

Research Article

Analysis on Communication Influence of Official Microblogs

Nan Chen,¹ Dingguo Yu^{1,2,3}, Yijie Zhou,³ and Wenjuan Li¹

¹Qianjiang College, Hangzhou Normal University, Hangzhou 310018, China

²College of Media Engineering, Communication University of Zhejiang, Hangzhou 310018, China

³Key Lab of Film and TV Media Technology of Zhejiang Province, Communication University of Zhejiang, Hangzhou 310018, China

Correspondence should be addressed to Dingguo Yu; yudg@cuz.edu.cn

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As an innovative way for government affairs disclosure, official microblogs have been widely used in information release, public opinion listening, and public services, which become a model of “Internet + government affairs.” The communication influence of official accounts is mainly related to the account’s attention, activity, and the posted articles. Based on AHP, we design a multi-hierarchy-rank model to filter the factors and determine the most important factors related to the influence of official microblogs. This study explores the communication influence of official microblog from the perspectives of breadth, depth, and intensity; then, a three-dimensional integration of government microblogs influence calculation model for radiation, activity, and interaction is built and a monitoring and analysis system for the communication influence of government microblog is developed; finally, about 2,800 official accounts and more than 1.5 million articles in Zhejiang Province are monitored and analyzed. According to microblog verification, our proposed calculation model not only quantifies the communication influence of official microblogs but also analyzes their dynamics and timeliness. Therefore, it helps government departments to promote the healthy and orderly development of government microblogs.

1. Introduction

The new medias have entered the “Wei” era, and social medias represented by Microblog, WeChat, etc. have developed rapidly, which have become the primary platforms for the release and sharing of major information. As an innovative way for government affairs openness, the government affairs Microblog and WeChat public accounts have become more and more important, becoming the “standard configuration” for government affairs construction in many industries and regions, and being used to release information, collect opinions, listen to public opinion, and serve the public [1–3]. From the 43rd “China Internet Development Statistics Report” issued by China Network and Information Exchange Center [4], it can be obtained that, as of March 2020, the number of online government service users in China have reached 694 million, accounting for 76.8% of the overall netizens, of which the number of government microblogs certified by Sina platform have reached more than 139 thousand.

In social media, users establish connections with other users through the following function to build the topology of the social network and conduct information interactions by publishing, forwarding, and commenting information. The government affairs microblog is a bridge and link between the government and the masses. After the public becomes a fan through the following function, they can not only learn about government affairs information but also participate in government affairs interaction and obtain government services. Therefore, government affairs microblogs can make government decision-making more fair, open, and transparent, enabling people to express their opinions and suggestions without time and space restrictions and protecting people’s right to speak. It collects public sentiment in time, and it is also a test of the government’s administrative ability. This form can not only collect public sentiment in time but also test the government’s administrative ability.

As a model of “Internet + government affairs,” government affairs microblog has promoted the openness of government affairs through the application of new social

media methods, enabling the sunny government and service-oriented government affairs to be indexed and evaluated. At present, the quality of the government affairs microblog platform is uneven, and some of them are proficient; how to evaluate and measure the effectiveness of its construction is imperative. On the one hand, it is necessary to summarize and analyze the effectiveness of the government affairs microblog platform construction at all levels of the province and relevant departments to find problems; on the other hand, the "Internet + government affairs" construction model needs to be further explored, so as to promote the openness of government affairs through Internet platforms, promote the Sunshine Government, and build a service-oriented government.

Affected by the massiveness, immediacy, and global interconnectivity of Internet platform data, as well as the complexity of social media network structures and the particularity of communication methods, the traditional media communication utility metrics and evaluation methods are completely incapable of evaluating the communication influence of government affairs microblogging platforms. Therefore, the study designs a data collector to extract related data from official accounts, such as articles and comments. Then, we propose a data analysis system, which can apply naive Bayes algorithm to filter the spam articles and users' comments. Next, analytic hierarchy process (AHP) is used to mine the data and extract relevant variables according to the hierarchy, which is called multi-hierarchy-rank. For example, in the study, we propose three factors of social media, such as network topology, user interaction behavior, and information content. And in the second layer, we can exact subfactors, such as user' comments, approval, due to the three elements mentioned above. Moreover, by applying big data mining and analysis techniques, our study constructs an evaluation system and corresponding computing models of government affairs microblog communication influence from the perspectives of breadth, depth, dimension, and effect. Last but not least, a government affairs microblog communication influence monitoring and analysis system software is integrated and developed to conduct an empirical analysis of the data collection and communication effects of government affairs microblog platforms established by government agencies at various levels in Zhejiang Province.

