A Pattern Recognition Framework for Detecting Changes in Chinese Internet Management System

Yu-Sung Su*, Yanqin Ruan, Siyu Sun, and Yu-tzung Chang

Abstract: Past studies on the Chinese internet management system have revealed a smart internet management system that takes advantage of time to filter content with collective action potential. How and why such a system was institutionalized? We offer a historical institutional analysis to explain the way in which the system evolved. We implement social network analysis to examine the Weibo posts of recurrent events, the elections in Area A in 2016 and 2018, to identify pattern changes in the system. There are two aspects of the changes: the centralization of the command line to a single authority and the implementation of a discriminatory strategy to deal with the various online expressions together forming this intelligent system. The improved Chinese information surveillance system demonstrates both a top-down information management and a bottom-up opinion formation.

Key words: internet censorship; devolution paradox; pattern recognition; social network analysis

1 Introduction

Information management is practiced by every government in every country[1]. Among them, China's surveillance of the internet is widely studied[2–4]. Past studies have identified the goals of Chinese internet management to exclude content with the potential to trigger collective action[5–8]. Counterintuitively, they claim that Chinese government allows certain criticisms of itself and its policies while avoiding becoming embroiled in heated discussions. Accordingly, the Chinese government dilutes and distracts the negativity brought by this loose control of information by employing or assigning internet commentators (known as 50 cents party members) to flood in irrelevant and cheerleading posts[9]. Some attribute this partial information filtering to the limited capability of the Chinese government and the creative adaptivity of ordinary netizens[10]. In other words, this implies that the Chinese government would examine all pernicious online information if it had the ability to do so. Still others supplement these findings by introducing the time variable into analysis. They argue that time buys buffer zones for inspectors to learn from the existing posts. Additionally, this tactic also avoids escalating the discussions due to instant review. As a result, the information management is delayed and taken place more effectively afterward[11, 12].

Ostensibly, existing studies do not come to a full agreement in terms of the internet censorship mechanism adopted by Chinese inspectors. Nevertheless, they are not mutually contradictory. As a matter of fact, a synthetic version of these accounts can help us to get a better if not a full picture of the Chinese censorship mechanism: Chinese inspectors are filtering the online information based upon three rules. Firstly, keywords filtering serves as an initial block; secondly, a distraction strategy is employed to water down frenzied online discussions; thirdly, a deferral tactic is used to learn from new ways of expression and sudden bursts of anger before implementing deletion afterwards.

However, with the ever-changing nature of the cyber communication, implementing such a system of information management requires significant ingenuity.

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The intriguing question is how and why such a system was institutionalized. To address this question, we propose a pattern recognition framework for detecting changes in Chinese internet management system. The framework follows the authors' design[11] by introducing a temporal aspect into the analysis to examine structure changes in the social network of online discussions of recurrent events. Specifically, we scrape the microblogging data of similar political events in 2016 and 2018 to formulate a longitudinal social network analysis. The quasi repeated observations design helps us to unscramble this complex system of information management by tracing its conducts along different time periods while at the same time holding potential confounding factors invariant.

Using this analytical framework, we are able to identify significant network structural differences between 2016 and 2018. The deferral tactic of information management mentioned in Ref. [11] is identified in 2018. Additionally, we observe a change of the information reviewing strategy from a tight control in 2016 to flexible management in 2018. We attribute this adjustment to several institutional changes which were enacted between 2016 and 2018. We find that similar to other governance issues in China, a devolution paradox has haunted the way in which Chinese government manages the online information. Nevertheless, the adaptive resilience of the regime helps it to achieve this effective management system through an evolutionary process[13, 14]. Moreover, we echo others on the responsiveness of Chinese government[15–18] in that sometimes the delayed management of information is a learning process of the government to better respond to these bottom-up societal pressures. Together, the Chinese information surveillance system demonstrates not only top-down information management but also bottom-up opinion formation (the top-down information management filters the online expression with a list of keywords and topics (see Section 2 for details). The bottom-up opinion formation, on the other hand, is a strategy for the Chinese government to learn from the netizens on never-defined or not-well-defined topics. Henceforth, the government gathers opinions and information from these online discussions in the first place and makes subsequent decisions on how to deal with these. The example topics with this sort are the LGBT issue discussed in Section 4, or concepts imported from the West, such as deliberative democracy and community building/development.).

