

Public Discussion and Agenda Network: Mapping the Overseas Communication Effects of the Belt and Road Initiative Postprint

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Abstract

[Purpose] The Belt and Road Initiative is an important international cooperation initiative proposed by China, and fully understanding the attitudes of international audiences is crucial for its in-depth advancement.

[Method] Based on the computational communication and network agenda-setting research framework, this study conducts topic modeling and sentiment analysis of Twitter discussions related to the “Belt and Road” topic to investigate the distribution of public discussions on the issue and the proportion of sentiments. The discussion content is visualized through topic modeling, sentiment computation, and semantic network analysis.

[Results] The overall focus of netizens demonstrates high correlation with the media agenda, with positive emotions accounting for the largest proportion overall, while negative emotions gradually decline alongside the progression of COVID-19 prevention and control policies.

[Conclusion] In an open discursive space, the overall sentiment is positive but highly correlated with the media agenda. In future external communication processes, it is essential to grasp the core essence, optimize communication methods, and effectively tell China’s story.

Full Text

Preamble

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Public Discussion and Agenda Networks: Mapping the Overseas Communication Effects of the “Belt and Road” Initiative

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Abstract

Objective: The “Belt and Road” Initiative represents a significant international cooperation proposal by China. Understanding international audience attitudes is crucial for advancing this initiative effectively. **Method:** Based on computational communication and network agenda-setting research frameworks, this study employs topic modeling and sentiment analysis of Twitter discussions about the “Belt and Road” to examine the distribution of public discourse and emotional proportions. Through topic modeling, sentiment computation, and semantic network analysis, the discussions are visualized. **Results:** Public attention points show high correlation with media agendas, with positive emotions comprising the largest proportion overall. Negative emotions gradually declined alongside the evolution of COVID-19 prevention and control policies. **Conclusion:** In an open discursive space, the overall sentiment is positive but highly correlated with media agendas. Future external communication efforts should grasp core concepts, optimize communication methods, and tell China’s story effectively.

Keywords: Belt and Road; semantic network; network agenda setting; topic modeling

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Introduction

In an era marked by major public health crises and compounded risks, the international communication of national image faces severe challenges. In external communication, a situation has emerged where “reasonable arguments cannot be disseminated,” with substantial efforts and development goals wasted as the West leverages technological and economic advantages to seize “information power” and set so-called “China issues” [1]. Some scholars have studied the communication field of the “Belt and Road” International Cooperation Summit Forum, evaluating the correlation between subgroup effects and overall communication effectiveness in discussions [4]. Meanwhile, other scholars have used social network analysis to visualize the structural positions of Chinese media in “Belt and Road” discussion networks, highlighting current difficulties and problems in external communication [5].

As the world’s second-largest economy with enormous foreign exchange reserves and a vast domestic market, China’s “Belt and Road” Initiative clearly conveys its diplomatic philosophy and values, playing a positive role in helping people in participating countries and overseas audiences understand China correctly [2].

Semantic network analysis, as an important methodological framework in social network analysis, has been widely applied in research on public policy dissemination and online public opinion. Some scholars have analyzed the concept of “reform and opening up” in online networks.

1. Literature Review

1.1 Social Network Analysis

Social network analysis is “a discipline that studies human relationships through graph theory,” aiming to explain social phenomena by analyzing exchange relationships among actors. It can visually present nodes and edges in networks, requiring processes such as data collection, unit determination, matrix organization, key data processing (centrality analysis, whole-network analysis, and core-periphery structure analysis), and results interpretation. Some scholars have employed computational communication methods to visualize communication maps, studying the Twitter communication field of the “Belt and Road” International Cooperation Summit Forum to evaluate correlations between subgroup effects and overall communication effectiveness [4]. Other scholars have focused on using social network analysis to visualize the structural positions of Chinese media in “Belt and Road” discussion networks, emphasizing current external communication dilemmas and problems [5].

1.2 Network Agenda Setting

In existing research, agenda-setting theory serves as the theoretical foundation for exploring mutual influence between media and public cognition in internet contexts. When organically combined with social network analysis, it can more comprehensively demonstrate communication effects by visualizing topic correlations between media and public through network structures, thereby analyzing their configurations and deepening understanding of how mass media shape public agendas.

Agenda-setting theory comprises three levels: object agenda setting, attribute agenda setting, and network agenda setting. The internet has rewritten the mass communication landscape, and changes in human cognitive structures have challenged traditional agenda-setting theory. Previous research mostly focused on linear expressions and presented flat analyses. Under the third-level agenda-setting framework, researchers argue that what influences the public is not a single issue or attribute but a cognitive network composed of a series of problems. News media not only tell people “what to think” or “how to think” but also determine how people connect different information fragments to construct cognition and judgment of social reality [7].