2. Analysis of Research Status at Home and Abroad

The three basic elements of social media include network topology, user interaction behavior, and information content [5]. The topology structure reflects the intuitive characteristics of user influence from the perspective of network topology; the user interaction behaviors (likes, reposts, comments, etc.) can reflect the generation and evolution of user influence; the information content (points of interest of user, topic content, novelty, dissemination time, etc.) can further reflect the details of the generation and evolution of influence [6]. Therefore, the main research direction today is measuring and evaluating the influence of microblog users from these three aspects.

The method of measuring the influence according to topology is mainly based on the measure of node degree, which mainly includes in-degree, out-degree, and degree centrality. The degree centrality [7] is used to measure the average influence of the current node on its neighbors; the higher the centrality of the node degree, the more the objects that focus on the user, the greater the influence of the node; the centrality of the degree reflects the local characteristics of the node. Besides, local centrality and local clustering coefficient not only consider the information of the node itself but also include some information of neighbor nodes.

Chen et al. established a part local centrality that collects multilevel neighbor information to sort the influence of nodes in the network via examining the degree information of the nodes with the nearest and second nearest neighbors [8]. The global evaluation criteria of nodes mainly comprise betweenness centrality [9], closeness centrality [10], and eigenvector centrality [11].

The PageRank algorithm and its extension method obtain the user's influence ranking by taking the user's interaction in the social network as an effective link and performing statistical ranking accordingly. For example, the Topic Leader Rank algorithm proposed by Wu et al. [12] can construct user behavior network computing user impact by using content and social attributes of microblog users; the Influence Rank algorithm [13] which considers the novelty of blog text itself and the link between blog posts; microblog-Rank algorithm [14] considering the user comment relationship; a calculation model of Sina microblog user influence based on information interaction proposed by Yu et al. In addition to the following relationships, users in social media also have actions such as likes, comments, and reposts, and the strength of influence between users can be better judged by analyzing these behaviors of users. By adding user reading habits and reposting characteristics in the process of calculating user influence, Mao et al. [15] comprehensively evaluated the influence. Based on a combination of network topology and historical user behavior, Tan et al. calculated the user influence [16]. On the basis of fully researching the four basic behaviors of users' forwarding, replying, reading, and copying, the calculation method of transition probabilities inside the network is given and the random walk model Multi-Rank based on multi-relational networks is proposed to calculate users' single-topic influence and multitopic influence by Ding et al. [17].

Most social media content is short and concise, and latent dirichlet allocation (LDA) model is widely used as a topic extraction method for social media content analysis. By using LDA model to obtain the distribution of users in different topics and Gibbs to find out the strength of users' influence in different topics, Tang et al. [18] have obtained the user influence. According to Twitter's attention structure and user interest similarity, the Twitter Rank algorithm was proposed by Weng et al. [14] to calculate the user's influence on each topic; combining the social network topology with the LDM model, the social-relational topic model (SRTM) was designed by Guo et al. [19] to calculate the user's influence. In addition to the content of the information, the innovative nature of the information content and the time at which the information is released all play a role in

determining the user's influence. Song et al. [20] calculate the user's influence by incorporating the novelty of information content into the topology of social networks.

