

Investigating Online Political Communication with Big Data and Deep Learning Methods

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DISSERTATION SUMMARY

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ABSTRACT

The increasingly important role of digital media in seeking information, establishing network, and participating in discussion has attracted considerable academic attention, particularly in investigating the process and mechanism of political communication in online discourse. However, the challenge of understanding political communication has grown alongside the complexity in human behaviors and opinions in the new political information environment.

The combinations of big data and computational methods have great potential to revolutionize our ability to understand social processes and human behaviors and therefore are expected to play a crucial role in social science research. Motivated by the utility and advantages of such research paradigm, we employed a series of advanced computational methods, including network analysis, topic modeling, and deep learning, to shed light on political communication in online discourse. More specifically, this dissertation investigates several crucial research questions in the field of political communication, including political homophily, affective polarization, extremism, and media frames. We believe that the investigation and findings herein can not only advance the horizons of political communication research but also contribute to the formulation of computational social science research framework that realizes the potential of computational methods and big data in social science research.

KEYWORDS

Big Data; Deep Learning; Text Mining; Political Polarization; Extremism; Populism; Media Frame

1. Introduction

With the transition to the ubiquitous usage of digital media over the last two decades, individuals, organizations, and social movements have been greatly affected by the transformed media environments. Specifically, in the field of politics, digital media has become a crucial platform for citizens to seek political information, share political opinions, and engage in political discussions. This new form of communication has changed the nature of public discourse regarding political opinions and political engagement in several ways, which requires an updated understanding of the underlying mechanism and characteristics of political communication in online discourse.

One of the crucial debates in this area centers around the implications of online political communication on democratic practice and civic engagement. Scholars once thought that political communication in digital discourse would bring in a new era of democratic discussion and debate; this innovation, however, has a dark side that has stimulated considerable scholarly attention. On the one hand, the high choice diversifi-

cation of the media diet and the fragmentation of the information environment in digital media (Flaxman et al., 2016; Stroud, 2010) may contribute to an “echo chamber”, where people are more likely to be connected to like-minded individuals and exposed to information that supports their existing political beliefs, which consequently poses a threat to social integration through intensifying opinion polarization. On the other hand, with the publicity of digital media, extremists are allowed to bypass media gatekeepers and disseminate messages to target audiences directly. In this term, extremist information, including radical political opinions and discriminatory views toward minorities, are more likely to be diffused and amplified in online discourse, which has led to a variety of adverse outcomes, such as increasing political distrust, xenophobic attitudes and social fragmentation (Hameleers & Fawzi, 2020; Heiss & Matthes, 2020; Schmuck & Matthes, 2017; Schmuck & Tribastone, 2020; Stětka et al., 2020). As digital media are becoming a primary source of political information and platform for political discussion, the increasing prevalence of these negative consequences highlights the need to investigate political communication in online discourse.

Although considerable efforts have been devoted to investigating online political communication, research continues to be challenged by the increasing complexity of human behaviors and opinions in online discourse. Specifically, political communication in online discourse involves a seemingly endless number of messages, expressed opinions and interactions among different actors. Thus, a central challenge for this research agenda has been the lack of valid methods and data to investigate online opinion and behaviors at scale. In recent years, an unprecedented amount of digital data alongside a variety of computational methods have opened up new avenues to address many limitations in previous social science research. The combinations of big data and computational methods have great potential to revolutionize our ability to understand social processes and human behaviors and therefore are expected to play a crucial role in social science research. Motivated by the utility and advantages of such research paradigm, we employed a series of advanced computational methods, including network analysis, topic modeling, and deep learning, to shed light on political communication in online discourse.

2. Political Homophily

In this chapter, we employed large-scale behavioral data to enable direct observations of Twitter users’ behaviors in different types of interactions. We collected and computed Twitter users’ following relationships to effectively estimate their ideological positions. Then, we employed the Twitter application program interface (API) and public Twitter dataset to identify a large number of tweets related to political issues. Specifically, we extracted interactions from tweets among users whose ideology had been estimated and investigated the pattern of their interaction behaviors. Doing so allows us to identify cross-cutting interactions and in-group interactions on social media. Furthermore, this study employed network analysis and computed polarization indexes to quantify how the extent of political homophily varies among different interaction types and different countries.

