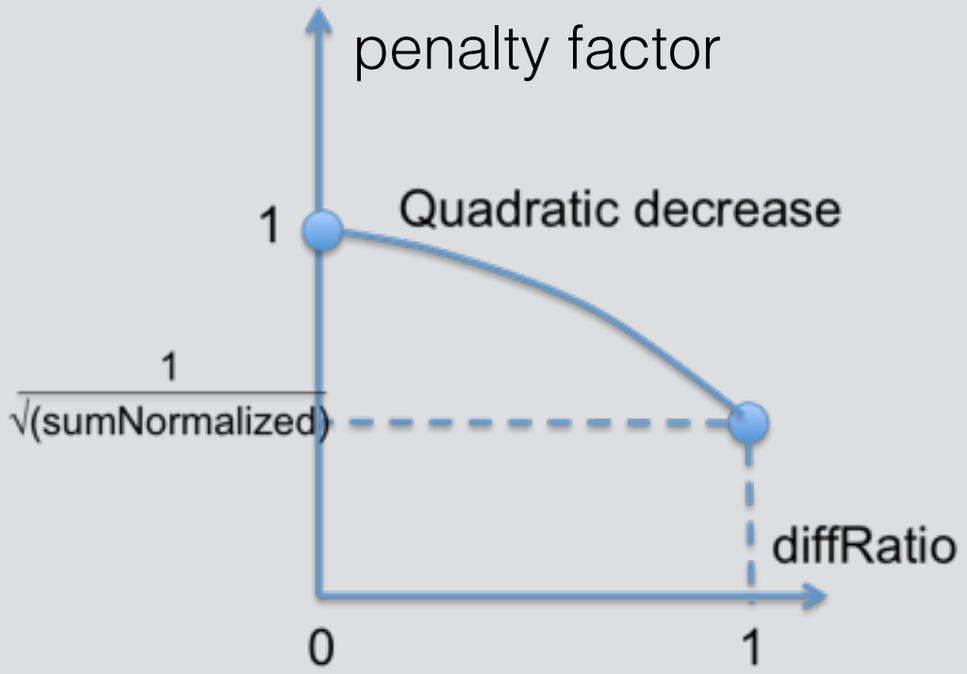
Controversy Scoring Function

- Introspection 1
  - Recap: controversyScore = *f* (**sum**, **diffRatio**)
  - How should *f* behave differently for the below cases?
  - 1) 1000 vs 0
  - 2) 5 vs 0
- diffRatio is 0 for both cases, but 1) should be penalized more

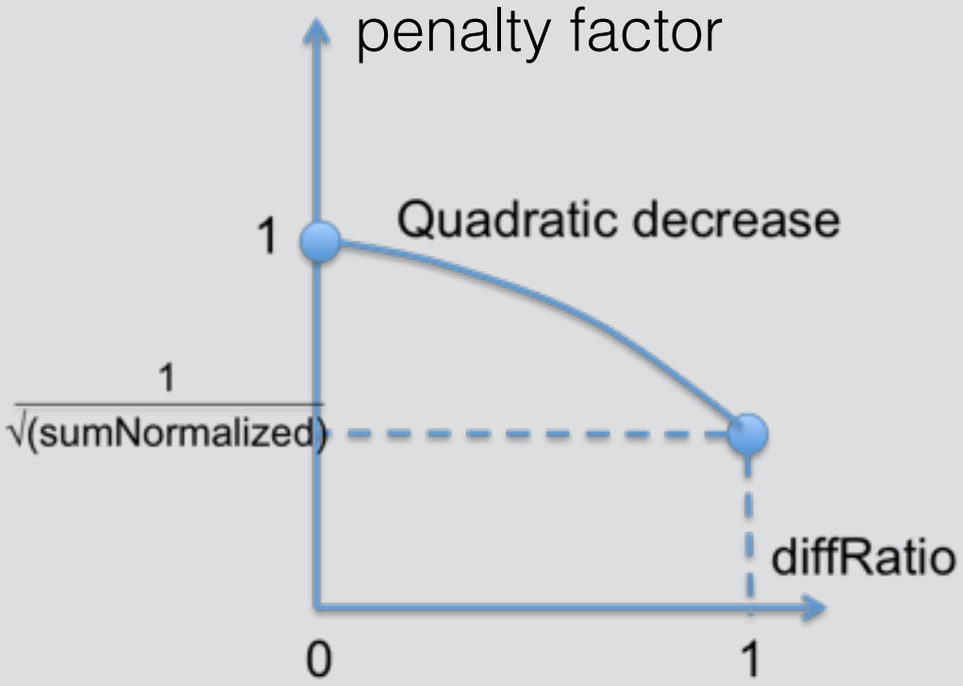
Controversy Scoring Function

- How much penalty should we give when diffRatio == 1?
  - My try: $\frac{1}{\sqrt{sum}}$
- How quickly should this value decrease as diffRatio approaches 1?
  - My try: quadratically