Unlike ordinary microblog users, government affairs microblogs, as bridges and bonds between the government and the masses, have special functions. Some targeted research on the influence of government affairs microblogs have been carried out by scholars at home and abroad. According to the user's forwarding behavior, Chen et al. [21] summarized the basic characteristics and determinants of government microblog communication by using cluster analysis and other methods. Aiming at user's forwarding behavior, Li et al. [22] built a relatively complete government microblog reposting scale prediction model by performing feature extraction from multiple aspects such as user characteristics, content characteristics, and time characteristics. The essential characteristics of the provincial government microblog were revealed by Sha et al. [23] from the three aspects of overall network characteristics, cohesive subgroups, and centrality. By introducing complex network structure and modular public opinion indicators, Feng et al. [24] analyzed the government information microblog information diffusion channels and influence. Luo et al. [25] obtained the relationship between the characteristics of fans and the influence of government microblog through cluster analysis; Wang et al. constructed the government affairs microblog influence evaluation system by applying rough set method [26].

3. Computational Model for Government Influence on Microblogs

The influence of social media users on communication refers to the ability by posting, reposting, commenting, and liking online behaviors and their remarks to lead public opinion in social networks that influences the spread of network topics and other users' thoughts, network behavior, and speech. The influence of government affairs microblogs is similar to that of social media opinion leaders, but it is also unique. In the study, according to the relevant connotation and model of the theory of communication influence, and the application of big data mining and analysis methods, a comprehensive evaluation index system for the influence of government affairs microblog communication is defined.

3.1. Design of Evaluation Index System. The evaluation index system for the influence of government microblog communication includes three first-level indicators, six second-level indicators, and fourteen three-level indicators that have been refined layer by layer, including radiation, activity, and interaction. The following is a one-by-one explanation and description of the indicators at all levels.

Radiation indicates the radiation range of the information published by the government's microblog account and is the criterion for judging the breadth of microblog's spread. The higher the calculated value of radiation, the larger the area spread by the content published by the account, which users can be more concerned with. The indicator is refined into the following:

- (1) The number of fans: Fans can see messages posted by the government affairs microblog on their own pages. Moreover, as a "blue V" authenticated user of Sina microblog, the government affairs microblog can actively send push messages to fans in the form of private messages. Fans can also further expand the visibility of the Microblog they follow through actions such as recommendations and comments.
- (2) The number of forwarded posts: Forwarding behavior is the determinant of microblog's influence expansion. When the user reads and then forwards, after this process is cycled, the number of people who read the microblog will also increase. Thus, the number of forwarded posts is directly proportional to the radiation.

In the forwarding behavior, the total number of forwarding only indicates the number of forwards. However, in the three-level indicator, the total number of forwards, the average number of forwards, and the maximum number of forwards are included in the index system, which can reflect the radiation more intuitively.

Activity indicates the activeness of government microblog in a certain period of time, including the frequency of updating microblog and the number of logins to microblog. The higher the calculated value of the activity, the more standardized the operation of the account and the ability to regularly publish blog posts, and the better the effect of disseminating information. The indicator is refined into the following:

- (1) The number of posts: This indicator includes the number of microblogs published by government affairs microblogs and the number of original microblogs published by it. The number of blog posts largely reflects the activity of an account. Particularly the original microblog has a higher topic level, which can arouse the interest of users, thus leading to an increase in user comments and retweets.
- (2) Active days refer to the number of times the government affairs microblog account is active, which is an important determinant of Microblog's attention. A third-level indicator is introduced under the second-level indicator, which comprises the total number of active days, the number of active days in a shorter period of time, and the number of active days in a longer period of time. According to long-term observation data, it is known that blog posts published within 7 days are the golden time period for likes and comments. After exceeding this range, the numbers of likes and comments have decreased significantly. Besides, there will be no more users to like and comment on the blog post for more than 30 days. Therefore, a longer period of time is selected as 30 days, and a shorter period of time is selected as 7 days, which can better reflect the active degree of government affairs microblog.