First, our results provide empirical evidence on political homophily on social media by presenting the interaction pattern, the topology of networks and measurement of polarization index. It should be noted that although the tendency of political homophily exists in the digital media environment, the presence of political homophily does not necessarily imply that individuals did not interact with ideologically opponents. In-

deed, the extent of political homophily varies across different types of interactions. Particularly, in conversations, a considerable number of cross-cutting interactions were found. In the contract, a higher degree of political homophily was found in likes and retweets. In those interactions revealing high extent of political homophily, likes typically express support for and the endorsement of specific content, and retweets also usually convey endorsement (Metaxas et al., 2021). Based on these findings, we argue that the primary cause of political homophily seems to be that individuals were more likely to express endorsement and support consistent with their existing opinions rather than to be disproportionately exposed only to information consistent with such opinions.

Then, our analysis indicates that ideology can affect the degree of political homophily. On the one hand, the extremity of users' ideological leanings significantly contributes to political homophily, which indicates that strong fragmentation occurs among people who hold extreme ideological positions and who are separated from people with opposing or relatively moderate viewpoints. On the other hand, the degree of political homophily varies between conservatives and liberals. In the US, interactions among conservatives reveal a stronger degree of political homophily in like, retweet and quotation interactions. These interactions are mainly meant to express endorsement and support; thus, this evidence suggests that conservatives are more likely than liberals to support others who hold similar political viewpoints. In particular, through the representation of the detected community in the network of interactions, we find that conservatives are more likely to create their own information ecosystem by forming sizeable and dense communities, while liberal users appear to form multiple less coherent communities, which indicates that conservatives tend to exaggerate within-group consensus. However, the ideological asymmetry of political homophily in Japan reveals a different pattern. More specifically, although ideological extremity is also associated with political homophily, unlike in the US, liberals in Japan were found to be more likely than conservatives to interact with others who held similar ideologies. The rigorous investigation of what factors cause the distinct pattern of political homophily in Japan is out of the scope of this study. Nevertheless, our empirical evidence suggests that ideological asymmetry of political homophily in other countries might not be necessarily consistent with the findings derived from empirical investigations on the US. In the previous study, the ideological asymmetry of political homophily was typically attributed to the different personality traits of conservatives and liberals; the study argued that since conservatives are usually more orderly and conventional and liberals are usually more creative and open-minded (Carney et al., 2008), thus conservatives are more likely to engage in political homophily. However, since ideological asymmetry represents a distinct pattern in the context of Japan in our results, it seems that personality traits might not necessarily determine political opinion and political behaviors. From this perspective, the ideological asymmetry of political homophily might not only be rooted in the different personality traits of conservatives and liberals but also depend on how personality traits and how ideological positions are translated into actual interaction behaviors in different culture and social contexts.

Additionally, this study examines how political interest affects political homophily on social media. Our analysis shows that political interests contribute to homophily in retweet and quotation interactions. Although previous studies have indicated that the level of political interest is positively associated with engagement in cross-cutting discussions (Dubois & Blank, 2018; Lu & Lee, 2020), we argue that since the primary purpose of retweeting and quoting others is to endorse them and promote the visibility of the original tweet, political homophily in these interactions reveals that even people

with a high level of political interest are exposed to diverse information, they are typically more confident in their political beliefs and thus more likely to show support for or endorse information that aligns with their ideological preferences through such interactions.

In summary, this study has provided much richer insights into political homophily on social media by accounting for interaction term variation as well as individual variation. Considering the increasing complexity and diversity of human behaviors in online discourse, we can assume that the influence of digital media could not be explained by a single mechanism but that a variety of mechanisms across different contexts and across varying individual characteristics.