Some scholars have conducted discourse analysis of foreign media reports and public discussions to examine media opinion tendencies and mechanisms affecting the public [8]. Internet and social media development pose new challenges to

the relationship between agenda setting and public policy formulation. Evidence shows that internet blogs facilitate public opinion mobilization and empower actors who cannot set agendas in mass media. Social media sometimes includes emotionally charged content from individual users that may improve information flow between stakeholders and project initiators. Some scholars analyzed 5,301 English media reports from various countries using machine learning, finding that multi-dimensional distances in space, economy, institution, and culture negatively affect sentiment tendencies toward the “Belt and Road” in national news [9].

Theoretically, network agenda setting advances the classical theory’s evolution in new media environments while promoting the application of “network analysis” in future communication research to address challenges that new media poses to classical communication theories.

1.3 Research Questions

This study addresses four key questions: (1) What issue orientations are presented in mainstream media tweets and social user discussions during the international communication of the “Belt and Road” concept? (2) What attitudes do social users demonstrate in these discussions? (3) What agenda networks are presented by Chinese mainstream media and users respectively in “Belt and Road” discussions? (4) To what extent is China’s self-image shaping effective?

2. Research Design

This study employs computational communication methods, including LDA topic modeling, unsupervised machine learning sentiment analysis using TextBlob and Vader, and visualization analysis via Gephi.

2.1 Data Collection and Processing

Using the Python-based Scweet tool, we collected overseas public Twitter data with three keywords: “the belt and road,” “one belt and road,” and “one belt one road.” The collection period spanned from January 1, 2020, to January 8, 2023, yielding 136,591 tweets with timestamps, likes, comments, and retweets. Mainstream media tweets were manually removed. Data cleaning involved converting all tweets to lowercase and filtering out irrelevant content such as #topic, @xxx, links, and numbers. Tokenization was performed using the NLTK natural language processing toolkit, resulting in 38,346 words.

2.2 LDA Topic Modeling

LDA is a probabilistic topic model for discrete datasets proposed by David M. Blei et al. in 2003. As a three-level generative Bayesian network, LDA assumes documents consist of latent topics composed of specific vocabulary, ignoring grammatical structure and word order. It provides topic distributions for each

document, enabling topic clustering or text classification, and is particularly suitable for large-scale corpora. Since its introduction, LDA has been widely applied in text classification and semantic understanding.

To determine optimal topic numbers, we introduced perplexity and coherence metrics. Perplexity, derived from information theory's entropy concept, measures how deterministically a given topic maps to vocabulary in a text. For LDA modeling, lower perplexity is better, indicating clearer learned topics. Calculations showed public discussion topics perform best at 10 topics, while mainstream media tweets perform best at <12.5 topics. Coherence measures differentiation between topics, describing inter-topic distribution distances. Higher coherence indicates stronger discrimination between different topics. Comparing both parameters, we determined 10 topics as optimal for public discussions and 7 topics for mainstream media tweets.

pyLDavis is an interactive visualization tool for LDA results. Inter-topic distance indicates topic proximity, while bubble distance represents topic dissimilarity. Overlapping bubbles suggest overlapping characteristic words between topics (see Figure 1 [Figure 1: see original paper]), allowing visualization of high-frequency words in each topic to facilitate subsequent analysis.

2.3 Sentiment Analysis and Attitude Coding

This study uses VaderSentiment, a sentiment analysis tool specifically optimized for social media that has garnered over 3,000 citations since its 2014 publication (as of 2022). Vader calculates sentiment for each tweet and classifies texts based on the vader_{compound} score with a threshold of 0.05 (see Figure 2 [Figure 2: see original paper]). The labeling scheme is: Positive: compound score \geq 0.05; Neutral: $-0.05 <$ compound score $<$ 0.05; Negative: compound score \leq -0.05.

We combined Vader with TextBlob for sentiment analysis. TextBlob is a go-to NLP library built on NLTK and Pattern that returns results as tuples (polarity, subjectivity). Polarity scores range from [-1.0, 1.0], where positive values indicate positive sentiment and negative values indicate negative sentiment. Subjectivity ranges from [0.0, 1.0], where 0.0 represents objective and 1.0 represents completely subjective (see Figure 3 [Figure 3: see original paper]).

2.4 Semantic Network Analysis

This approach applies social network analysis techniques to textual analysis. Semantic network analysis assumes that frequently co-occurring words or concepts in texts imply certain connections measurable through statistical indicators like co-occurrence frequency. This method helps social science researchers identify topics within texts through word relationships.