Interaction indicates the degree of interaction between government microblog users and other users. The main purpose of government affairs microblog is not only to disseminate government information, but also to collect and understand people's opinions to serve the people. Therefore, the degree of interaction is an important dimension for calculating the influence of government affairs microblogging. This indicator is refined into the following:

- (1) Number of comments: When users generate their own thoughts or opinions on a government microblog, they will comment on it. The comments on the government affairs microblog largely reflect the public's views on certain social events and policies. The comments on Microblog can be recommended at by other users, or "@" other users to discuss. Therefore, the number of comments can reflect the level of interaction between government affairs microblog and other users. Not only is the number of comments expressed by its total number, but also the average and maximum numbers are included based on the total number, so that the number of reviews can be measured more accurately and intuitively.
- (2) The number of likes, which is similar to the number of comments: When users have the same opinion on a microblog or express support for the content of the microblog but do not want to express their views, they often like the microblog. The government affairs microblog publishes some microblogs about hot events and policies. If the blog is liked, this can indicate that the information is recognized and supported by the public, which can also play a role in understanding public opinion. The number of likes is also divided into total likes, average likes, and maximum likes.
- (3) The credibility from comments: When users are interested the contents released by the official

account, they will comment on them. But at the same time, there will inevitably be some irrelevant information, which we call spam information. Therefore, we add another dimension to the interaction influence. We use the ratio of the number of valid comments to the total number of all comments to reflect the user's trust degree to this account.

3.2. Index Weight. The communication influence evaluation index system of the government microblog combines multiple evaluation methods, and then the experts will score to determine the weight of the indicators at all levels. By consulting experts in related fields, they will score according to the/importance of different indicators and the difficulty of obtaining data. Then the expert scoring results are processed to determine the weights of three different levels of indicators. The indicator weights are shown in Table 1.

3.3. Calculation Method of Transmission Influence. The calculation of government microblog's communication influence is based on the above evaluation indicators, including its interactive data (such as the number of likes and comments) and user information (such as the number of fans and the total number of posts).

The evaluation index system divides the communication influence into three levels of indicators and the data collected directly can only describe the current microblog characteristics. A normalized operation is used on the collected data to truly reflect the characteristics of government microblogs. The normalization method is calculated by comparing the user's current day's index value with the highest value of the index and as

$$I_{kk} = \frac{d_k}{d_{\max}}. \quad (1)$$

If the total comment I_{11} is taken as an example, then

$$I_{11} = \frac{\text{total number of comments on government affairs microblog}}{\text{the maximum total number of comments on all government microblogs collected}}. \quad (2)$$

The calculation of communication influence needs to be added step by step according to the indicator weight table. The index value of the lowest level indicator can be calculated directly, and the secondary indicator (such as the number of likes) is calculated by weighting the subindicator to which it belongs. By analogy, the calculated value of the first-level indicator (such as the degree of interaction) is calculated by weighting its two second-level indicators and then added. Finally, the calculation of the communication influence is obtained by adding the weighted calculations of the three dimensions. The calculation formula for the second-level indicator is shown in Formula (3):

$$I_x = I_{11} \times \lambda_a + I_{12} \times \lambda_b + I_{13} \times \lambda_c. \quad (3)$$

The calculation formula for the first-level indicator is

$$I = I_1 \times \theta_a + I_2 \times \theta_b. \quad (4)$$

The formula for calculating the communication influence is

$$IF = 0.4 \times R + 0.3 \times A + 0.3 \times I. \quad (5)$$

4. Monitoring and Analysis System for the Communication Influence of Official Microbloggy

4.1. Structural Design of System Functions. According to the designed calculation model of communication influence of the government microblog, we have developed a

TABLE 1: Temperature and wildlife count in the three areas covered by the study.