3. Affective Polarization

This chapter introduces text classification methods based on advanced natural language processing (NLP) techniques, which are applied to empirically examine affective polarization on social media. Affective polarization describe political polarization from the perspective of increasing hostility toward, dislike of and distrust of opposing parties and their supporters (Garrett et al., 2019; Iyengar et al., 2019; Rogowski & Sutherland, 2016). Affective polarization is rooted in social group identity theory, which suggests that group membership can trigger more positive emotional reactions toward the ingroup than the outgroup and a greater willingness to cooperate with members of the ingroup (Iyengar et al., 2012; Tajfel, 1982). With regard to politics, partisan social identities contribute to bipolarity and the favoring of people with similar political views while being strongly biased against those with opposing political views (Iyengar & Westwood, 2015). Thus, increasing affective polarization is generally associated with negative feelings toward opposing political parties or their supporters and positive feelings toward one’s preferred political party and political views.

Taking such ingroup favoritism and outgroup animosity into consideration can offer a more complete picture of political polarization. Specifically, beyond selective exposure, affective polarization emphasis on that strengthening social identity through derogating the outgroup can also contribute to the increasing political polarization. From this perspective, even if individuals are exposed to more cross-cutting information than we expect, opposing views can still motivate negative reactions through information processing and the increased salience of partisan social identity, consequently, cross-interaction might induce increasing political polarization rather than deliberation. This may help explain the mechanism of political polarization on social media: If cross-cutting interactions cannot enhance cohesion but are more likely to stimulate animosity and disagreement among opposing ideological groups, this may account for the increase in political polarization in cases of cross-cutting information exposure and interactions on social media. Therefore, beyond the mechanism of selective exposure, the investigation of affective polarization from the perspective of increasing animus among ideological groups is important for guiding depolarization strategies. However, the mechanism that increases in political polarization is in fact attachment to outgroup animus in interactions has not been explicitly examined, especially in the context of social media.

In terms of behavioral evidence, affective polarization is the tendency for individuals to express positive attitudes toward like-minded peers and negative attitudes toward ideological opponents. Digital trace data has provided a unique opportunity to investigate peoples’ behaviors and opinions directly. More specifically, based on the

estimated ideology of users in the former chapter, we can identify in-group interactions and cross-cutting interactions among ideological groups. Then, for each interaction, we can employ NLP techniques to detect the expressed sentiment and opinion in the tweet content of interactions. In this term, the combination of ideology estimation and NLP techniques can provide insight into how expressed sentiment and opinion varies between in-group interaction and cross-cutting interactions, which can be considered as the behavior-based indicators of affective polarization.

Our suggest that affective polarization is remarkably consistent across different expressions of animus including negative sentiment, offensive speech and hate speech. From this perspective, although many studies have indicated that interactions with out-partisan groups can potentially mitigate polarization (Wojcieszak & Warner, 2020), our results suggest that depolarizing effects should be interpreted with caution. Indeed, expressed sentiment and incivility reflect peoples' feelings and evaluations of tweets published by other users. Negative sentiment and incivility provide two important insights into cross-cutting interactions: On the one hand, people might be immune to opposing opinions rather than adjusting their attitudes after exposure to content published by outgroups. On the other hand, due to disagreement regarding political issues, cross-cutting interactions are more likely to lead to conflict than to deliberation.

Additionally, this study highlights that the extent of hostility toward outgroups is characterized by different targets in interactions. Importantly, we find that although partisan hostility occurs in both interactions involving politicians and those involving ordinary users, the animus expressed toward politicians with opposing ideology far exceeds that expressed toward ordinary users with opposing ideology. Such results are consistent with previous studies suggesting that political elites are often the target of incivility and attacks on social media (Rossini, 2021; Theocharis et al., 2016).