The paper is organized as follows. In Section 2, we offer an institutional explanation for the evolvement of the information surveillance system with reference to official deliberations and regulations. Accordingly, the system we face today (after 2018) differs greatly from the previous system (before 2018). Nevertheless, it took years for the Chinese government to realize that the old "united front tactic"[19] was essential to managing this new field of public expression. In Section 3, we present our research design along with the real time data collection process between 2016 and 2018 on specific political events to show the changing patterns of Chinese internet management. In Section 4, we visually display the diagrams of social network analysis to show that the management of internet information is indeed evolving. We conclude in Section 5.

2 Old Combating Skills Against New Battle Field

The rapid development of the internet has posed a great challenge to the information management of the Chinese government. Internet filtering as well as the firewall have been used as tools to regulate information flows in cyberspace. In China, both government authorities and companies are engaged in internet review. As time goes on, individuals are trained to self-reviewing their online expression to cope with the system.

On top of these, the greatest concern for both the authorities and companies is political risk. The authorities fear that the availability of too much unrestrained information to citizens may be detrimental to the government as well as the regime. Different departments and agencies in the government are thus devoted to information control. The companies, on the other hand, are striking a balance between increasing the user viscosity by providing opinion friendly cyberspace and evading administrative penalties for overlooking the online expressions.

Granted that the internet is a relatively new public domain, "crossing the river by feeling the stones" is a rational but inefficient managerial skill to keep the cyberspace in order. In 2000, a batch of laws and regulations targeted at managing the internet were passed, including the "Decision of the Standing Committee of the National People's Congress on Preserving Computer Network Security", "Regulation on Internet Information Service", and "Regulation on Telecommunications". A group of departments are

responsible for overseeing the management of the internet. These include the Ministry of Industry and Information Technology, the Ministry of Public Security, the State Administration of Press, Publication, Radio, Film and Television, and the Ministry of State Security. A corollary to multiple departments that share with the same concern and hence the same political responsibility is a multichannel management (*jiu long zhi shui*) of the cyberspace in China. Simply put, no one wants to be held responsible for unleashing "malicious" views and ideas on cyberspace. And the way to achieve this is to get involved in the management to ensure the departments' concerns are properly handled. So, a system of a tight control was a natural product of this multichannel management.

For example, China's largest social media platform, Sina Weibo, was managed by three departments (the Ministry of Industry and Information Technology, the Ministry of Public Security, and the State Internet Office) as well as their subordinate units at the same time. The byproduct was a naïve system with a blacklist of keywords that kept expanding over time. As a matter of fact, the information management system has a simple if not clearly defined list of nine types of contents that are forbidden to be produced, copied, published, or transmitted via the internet[20]. They are listed as follows:

(1) Against the cardinal principles prescribed in the constitution.

(2) Detrimental to state security, state secrecy, state power as well as national unification.

(3) Detrimental to state honor and interests.

(4) Instigating national enmity or discrimination and breach of national unity.

(5) Breach of state religious policy, propagating heretical or superstitious ideas.

(6) Disseminating rumors, disrupting social order as well as stability.

(7) Disseminating obscenity, pornography, force, brutality, and terror or crime-abetting.

(8) Humiliating, slandering others, and trespassing the lawful rights and interests of others.

(9) Other contents forbidden by laws and regulations.

The multi-entities and multi-channel management system forced the Chinese government into a devolution paradox which held back any potential reform or improvement to the system. Similar to other public management issues in China, a devolution paradox refers to a situation where overly tight control creates gridlock and an attempt to loosen it generates chaos (*yi guan jiu si, yi fang jiu luan*). Any reform of the system to relax constraints on certain online expressions would end up with government authorities and companies shirking from the responsibility for the management of information. In other words, there is no reloading once offloaded. A void of control is thus created. Henceforth, a reform of the system was not likely to happen if the devolution paradox was not solved.

The critical juncture in the reform of the system has to do with an institutional change in 2014. It took years for the Chinese government to realize that the key to solve the devolution paradox is to define clearly who is in charge of the management of internet. Since 2013, the Chinese government has made several public deliberations calling for a reform on the system. In 2014, the Central Leading Group for Cybersecurity and Informatization was established and attached to the National Information Office. In the later years, the Office enacted relevant regulations. Accordingly, companies revised agreements and regulations with internet users.