First-level index	Weights	Second-level index	Weights	Third-level index	Weights
Radiation R	$\beta_1 = 0.4$	Number of forwards R_1	$\theta_1 = 0.6$	Total number of forwards R_{11}	$\lambda_1 = 0.6$
				Average number of forwards R_{12}	$\lambda_2 = 0.3$
		Number of fans R_2	$\theta_2 = 0.4$	Maximum number of forwards R_{13}	$\lambda_3 = 0.1$
Activity A	$\beta_2 = 0.3$			None	None
		Number of posts A_1	$\theta_3 = 0.7$	Total number of posts A_{11}	$\lambda_4 = 0.5$
				Number of originals A_{12}	$\lambda_5 = 0.5$
		Activity A_2	$\theta_4 = 0.3$	Total activity A_{21}	$\lambda_6 = 0.5$
				Total activity in a long period A_{22}	$\lambda_7 = 0.2$
Interaction I	$\beta_3 = 0.3$			Total activity in a short period A_{23}	$\lambda_8 = 0.3$
		Number of comments I_1	$\theta_5 = 0.5$	Total number of comments I_{11}	$\lambda_9 = 0.5$
				Average number of comments I_{12}	$\lambda_{10} = 0.3$
		Number of likes I_2	$\theta_6 = 0.5$	Maximum number of comments I_{13}	$\lambda_{11} = 0.2$
				Total number of likes I_{21}	$\lambda_{12} = 0.5$
				Average number of likes I_{22}	$\lambda_{13} = 0.3$
				Maximum number of likes I_{23}	$\lambda_{14} = 0.2$
		Credibility I_3	$\theta_7 = 0.2$	Ratio of the number of valid comments to total number of comments I_{31}	$\lambda_{15} = 1$

communication influence monitoring and analysis system software of official microblogs, comprising three major modules of microblog data directional collection, analysis engine, and visual analysis, and the software structure is shown in Figure 1.

The microblog data directional collection is mainly used to collect the data of the microblog, which can automatically collect microblog data of monitored accounts according to the configuration, comprising the content of each blog post and the corresponding statistics of the blog posts, likes, reposts, and comments. In addition, it automatically updates the statistics of blog posts on a regular basis. The data directional collection module is mainly composed of two parts of the acquisition management module and the microblog crawler. The collection management module can centrally manage and control the numerous microblog crawlers deployed in a distributed manner; the microblog crawler can realize the automatic collection of microblog web page information and can intelligently parse the web page content, automatically deduplicate, denoise, and extract the specified information content, and finally convert it into structured data.

The analysis engine can automatically perform statistical analysis on the collected microblog data and calculate the monitored influence of the government microblog account based on the defined government influence microblog’s propagation influence calculation model. The visual analysis module presents the calculation results with intuitive images such as graphs and tables.

4.2. *Experiment and Result Analysis.* First, more than 2,600 official microblog accounts in Zhejiang Province are collected, involving public security, culture, tourism, transportation, taxation, party and government agencies, social teams, and other industries. Then, the monitoring and analysis system for the communication influence of government microblogs is

used to monitor and analyze them. The system automatically collected the likes, forwards, and comments of each article published by these accounts in the past 3 months. As of December 30, 2019, the system has collected a total of 1.03 million microblog articles and about 3.56 million comments. Based on this data, the influence of official microblog account monitored by the system is calculated according to the government influence microblog communication influence calculation model proposed in the study.

The information of Top 30 government affairs microblog accounts obtained by the model is shown in Table 2.

From the data obtained from the analysis system, it can be seen that the government microblogs of government agencies, tourism, and public security have a stronger influence on social media users. The government department microblogs, which are officially set by the People’s News Government Office, rank first in the influence of Zhejiang government microblogs. The articles published by the official microblogs of government agencies at all levels cover a wide range of fields, containing culture, scenery, education, security, and people’s livelihood. Thus, most users will use this type of government microblogs to learn what has happened at the present moment. Therefore, the microblogs of the government agency sector rank first. Next, the influence of travel microblogs ranks second. Obviously, Zhejiang has always been famous for its rich tourism resources, beautiful scenery, and complete supporting facilities. Therefore, tourists will learn about tourism projects and activities of Zhejiang Province from the microblogs’ articles of tourism departments. What is more, the microblogs’ influence of public security ranks third. Users can obtain safety information and knowledge by such microblogs and try their best to prevent accidents.