Regarding to methodological contribution, through the chosen methodology, we demonstrated how using digital trace data coupled with computational methods can help us understand human behaviors and social phenomena in online discourse. NLP techniques can contribute to a wide range of academic fields, including sociology, psychology, and communication, by extracting emotions, subjectivity, and opinions from textual data. In particular, the application of computational methods, along with the continued development of big data, has tremendous potential to deal with text classification task in a more effective, faster, and potentially even more reliable way than human judgment. Given its unique advantages, interdisciplinary research that incorporates big data sources and computational methods is needed in the future social science research. This study provides an example of how this innovative methodology can be applied practically in combination with observational digital trace data and advanced NLP technology. Specifically, this study shows that advanced pre-trained models have great potential in dealing with large-scale text datasets through simple fine-tuning implementation. Thus, this methodology opens up potential new avenues for future studies that aim to understand individuals' opinions and behaviors in the information environment by unitizing digital text data.

4. Online Extremism

In this chapter, we attempt to increase understanding on the characteristics of social media users through their representational practices. Specifically, our analysis investigates the underlying issue preferences and communication strategies of extremists, and

further explore the relationship of these aspects with extremist movements in online discourse.

With Structural Topic Model (STM) methods, the ideological positions of users who published tweets were incorporated into the topic modeling process. Following this, the estimation of the STM quantities can be understood as a regression in which topic proportion are the outcome variable and ideological position is the explanatory variable. STM’s ability to account for covariates can provide insight into how ideological positions influence users to devote a larger portion of their published tweets to discussing a certain topic. In this way, it is possible to determine whether there are any differences between different ideological groups when they engage in discussions related to a certain topic.

In this term, our analysis examines the variations based on partisanship identity and ideological extremity. In conjunction, the observed differences suggest that conservatives and highly ideologically extreme individuals are more active in propagating their viewpoints and engaging in political discussions by publishing tweets related to political issues. Such ideological asymmetries of topic preferences hold critical implications for understanding the increasing prevalence of online extremism in Japan. Indeed, although recent years have seen an increase in online extremism in Japan, according to previous survey-based research, in which respondents were asked to locate themselves on an ideological dimension, the majority of Japanese citizens are ideologically moderate rather than extremists (Tsuji, 2017). Moreover, although the expression of anti-immigrant, nationalistic and political extremist sentiments appears to be particularly visible and widely diffused on social media, the number of internet right-wingers in Japan is likely limited. These results raise the question of how we can understand and explain the increasing presence of extremist movements in online discourse despite the limited number of extremist social media users.

The puzzle can be addressed by the divergent behavioral characteristics between conservatives and liberals. More specially, through vertical organizational structure, conservatives are typically better able to coordinate communication and organize campaign strategy (Bennett et al., 2018). Indeed, our results provide empirical evidence to support this argument since we find that radical conservative users are more likely to engage in discussions related to political issues. User-generated content related to political and social issues can serve various functions, including expressing opinions, offering argument rebuttals and practicing political engagement. Furthermore, due to its affective characteristics, the content published by extremists can even spread to mainstream discourse and contribute to the normalization of extremist opinions. Thus, we argue that the topic preferences and communication strategies of extremists can make their viewpoints more prevalent in online discussions and have an increasing influence on public opinions about these issues. As a consequence, extremists are becoming a powerful force on social media, and the growth in extremist content online in Japan has been greatly amplified by the propaganda behaviors of extremists rather than by an increasing number of extremists.

Considering the sociopolitical contexts in Japan, since previous studies have indicated that conservative users are more connected with moderate users in Japanese Twitter discourse (Yoshida et al., 2021), it is reasonable to assume that such behavioral characteristics of conservative users can mobilize conservative viewpoints to be more salient and influential. From this perspective, the increasing presence of online extremism might be partly explained by the topic preferences and communication strategies of extremists. Specifically, right-wingers effectively adopt social media to disseminate their opinions and gain attention, leading online extremism in Japan to

be especially skewed toward conservatives.

