

Hotspots of News Articles

Joint Mining of News Text and Social Media to Discover Controversial Points in News

Graham Dyer, Ismini Lourentzou

Department of Computer Science, University of Illinois at Urbana–Champaign
{gdyer2, lourent2}@illinois.edu



Motivation

Novel text mining problem: mine news and text and social media jointly to discover the most controversial sentences in news.

- Highlighting controversial points in news articles for readers.
- Revealing controversies in news and their trends over time.
- Quantifying the controversy of a news source

Leverage relevant comments in Twitter to assess public opinions about an issue mentioned in a news articles

Implementation

We implemented

1. the algorithms that use our multimodal ranking theory
2. a real-time server and interface
 - content is gathered from the necessary sources
 - ranked using controversy scoring and
 - presented to the user in a *pleasant yet efficient manner*

In an effort to develop a keyword-based controversy application programming interface (API) for future usefulness, we have created an impressive user-facing product. Our API will continue to get more accurate by leveraging click-through rates and timestamps, indicative of human interest.

Overall Application Flow

1. The user performs a keyword search
 - Build a news article corpus
 - Build a twitter corpus
2. Map the most relevant social content to each sentence in a news article
 - Rank matching tweets according to their relevance to a sentence
 - Okapi BM25 retrieval function [2]
3. Analyze sentiment and linguistics features
4. Feed our controversy scoring function

For each news article produce:

 - A ranked set of sentences
 - An overall score
5. Make the system real-time and low-latency
6. Create a user-interface which leverages our API
7. Track usage to increase accuracy of controversy detection

Mining Approach

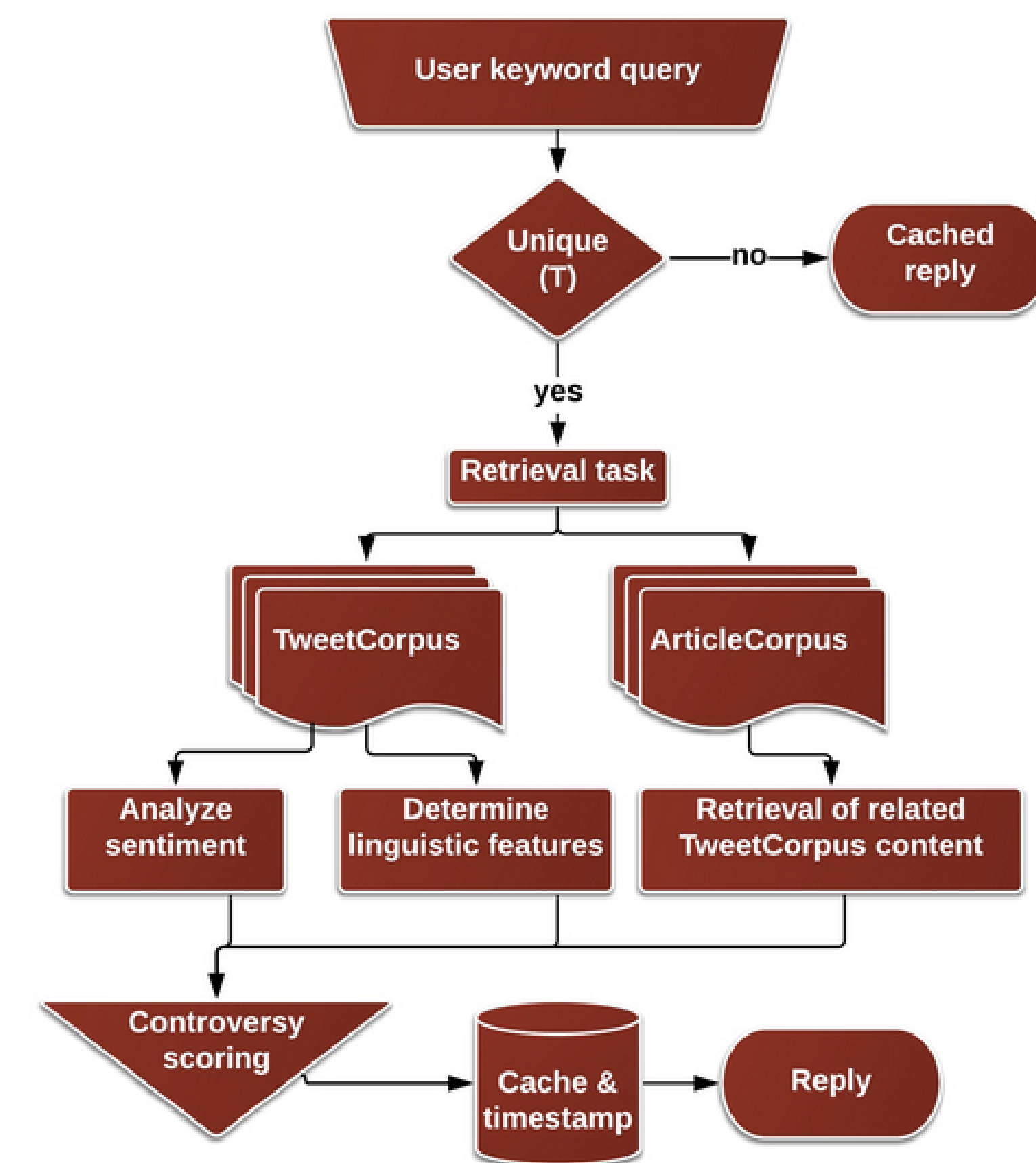


Figure 1: API design approach

Controversy Scoring function

Entropy is a widely used measure of uncertainty of a random variable. We thus propose scoring controversy based on entropy (e.g., of the distribution over the polarities of sentiment) with a **higher entropy indicating more controversy**.

Entropy $H(X)$ of a random variable X with n outcomes x_1, \dots, x_n is defined as

$$H(X) = - \sum_{i=1}^n p(x_i) \log_b p(x_i) \quad (1)$$

where $p(x_i)$ is the probability mass function of outcome x_i .

For example, it is easy to interpret sentiment as a discrete random variable X_{sent} with n possible outcomes and propability function:

$$p(X_{sent} = x_i) = \frac{f(x_i) \in C'_i}{\sum_{i=1}^n f(x_i) \in C'_i} \quad (2)$$

where $f(x_i) \in C'_i$ is the number of comments that have sentiment equal to x_i and $\sum_{i=1}^n f(x_i) \in C'_i$ is the total number of comments.

Results in previous evaluation reveal a high performance (82.59% in ranking sentences) on a data set created from controversial debate topics found online [1]

Future Directions

Over the course of Summer 2015, we hope to continue to improve our user-facing product and API. Our source-code has already been open-sourced [3] and our API routes will be made public shortly.

References

- [1] Most controversial debate topics.
- [2] Okapi bm25 formula.
- [3] Lourentzou I. Dyer G., Huang L. Controversy detection.

Acknowledgments

We would like to thank **Lisa Huang** for her continued contributions to this project as well as **Professor ChengXiang Zhai** and the **PURE Committee** for their support of our work.