Tweeting Under Pressure: Analyzing Trending Topics and Evolving Word Choice on Sina Weibo

Le Chen    Chi Zhang    Christo Wilson
College of Computer and Information Science
Northeastern University
Censorship in China

- Great Firewall of China (GFW)
Censorship on Weibo

• What will be censored?

• How is censorship implemented?

THE WORST THING ABOUT CENSORSHIP IS
Current Understanding of Censorship on Weibo

• **Scale of censorship**[1][2]
  - 16% of censored tweets vs. 0.01% of censored tweets

• **Velocity of censorship**[3]
  - Focus on 3K of Chinese celebrities
  - 30% of tweets are deleted within 30 minutes

---

Sorry, this tweet is inappropriate to be public…

Impact of Censorship

• Information dissemination
  o Extensively studied on Twitter
  o Missing: adversarial forces

• Chilling effect?
  o Dissuade people from discussing about censored topics

• Do users adapt?
  o Change linguistic conventions or behaviors
Outline

• Motivation

• Methodology of data gathering
  o Data gathering: API or DIY
  o Crawler design and data collection
  o Validation of the method

• Topics analysis

• Word usage on Weibo
Sina Weibo Overview

- Launched in August 2009
- By December 2012, ≈ 500 million users
- Over 4.6 million users and 100 million tweets daily
Data Gathering Challenges

• Unlike Twitter, Weibo removes data

• Censorship happens in minutes
  o Frequently revisit users to keep track of censorship

• Strict rate-limit on requests
Locating Users

- Users most likely to be censored

Selected Users

- Celebrity: 3K
- Top commentors: 177K
- Random commentors: 100K
- # of followers > 10M
Crawler Design

• Design challenges
  o Different users tweet at different speed
  o Censorship happens shortly after tweets are posted

• Solution
  o Crawl the users at different speed
  o Revisit again and again to check censored tweets

Three buckets: one hour (5K), three hours (22K), daily (253K); crawled active users more often
Validation

- Crawl in hours but censorship happens in minutes
- Intensive crawling
  - 500 random users from each group
  - Once per minute for a week

1. Gathers > 50% censored tweets
2. > 99% of content on Weibo is comments and comments are never censored
Daily Activity on Weibo

- 830K tweets; 18M comments; 9K censored tweets
- 1% of tweets are censored
  - Estimates from prior work: 0.01% -- 16%

October 2013 COSN'13
Outline

• Motivation
• Methodology of data gathering
• Topics analysis
  o Locating trending topics
  o Analysis of trending topics
• Word usage on Weibo
Key Research Question

• What is the impact of censorship on discourse on Sina Weibo?
  - Impact of censorship in trending topics
  - Censored topics vs. uncensored topics
Locating Trending Topics

• Topic Extraction
  o Latent Dirichlet Allocation (LDA)
  o LDA output: 1) topics; 2) words in each topic

• Challenges
  o Chinese does not include breaks between words
    • Solution: word segmentation using OpenCLAS
  o Many new words on Weibo
    • OpenCLAS has a small dictionary (104K)
    • Solution: Use the Sogou Pinyin Dictionary (including words from social media)
    • Sogou pinyin: crowd-sourced and keep updating
Topic Validation

• Output of LDA: 300 topics
  o 37 trending topics corresponded to real-world events;

• Locating trending topics

<table>
<thead>
<tr>
<th>General</th>
<th>Real-world events</th>
<th>Censored</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economics</td>
<td>Boston marathon bombing</td>
<td>Lushan secretary</td>
</tr>
<tr>
<td>Food</td>
<td>Ya’an earthquake</td>
<td>Beijing taxi driver</td>
</tr>
<tr>
<td>English learning</td>
<td>Wechat charge</td>
<td>Bird flu</td>
</tr>
</tbody>
</table>

• Validation
  o All 11 trending topics listed on external sources
High-level Overview

- 37 real-world events

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Range</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifespan(days)</td>
<td>2 ~ 14</td>
<td>4.6</td>
</tr>
<tr>
<td># of tweets</td>
<td>394 ~ 108K</td>
<td>19K</td>
</tr>
<tr>
<td># of comments</td>
<td>538 ~ 3.1M</td>
<td>635K</td>
</tr>
<tr>
<td>% of censored tweets</td>
<td>0% ~ 82%</td>
<td>1.7%</td>
</tr>
</tbody>
</table>

- Most topics are not censored
  - 5 topics experienced >5% of censorship
Impact of Censorship

- Does censorship have impact on user behavior?
- Correlation between censorship and # of tweets per user
  - Spearman’s $\rho = -0.1$
- But our crawler missed some censored tweets
  - Adjustment factor = % of missing tweets

![Likely region graph](image)
Key Research Question

• What is the impact of censorship on discourse on Sina Weibo?

• Ans: We observe there is no chilling effect. Instead, censored topics see more active users tweeting more frequently.
Outline

• Motivation
• Methodology of data gathering
• Topics analysis

• Word usage on Weibo
  o Locating morphs
  o Morph usage and censorship
  o Dynamics of Morph usage
Key Research Question

- Do Weibo users adapt in order to avoid censorship?
  - Keyword-based censorship leads to linguistic adaptation
  - To analyze adaptation, we focus on morphs
Locating Morphs

• What is a morph?

<table>
<thead>
<tr>
<th>Type</th>
<th>Original</th>
<th>Literal Meaning</th>
<th>Morph</th>
<th>Literal Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homophone</td>
<td>和谐</td>
<td>Harmony</td>
<td>河蟹</td>
<td>River crab</td>
</tr>
<tr>
<td>Pinyin Initial</td>
<td>美眉</td>
<td>Pretty eyebrow</td>
<td>MM</td>
<td>N/A</td>
</tr>
<tr>
<td>Neologism</td>
<td>囧</td>
<td>Brightness</td>
<td>囧</td>
<td>Embarrassed</td>
</tr>
<tr>
<td>Anglicization</td>
<td>京温</td>
<td>Jingwen Mall</td>
<td>京wen</td>
<td>Jingwen Mall</td>
</tr>
<tr>
<td>Homograph</td>
<td>翻墙</td>
<td>Over the GFW</td>
<td>番羽土啬</td>
<td>N/A</td>
</tr>
</tbody>
</table>

• Identify novel morphs
  o A morph from topic A used > 100 times prior to the start date of A was not invented during A, and is not a novel morph
Morph Usage Over Time

<table>
<thead>
<tr>
<th>Topic</th>
<th>Story</th>
<th>Original</th>
<th>Morphs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxi</td>
<td>A rumor involving a taxi driver to meet President Xi.</td>
<td>郭立新 (the driver’s name)</td>
<td>郭师傅 (Shifu Guo), 北京的哥 (Beijing Taxi Driver)</td>
</tr>
</tbody>
</table>

Censored region

![Graph showing tweet and comment distribution over time for different stories and morphs](image)
Morph Usage and Censorship

• Is there a relationship between censorship and morph usage?
Key Research Question

• Do Weibo users adapt in order to avoid censorship?
• Ans: We observe that as censorship becomes prominent, the morph usage becomes popular.
• What are the dynamics of morph generation?
• Please refer to the paper, or we can discuss after the talk.
Summary

- Study the impact of censorship on discourse and word choice on Weibo
- Crawled 280K users on an hourly basis for 44 days, gathering 839M tweets and comments
- There is a positive relationship between censorship and user engagement
- Weibo users tend to introduce morphs to heavily censored topics
- Updating information dissemination models that take adversarial forces into account
Questions?