5. Media Frame and Online Populism

This chapter considers the expression of anti-China sentiment in online news discourse as a lens to investigate the influence of media frames on online populism. Specifically, we collect data and establish an analysis framework based on framing theory to understand how media frames influence the expression of anti-China sentiments.

Our results shed light on how Japanese online news media have covered issues related to COVID-19 and China from the perspective of the valence frames and topic frames of news articles. According to agenda-setting arguments, shifts in the media frame can lead to these issues and certain perspectives becoming more salient and attracting greater public concern (McCombs & Shaw, 1972). In general, the media frame can be investigated from two perspectives: (1) the amount of attention devoted to a specific frame and (2) the framing strategy used to highlight various aspects of the issues. Accordingly, our results indicate that after the prevalence of COVID-19 in Japan increased, news reporting on the negative aspects of China as well as politics/international relationship issues significantly increased; that is, more attention was devoted to these frames. Additionally, from the perspective of framing strategy, despite the majority of news expressing moderate valence overall, we found that news related to politics/international relationship issues is more likely to emphasize negative aspects of China. In this regard, our study provides insight into the dynamics of agenda movement in the news related to COVID-19 and China.

Also, through the utilization of digital trace data and deep learning methods, this study examines the framing effect by demonstrating how COVID-19-related news coverage can trigger the expression of anti-China sentiments in comment sections.

From the perspective of frame valence, our results confirm that news articles emphasizing negative descriptions of China are more likely to induce the expression of anti-China sentiments. This finding is not surprising: Several previous studies have indicated that audiences tend to perceive and understand issues in the ways suggested by their received information (Igartua & Cheng, 2009; Matthes & Schmuck, 2017; Schemer, 2012; van Klingeren et al., 2015). Moreover, it has been surmised that negative information is typically more salient and memorable than positive information (Lau, 1985) and can thus be more persuasive (de Vreese et al., 2011). Therefore, an increase in negative frames in the news that emphasize the negative aspects of China can be considered a potential key factor in the increase in expressed anti-China sentiment.

From the perspective of the topic frame, we found that news articles related to politics and international relations induced more expressed anti-China sentiments than other topics did. Specifically, in the regression analysis, we found that news articles related to politics/international relations still induced a greater expression of anti-China sentiment by controlling the effect of the news valence. This suggests that when the received information is related to these topics, even if the news coverage makes no explicit mention of China's negative aspects, it can still induce the expression of anti-China sentiments. We argue that the difference in audiences' information processing for news with different topic frames actually mirrors the variations in reaction patterns across news articles with different topics. More specifically, as politics/international relations issues related to China are a common area of stereotyping among most Japanese people, such schema is more likely to activate negative sentiments when readers are exposed to related information. From this perspective, the expression of anti-China

sentiment can be explained by individuals' information processing of related news coverage, including the activation of potential negative stereotypes that link China with negative interpretations.

In summary, this study suggests the important role of news media as an agenda builder in shaping the expression of sentiment. Our results indicate that the anti-China sentiment expressed in online news comments grew with the spread of COVID-19 in Japan, and we argue that this pattern can be partly explained by the shift of the media frame. More specifically, we find that an increasing number of infections has induced a similarly increasing number of news items related to COVID-19, which reflected the growing salience of COVID-19-related issues. In the meantime, we also find that in news articles related to China and COVID-19, the salience of news frames with a negative valence and of politics/international relationship-related topics increased as the prevalence of COVID-19 in Japan. Since we empirically confirmed that exposure to these new frames is likely to induce a higher level of expressed anti-China sentiment, there is strong reason to argue that the increasing salience of expressed anti-China sentiment can be attributed to the shift of the news frame, which may not only affect users' opinions by emphasizing the negative aspects of China but also provide the raw material for expressing anti-China sentiments and opportunities to do so. Indeed, both before and during the peak of COVID-19, these frames similarly led to the expression of anti-China sentiments; that said, the effects of framing on sentiment and opinion toward China are generally stable. From this perspective, the extent of the expressed sentiment actually depends on the nature of the content and frames available through digital news media.

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