Taking Sina Weibo as an example, the Office enacted the "Provisions on the Administration of Mobile Internet Applications Information Services" in 2016, which stated clearly that the Office shall be responsible for the law enforcement of reviewing and administration of the information contents of mobile internet apps nationwide. The agreements and regulations with users of Weibo were thus revised to reflect this change in January 2017.

The development we depict so far does not show signs of relaxing the system. Nevertheless, centralizing of the command line into one authority was institutionalized and critical to the subsequent reforms.

The reform of the information management system in the following years has to do with series of speeches made by Chinese President Xi. In April 19, 2016, Xi hosted and spoke at a symposium on cybersecurity and IT applications. In this speech, he claimed that a sound domain for online opinion expression should not be only one voice and one tune. Well-intentioned criticism and public oversight online should be studied and taken into account, regardless of whether it is directed at the work of the CCP and government or at officials personally, and regardless of whether it is mild-mannered or unpleasant to hear[21]. This was the first public deliberation from the highest authority since 2000 that proposed a pluralist cyberspace with properly expressed criticisms.

Later in October 2017, Xi delivered a report to the

19th National Congress of the Communist Party of China. In this speech, he reiterated the entreaty to create a sound cyberspace with better online contents under a system of improved management. He elaborated the point by proposing a system of discriminatory management which provides different treatments for different contents in this "new battlefield"[22]. This differential treatment of online information was not a new invention. In December 2015, Xi made a similar speech to the National Conference on Party Schools. He claimed that the cyberspace is a major field of competition. Borrowing old combat skills to fight in this new battlefield, Xi divided the battlefield into three areas. In his words, "The red area is the domain where we have the initiative and must keep it. The black area is where we find malicious views in opposition to the Party, so we must resolutely fight back and reduce their negative influence. The grey area is an intermediate zone that we must make an all-out effort to win over and turn into red." In other words, the system should endorse the red area, block the black area, and transform the grey area[23]. The system has transformed from a passive filtering into active management of the online information. We have summarized the historical development of the reform in Table 1.

In short, we have identified three important changes in the system. Firstly, the Chinese government has settled the management of internet into a single authority since 2014. Secondly, while it permits a pluralist voiced cyberspace, it has employed a discriminatory strategy to better administer this public domain. Thirdly, inspectors, whether they are from the government or companies, should actively engage into the online discussion to lead and learn from the contents.

Therefore, based on our review of the evolution of the system, we should be able to identify the changes in information management after the aforementioned institutional changes. In Section 3, we propose a pattern recognition framework for detecting these changes.

3 A Framework of Pattern Recognition and Data

We choose recurrent political events, the elections in Area A, to better identify the pattern change in the control of the online expression by holding the contents for discussion as well as the other confounding factors seemly invariant. The elections in Area A have been a hot issue for discussion and can attract widespread attention among Chinese netizens. This issue is also highly political because the election results set the directions of the relationship between Mainland China and Area A in subsequent years. If a pro-China party wins the

Table 1   Historical institutional analysis of the reform of Chinese internet information management system.

| Year	Historical development
	Antecedent condition
2000	● A batch of laws and regulations on internet management were passed; a group of departments were enlisted to be responsible for the management.
	● The multi-entities and multi-channel management system led to a devolution paradox that impeded reform of the system from happening.
	Critical juncture
2014	● The Central Leading Group for Cybersecurity and Informatization was established and attached to the National Information Office.
	● The centralization of the command line of the internet management to a single authority solved the gridlock in the system and triggered the reform.
	Structure persistency
2015	● Xi called for a discriminatory strategy to deal with various internet expressions[21, 22].
2016	● The National Information Office enacted the "Provisions on the Administration of Mobile Internet Applications Information Services", stating clearly the Office shall be responsible for the law enforcement of reviewing and administration of the information contents nationwide.
	● Xi claimed a sound domain for online opinion expression should not be only one voice and one tune[22, 23].
	Reactive sequence
2017	● The governments and companies made changes to the management.
	● e.g., Sina Weibo revised the agreements and regulations with users.
	Outcome
	● An improved system with both a top-down information management and a bottom-up opinion formation was presented.

election, this will lead to more intensive interactions between mainland China and Area A. Otherwise, a stringent and unfriendly relationship will result if a pro-China party loses the election. The events fit well to the three narrative battlefields. The pro-China discussion is the red field and the expression otherwise is the black field[23]. Somewhere between these two political ideologies and preferences is the grey field where the Chinese government should focus its efforts into content management. Various surveys have shown that the majority of Area A themselves are in the middle point between these two extremes[24].