	diffRatio	penalty factor
	~ 0.0	1.0
	~ 1.0	$\frac{1}{\sqrt{sum}}$



Controversy Scoring Function



Let $x = diffRatio$ and $f(x) = penalty$

$f(x) = 1 - kx^2$

Condition 1: goes through $(1, \frac{1}{\sqrt{sum}})$

$\frac{1}{\sqrt{sum}} = 1 - k$

$k = 1 - \frac{1}{\sqrt{sum}}$

$f(x) = 1 - (1 - \frac{1}{\sqrt{sum}}) \cdot x^2$

Controversy Score: Result

$$sum = numPos + numNeg + 1$$

$$diff = |numPos - numNeg|$$

$$diffRatio = \frac{diff}{sum}$$

$$penalty = 1 - (diffRatio^2) \cdot (1 - \frac{1}{\sqrt{sum}})$$

$$controversyScore = sum \times penalty$$

Demo

Clustering

- Pick top k controversial words
- Reminder: vector representations of documents
  - [“Syria”, “weapon”, “attack”, “Assad”, “rebels”]

Doc: [+3 , -3 , +1 , -2 , **-20**]

- Use k-means (k = 2) algorithm to separate the vector representations of documents
- (dimension = # of controversial words we use)

Sample Polarized Documents (1)

- 1. Syrian Conflict - **For** military intervention
- U.S., Russia make pact on disarming Assad, but the war must end, too.
- THE CHEMICAL weapons disarmament plan for Syria hammered out in Geneva by Russian Foreign Minister Sergei Lavrov and U.S. Secretary of State John Kerry is unprecedented. Removing these dangerous **weapons** in a civil war would be a significant **accomplishment**. But the joint effort by Russia, the United States and United Nations must not distract from a larger strategy to end the battles of bullets and bombs that have cost 100,000 lives.
- …

Sample Polarized Documents (2)

- 2. Syrian Conflict - **Against** military intervention
- Syrian rebels killed or kidnapped hundreds of civilians, report says.

- Jihadi-led rebel fighters in Syria killed at least 190 civilians and abducted more than 200 during an offensive against pro-regime villages, committing a war crime, an international human rights group said Friday.

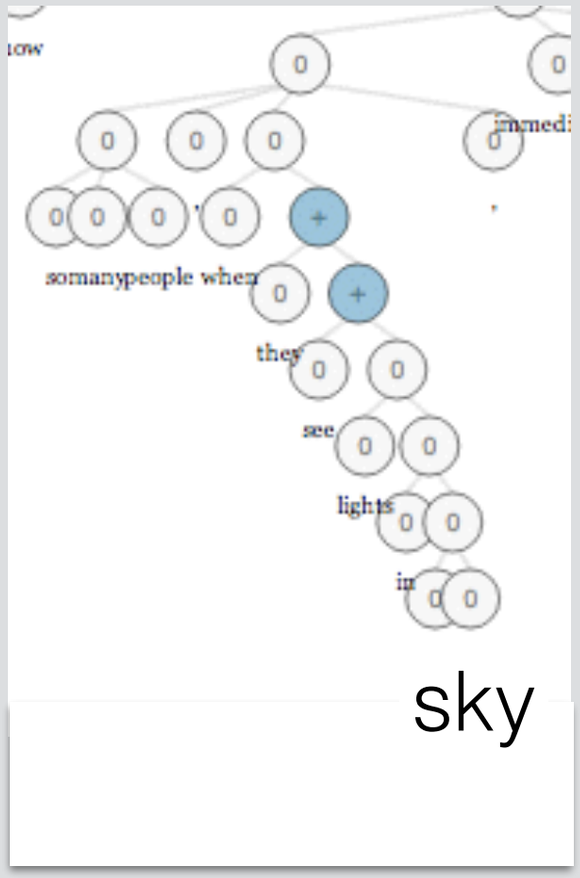
- …

Future Work (1)

- Problem 1: **Granularity**
    - “Assad”, “Syrian regime”, both refer to the same notion
    - Current method (based on stemming) doesn’t capture this
- Solution:
    - Use Latent Dirichlet Allocation (in progress) to aggregate the sentiments across these words

Future Work (2)

- Problem 2: **Lack of precision** in sentiment analysis (critical)
  - robert sheaffer, a ufo investigator with skeptical inquirer magazine and author of the "bad ufos blog, told discovery news, it s remarkable how so many people, when they see lights in the **sky**, immediately jump to the conclusion that they might be seeing (an alien spacecraft) in reality there are many different possible explanations for lights in the sky, all of them more likely than alien visitors.

