Depicting U.S.-China Disputes on Tech Giants through Social Media:

Evidence from Large-scale Twitter Data

下一步修改：突出只是介绍一个promising的领域，然后提供了一个demo（可以不出现在标题中）



**Existing Works**

This section summarizes existing works in understanding the dynamics of public opinion, pointing out its shift from traditional media to social media and the impetus behind it. We show that large-scale social media data ensures a promising future for the interdisciplinary study of political communication as well as social simulating and modelling.

**1 Traditional media as the beginning: Efforts by social scientists**

@铭琪

The Verb In Context System (VICS) is also an early attempt to understand the mentality of people, especially political leaders [1]. Based on the 1969 study of the ‘operational code’ [2], the VICS analyse people’s political opinion and beliefs on power, predictability, role of chance, etc., through their use of verbs. An exhaustive dictionary was established to provide reference to the orientation of each verb, e.g., friendly or hostile, optimistic or pessimistic. The VICS is widely used for study political figures [3-7], while its generalization to the public remains somehow stagnant, at least partly due to a lack of available texts written by ordinary citizens.

**2 The advent of social media: Previous works in depicting online public opinion**

The advent of social media and the rapid development of computer science bring about opportunities to directly study the public’s opinion for the first time. Opposite to social scientists’ focus on xxx, data science researchers has been working to discover more latent and complex information from online data.

Sentiment analysis is a frequently employed technique for study social media data in text modality. The basic goals of sentiment analysis are emotion recognition and polarity detection [8, 9]. Many research uses this method explore country images, evaluate international relations, and predict electoral results.

Xu et al. [10] and Chen et al. [11] are both event-based country image study with Twitter data, observing online public opinion during the 70th anniversary of the People’s Republic of China and the COVID-19 pandemic, respectively. Their data was retrieved through Twitter Streaming API, and sentiments towards China (positive, negative, neutral) were analysed with machine learning algorithms trained on manually labelled data. Their features include: 1) Xu et al. collected and compared English and Chinese data, while Chen et al. focused on English discourse. It was found that a significant opposition existed between the online public opinions towards China of the two languages. 2) Chen et al. provided fine-grained sentiment analysis by dividing online public opinion towards China into seven categories: Politics, Economy, Foreign affairs, Culture, Epidemic situation, Anti-epidemic measures, and Racism. They revealed that the gradual increase in negative politics-, foreign affairs-, and racism-related tweets and the decrease in non-negative epidemic situation-, anti-epidemic measures-related tweets resulted in the overall sentiments’ transition from non-negative to negative towards China. 3) Chen et al. displayed the different patterns in the attitudes of Congress members, media, and social bots, showing that social bots were more likely to spread negative sentiments towards China, while media were usually non-negative. For U.S. congress members, the Republicans were more negative than the Democrats. 4) Xu et al. explored how positive and negative tweets were distributed among different countries and found that states enjoying better diplomatic relations with China generally had a positive view towards China. 5) Xu el al. obtained word vectors for the top 100 frequently and uniquely used words for both English and Chinese, positive and negative tweets through word2vec. Preferred topics of distinct languages and sentiments were analysed, e.g., positive Chinese tweets mostly focused on celebration activities while negative Chinese tweets tended to talk about broader topics like Hong Kong.

Chambers et al. [12] modelled relations between nation states using sentiments revealed in Tweets with country names. Seventeen months of Twitter data was collected and aggregated sentiments for nation pairs were calculated. The results indicated an alignment between human polls and social media sentiments, verifying the validity of applying social media data to infer international relations.

Predicting election results with social media data is also a focus for researchers. Related works include [13-16].

Other papers addressing online public opinion towards political events include

**3 The era of large-scale Internet data: Promises for data scientists**

Despite their considerable endeavour and contributions to the emerging field of large-scale social media data analysis, the shortcomings of these works are also prominent. Their contributions to social challenges are vague:

Lack real-time or ‘nowcast’ analysis, which has the potential to detect major events at an early stage and provide governments and the society with necessary notifications.

[1] M. Schafer and S. G. Walker, "Operational code analysis at a distance: The verbs in context system of content analysis," in *Beliefs and leadership in world politics*: Springer, 2006, pp. 25-51.

[2] A. L. George, "The 'operational code': A neglected approach to the study of political leaders and decision-making," *International studies quarterly,* vol. 13, no. 2, pp. 190-222, 1969.

[3] S. G. Walker, "Anticipating attacks from the operational codes of terrorist groups," *Dynamics of Asymmetric Conflict,* vol. 4, no. 2, pp. 135-143, 2011.

[4] J. Renshon, "When public statements reveal private beliefs: Assessing operational codes at a distance," *Political Psychology,* vol. 30, no. 4, pp. 649-661, 2009.

[5] J. Renshon, "Stability and change in belief systems: The operational code of George W. Bush," *Journal of Conflict Resolution,* vol. 52, no. 6, pp. 820-849, 2008.

[6] S. B. Dyson, "Alliances, domestic politics, and leader psychology: Why did Britain stay out of Vietnam and go into Iraq?," *Political Psychology,* vol. 28, no. 6, pp. 647-666, 2007.

[7] E. Cuhadar, J. Kaarbo, B. Kesgin, and B. Ozkececi‐Taner, "Personality or role? Comparisons of Turkish leaders across different institutional positions," *Political Psychology,* vol. 38, no. 1, pp. 39-54, 2017.

[8] E. Cambria, "Affective Computing and Sentiment Analysis," *Ieee Intelligent Systems,* vol. 31, no. 2, pp. 102-107, Mar-Apr 2016, doi: 10.1109/mis.2016.31.

[9] S. Poria, E. Cambria, R. Bajpai, and A. Hussain, "A review of affective computing: From unimodal analysis to multimodal fusion," *Information Fusion,* vol. 37, pp. 98-125, 2017, doi: 10.1016/j.inffus.2017.02.003.

[10] Y. Xu, Q. He, and S. Ni, "Understanding Online Public Sentiments: A Machine Learning-Based Analysis of English and Chinese Twitter Discourse during the 2019 Chinese National Day," presented at the The 2nd International Multidisciplinary Information Technology and Engineering Conference (IMITEC 2020), Kimberley, South Africa, 2020.

[11] H. Chen *et al.*, "Country Image in COVID-19 Pandemic: A Case Study of China," *IEEE Transactions on Big Data,* pp. 1-1, 2020, doi: 10.1109/TBDATA.2020.3023459.

[12] N. Chambers *et al.*, "Identifying political sentiment between nation states with social media," in *Proceedings of the 2015 Conference on Empirical Methods in Natural Language Processing*, 2015, pp. 65-75.

[13] N. Tsirakis, V. Poulopoulos, P. Tsantilas, and I. Varlamis, "Large scale opinion mining for social, news and blog data," *Journal of Systems and Software,* vol. 127, pp. 237-248, 2017.

[14] A. Jungherr, H. Schoen, O. Posegga, and P. Jürgens, "Digital trace data in the study of public opinion: An indicator of attention toward politics rather than political support," *Social Science Computer Review,* vol. 35, no. 3, pp. 336-356, 2017.

[15] J. C. A. D. Lopez, S. Collignon-Delmar, K. Benoit, and A. Matsuo, "Predicting the brexit vote by tracking and classifying public opinion using twitter data," *Statistics, Politics and Policy,* vol. 8, no. 1, pp. 85-104, 2017.

[16] E. D'Andrea, P. Ducange, A. Bechini, A. Renda, and F. Marcelloni, "Monitoring the public opinion about the vaccination topic from tweets analysis," *Expert Systems with Applications,* vol. 116, pp. 209-226, 2019.