The foundation of semantic network analysis is identifying word relationships. Before analysis, sentences must be segmented into individual words as network

nodes. Stop words without substantive meaning (e.g., “and,” “but”) require cleaning. Word associations serve as edges in the network.

Modularity refers to words belonging to specific topics or frameworks that appear less frequently in other topics. For instance, political and entertainment topics have different common word combinations. Therefore, semantic network analysis clusters words in semantic networks to discover different word group combinations, efficiently processing massive texts to cluster different topics and aid text comprehension.

After clustering analysis, six modular themes emerge, with different themes represented by core words in the semantic network. Cohesion factors reveal actual or potential relationships among social actors. Modular analysis of overseas public Twitter semantic networks identified six sub-clusters, primarily focusing on inter-state relations, economic trade cooperation, and global development strategies, with core vocabulary including “country,” “infrastructure,” and “railway,” emphasizing transportation and urban development.

Mainstream media Twitter semantic networks also show six sub-groups through modular analysis. The most prominent sub-group centers on economic trade cooperation, with core vocabulary “exports,” “development,” and “initiative,” expressing win-win outcomes through trade, investment, and mutual consultation. Another sub-group focuses on “Belt and Road” connectivity, with core words “construction” and “railway,” highlighting transportation, railways, and maritime shipping to emphasize interconnection construction.

Comparing both semantic networks reveals similar cluster sub-groups in cyberspace, with high-similarity vocabulary concentrated on state relations, transportation, and trade. Netizen attention aligns closely with overall issue communication patterns, though derivative discussions diffuse toward urban development and payment methods. Therefore, comparing media and public agenda networks shows similar attributes occupying central positions, including “state relations,” “transportation,” and “trade exchanges,” while distant nodes demonstrate personalized differences.

3. Results

3.1 Attribute Networks in Media and Public Agendas

This study examines how media and public influence each other’ s agenda networks regarding the “Belt and Road” through semantic network generation. Mainstream media agendas concentrate on seven themes across four dimensions: (1) Economy (co-consultation, international economic trade); (2) Politics (China, Xi Jinping); (3) Society (railway transportation); and (4) Culture (green development, cooperation and sharing). Public agendas revolve around ten themes: (1) Economy (business cooperation, debt, payment methods); (2) Politics (state relations, leaders, cooperation); (3) Society (transportation, urban development); and (4) Culture (values, mutual exchange and

construction). Overall, public discussion topics show high correlation and are closely aligned with mainstream media content agendas, demonstrating high topic association and overall balance.

3.2 Network Agenda Setting Effects in Public Discussion

Visualization analysis of semantic networks reveals different emphases between the two agenda networks. In the public agenda, value connections among elements show “country” at the network center, forming semantic connections with subject-representing sub-networks, with “China” and “transportation” surrounding it.

“Belt and Road” topics on Twitter exhibit several emotional characteristics: positive tweets exceed 50%, with negative and neutral proportions similar. Overall public opinion shows positive tendencies, with emotions fluctuating alongside COVID-19 prevention and control processes, generally shifting toward positive sentiment. Sentiment polarity peaks around 0.1, with both highest peaks below 0.25, indicating not particularly high positive sentiment intensity. Negative polarity peaks correspond to rational netizens whose evaluations of “Belt and Road” topics are not absolute. Subjectivity peaks at 0 and remains below 0.5, showing overall objective emotional expression that continues declining between 0.5-0.8, though extremely subjective emotions (0.8-1.0) increase. Data demonstrates that with optimized COVID-19 policies, overall positive sentiment gradually rises with stronger objectivity.

3.3 Discourse Expression

We divided collected tweets into 100 weeks and calculated sentiment polarity using Vader and TextBlob. Due to varying weekly tweet volumes, we used mean sentiment polarity sums to represent weekly sentiment for graphing. Overall subjectivity scores remain stable with slight fluctuations around the 0.1 mean, showing clear objectivity characteristics. Emotional fluctuation ranges are somewhat larger with noticeable temporal changes, but overall positive sentiment exceeds neutral and negative, presenting a positive yet objective overall situation.

4. Conclusion and Discussion

Big data profoundly impacts public opinion research in the internet era. While computational communication data remains largely text-based, future “meta-verse” developments may create more public opinion expression forms. However, comprehensively and three-dimensionally reflecting and understanding social reality issues requires continued attention. Data collection has always been a challenge for international communication topics. To break down audience research barriers, besides technical support, current theoretical perspectives must be integrated to broaden thinking, enhance China’s international discourse power and influence, and build Chinese discourse and narrative systems.

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