In addition, the other influential factors of government affair microblogs’ communication influence in Zhejiang Province are shown in Figure 2. It obviously can be seen that microblog’s fan number, article number, and interaction

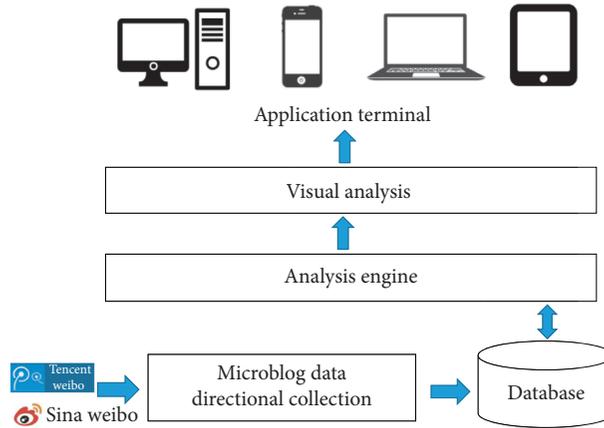


FIGURE 1: The structure of influence monitoring and analysis system.

TABLE 2: Communication influence ranking table.

Influence ranking	Names of official microblogs	Radiation index	Activity index	Interaction index	Influence index
1	Hangzhou publicity	58707	54880	23095	48251
2	Yuhang publicity	59621	38068	27480	48043
3	Zhejiang travel	58784	31920	28460	47088
4	Zhejiang fire	37734	30061	24168	33016
5	Hangzhou police	33675	43601	26124	32728
6	Zhuji education	38379	17242	22865	31521
7	Hangzhou travel	32525	40410	23576	30944
8	Zhejiang committee	25989	47662	29668	29586
9	Zhejiang publicity	27341	42840	27392	29190
10	Peace wenzhou	24362	26036	38835	28626
11	Ningbo police	22638	67075	24911	28534
12	Ningbo publicity	20189	59135	28554	27146
13	Jinhua police	18318	37771	31199	24237
14	Chunan publicity	19100	44447	24486	23611
15	Peace jianggan	14902	21300	42578	23433
16	Jiaxing fire	23238	22231	22755	22983
17	Bingjiang publicity	18732	21173	31545	22620
18	Jianggan publicity	19169	36183	23052	22272
19	Shangcheng publicity	21625	30005	19799	22103
20	Zhejiang police	17683	34887	25303	21858
21	Hanzhong urban management	14950	39697	28278	21621
22	Wenzhou traffic	14553	43372	26931	21481
23	Peace west lake	19404	17440	26016	21029
24	Huangyan publicity	16850	12931	31121	20395
25	Shangcheng petition	7754	15755	29003	20186
26	Haining publicity	14219	29224	28984	20142
27	Zhejiang law	21272	9841	20380	19669
28	Yiwu fire	7025	20310	26254	19616
29	Qiandao lake travel	15845	33727	20344	19224
30	Zhejiang weather	12893	38300	23701	18935

number make great contribution to communication influence of microblogs. Those with a large number of fans, articles, and interactions (likes, comments, and forwards) commonly have great influence on social media users. To be fair, compared with the three factors, the article number of

microblogs has a weaker impact on communication influence of microblogs.

All in all, these microblogs of strong communication influence have the characteristics of high quality contents, large numbers of fans, fast update speed, frequent

