

A Social Media Big Data-Based Disaster Assessment Framework for Typhoon-induced Flood: Case Study of Typhoon Lekima

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Introduction

- In 2019, the typhoon Lekima hit China, bringing strong winds and heavy rainfall to the nine provinces and municipalities on the northeastern coast of China.
- The current observation technologies include remote sensing and meteorological observation. But they have a long time cycle of data collection and a low interaction with disaster victims. Social media big data is a new data source for disaster research, which is spatially efficient and can obtain feedback from affected areas and people almost immediately at the same time as a disaster occurs.

Methods

We propose an assessment framework of social media data-based typhoon-induced flood assessment, which includes five parts:

- Data acquisition.** Obtain Sina Weibo text and some tag attributes based on keywords, time and location.
- Spatiotemporal quantitative analysis.** Collect the public concerns and trends from the perspective of words, time and space of different scales to judge the impact range of typhoon-induced flood.
- Correlation analysis & multi-source data fusion analysis.** Integrate multi-source data including meteorological monitoring, population economy and disaster report for correlation analysis.
- Emotional analysis & crisis management.** Use time-space sequence model and four-quadrant analysis method to track the public negative emotions and find the potential crisis for emergency management.
- Text clustering & sub event mining.** Extract subevents by text similarity clustering algorithms for automatic recognition of emergencies.

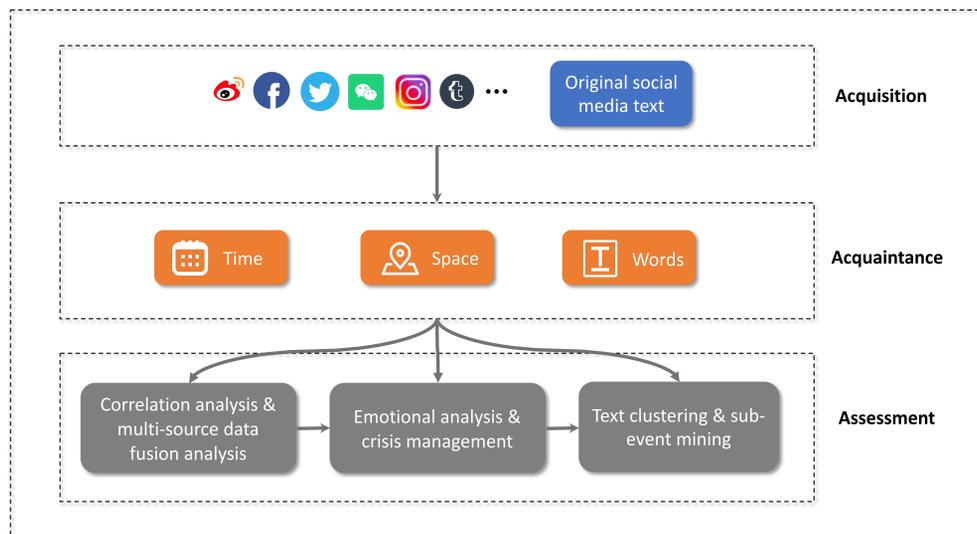


Fig.1. The Social Media Big Data-Based Disaster Assessment Framework

Reference:

- Ahmadalipour A, Moradkhani H. A data-driven analysis of flash flood hazard, fatalities, and damages over the CONUS during 1996-2017[J]. Journal of Hydrology, 2019: 124106.
- Kryvasheyev Y, Chen C, Obradovich N, et al. Rapid assessment of disaster damage using social media activity[J]. Science Advances, 2016, 2(3):e1500779.
- Zheng S, Wang J, Sun C, et al. Air pollution lowers Chinese urbanites' expressed happiness on social media[J]. Nature Human Behaviour, 2019, 3(3): 237.
- Bai H, Yu G. A Weibo-based approach to disaster informatics: incidents monitor in post-disaster situation via Weibo text negative sentiment analysis[J]. Natural Hazards, 2016, 83(2):1177-1196.

Results

This framework is validated with the case study of typhoon Lekima. We collected 483,712 Weibo texts related to typhoon Lekima in 2019.08.04-08.31.

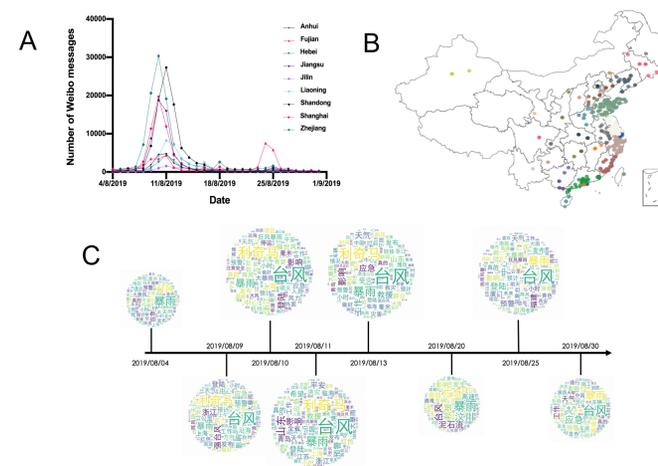


Fig.2. Spatiotemporal quantitative analysis by timeline(a), scatter map(b) and wordcloud(c).

- The proliferation of Weibo indicates the occurrence of disaster emergency.
- Before the disaster, people pay more attention to the hazard (rainstorm, typhoon).
- During the disaster, the attention to some affected area, rescue begin to rise.
- After the disaster, the impact of the event plummeted.

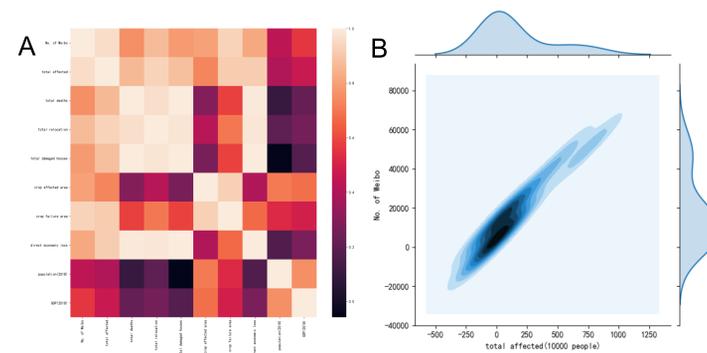


Fig.3. correlation analysis

- No. of Weibo has the highest correlation with the number of total affected, followed by the direct economic losses and total damaged houses.
- No. of Weibo has a low correlation with local population and GDP.

By emotional judgment and four-quadrant analysis, we find that there are several times of public emotional fluctuation during typhoon Lekima. Based on text similarity clustering, involving topics include typhoon landfall, soldiers fighting day and night, some disaster area, and data calculation reliability.

The results show that social media big data makes up for the gap of data efficiency and spatial coverage. Our framework can assess the influence coverage, hazard intensity, disaster information and emergency needs, and it can simulate the disaster propagation process based on the spatiotemporal sequence.

Conclusion

- The proposed framework can be applied on a wide spatial scope and even full coverage.
- Social media big data can provide technical reference for natural hazard analysis, risk assessment and emergency rescue information management.
- Social Media Big Data-Based Disaster Assessment has a promising potential in large-scale and real-time disaster assessment.