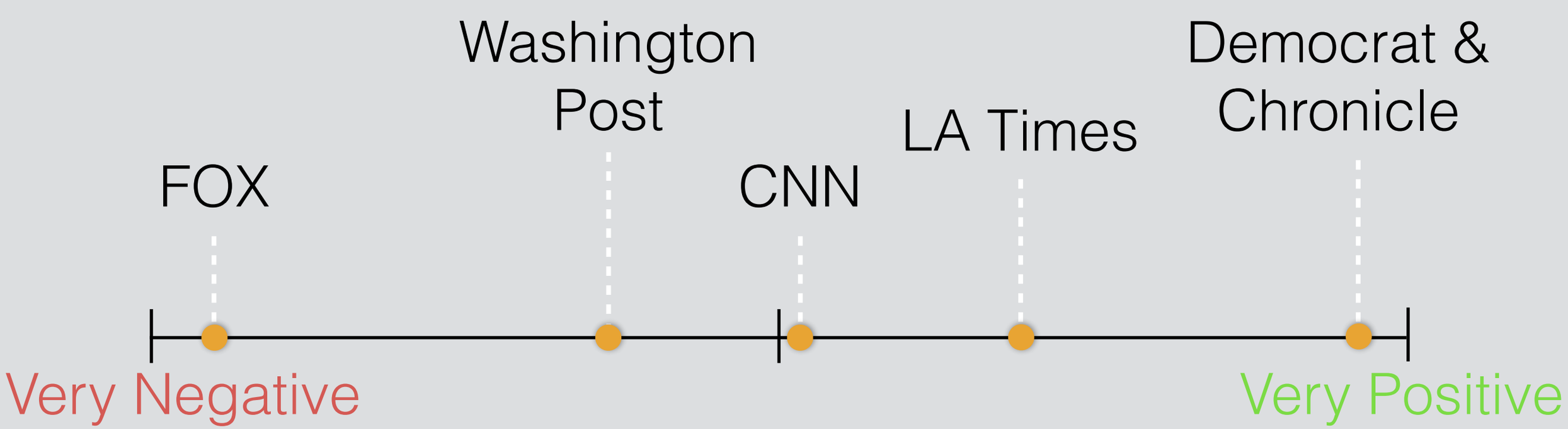


(source: Stanford NLP Group)

- Solution:
  - Better sentiment analysis method!

Future Work (3)

Select the controversial topic: Obamacare Justin Bieber …



(Not based on actual data)

Conclusion

- **Controversy scoring function** using sentiment signals (contribution)
- **Vectorization of documents** using the sentiment score for each of the most controversial words
- **k-means clustering** to separate polarized views

Thank You

- **Dafna** for your amazing support and guidance
- **Dima** for helping me familiarize myself with the code base
- **Professor Leskovec** for inviting me into the research group
- **Everyone here** for attending my talk

Problem 1

- (corpus, topic) ▶ controversy score
- Examples (corpus is a collection of recent news articles):
  - (corpus, Obamacare) ▶ 4.1
  - (corpus, Bieber) ▶ 3.5
  - (corpus, Economic prosperity) ▶ 0.3

Preprocessing

- 1. For each noun in the document,

  - Identify 1) # of positive adjectives applied to this noun, and 2) # of negative adjectives applied to this noun

Controversy Score

$$function\ GetControversySore(numPositiveNeighbors,\ numNegativeNeighbors):$$

$$sumNormalized = numPositiveNeighbors + numNegativeNeighbors + 1;$$

$$diffRatio = \frac{|numPositiveNeighbors - numNegativeNeighbors|}{sumNormalized};$$

$$diffFactor = 1 - (diffRatio^2) \cdot (1 - \frac{1}{\sqrt{sumNormalized}});$$

$$return\ \ln(sumNormalized \times diffFactor);$$

	diffRatio	diffFactor
Positive Negative	0.0	1.0
Positive Negative	~ 1.0	$\frac{1}{\sqrt{(sumNormalized)}}$