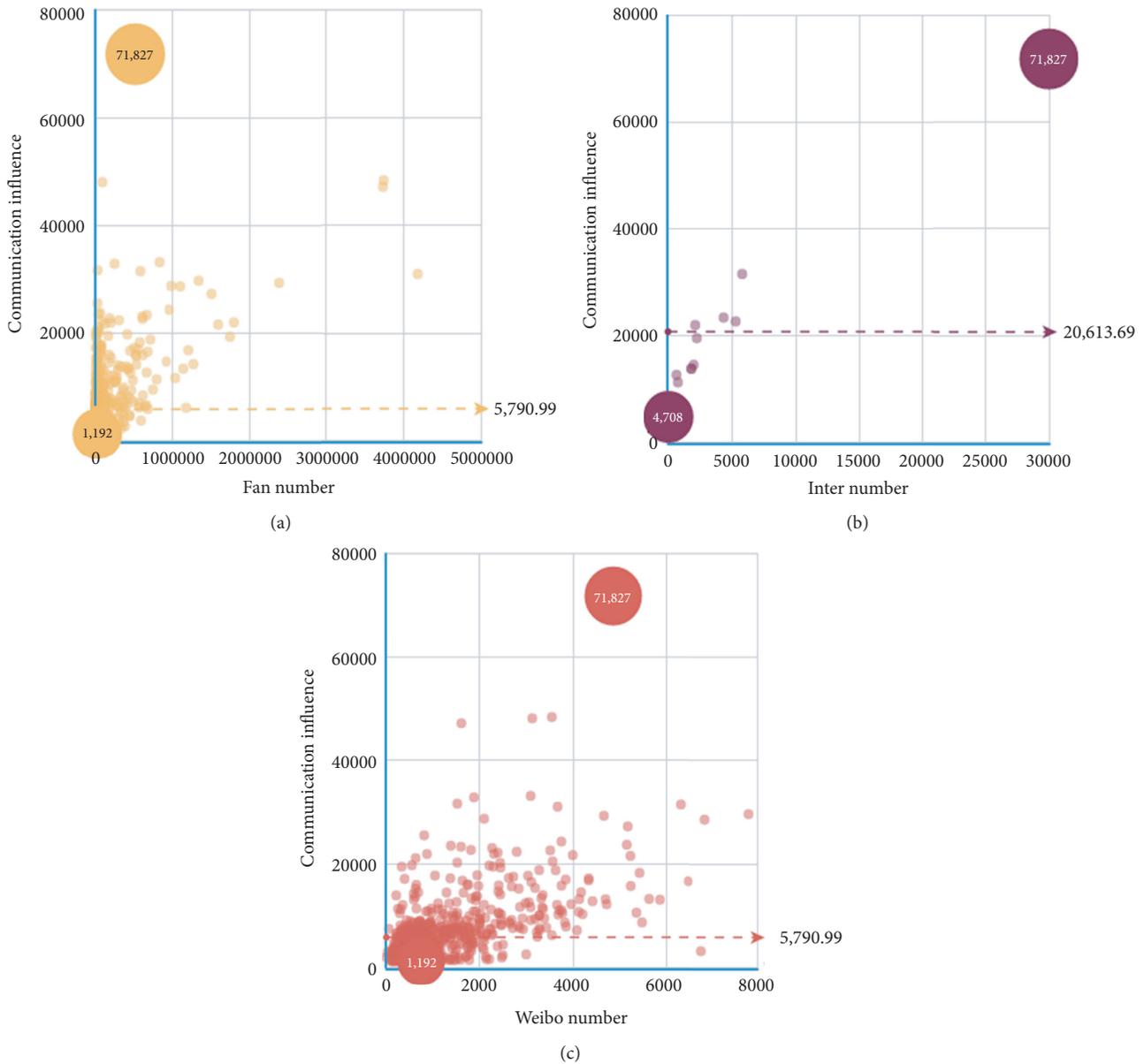


FIGURE 2: Influential factors of government affairs microblogs' communication influence.

interaction, etc., which attract the attention of the public, thus having a higher impact.

5. Conclusions

The government affairs microblog with a wide spread and large influence will have a profound impact on social issues, citizen deliberations, and popularization of policies. However, the spread and operation of various government microblogs are different, and homogeneous government microblogs still exist. In response to this situation, to better perform quantitative analysis and evaluate the effect and influence of government affairs microblogs, a set of government affairs microblog communication effect evaluation system and a monitoring and analysis system of micro government communication influence is designed in this study, thus analyzing

and judging the government affairs microblog's communication effect and influence through a scientific and effective method. According to the practical data analysis results, the trinity model of governmental microblog communication impact based on radioactivity, activity, and interaction designed in this study can better analyze and evaluate the communication influence of government affairs microblog; besides, it can also reflect the dynamic and timeliness of communication influence of government affairs microblog. Moreover, the results indicate that the number of fans and posts is an important factor influencing the influence of microblog accounts, but it is not a decisive factor.

Data Availability

The data in this paper are derived from Sina Web account.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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