In the previous institutional analysis, we conjecture that changes in the censorship system cannot be plausible before institutionalization of a clearly defined single authority in charge of reviewing the conduct of content management. We analyze two events. They are the elections held in January 2016 and in November 2018, respectively. The timing of the two elections is perfect in the sense that the first election event took place before Weibo, the largest social media platform in China, published the revised user agreement in January 2017, stating the single administration unit is the National Information Office. To this end, in every minute in the months of the two elections, we scrapped the relevant posts from the Weibo to make the following comparison (see Fig. 1). To make the whole comparison computational possible, we limit our analysis to a six-day period, which is three days before and after the elections. In the end, we have 779 612 posts during January 14–19,
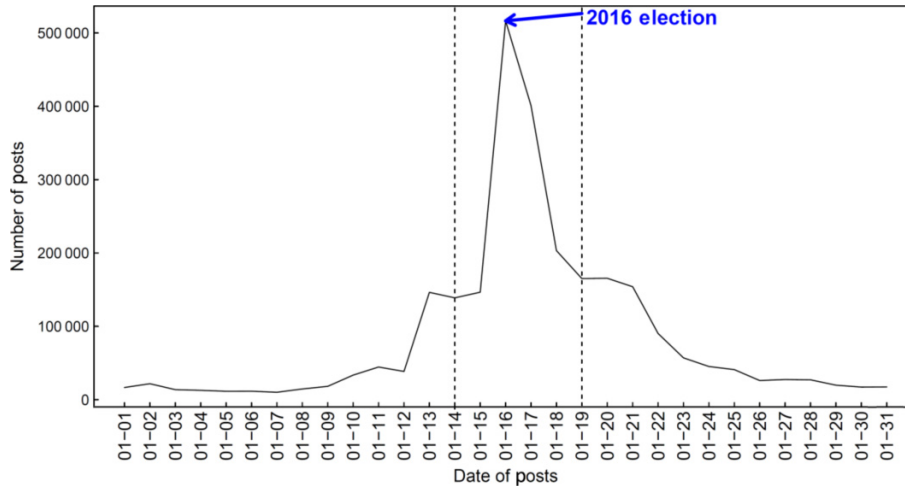

(a) 2016 Weibo posts
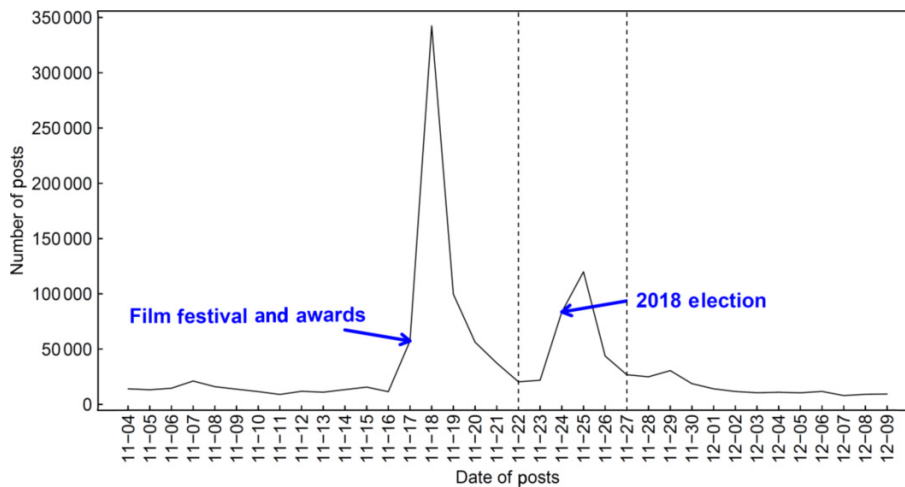
(b) 2018 Weibo posts

Fig. 1   Plot of the number of Weibo posts by date. Two spikes were observed near the election day in 2018. The first spike is about the Film Festival and Awards, which is an awards festival for Chinese language films. The second spike concerns the election.

2016 and 349 306 posts during November 22–27, 2018.

We propose a pattern recognition framework to detect both between and within structural changes using social network analysis to better identify the adjustment of the information management system. Firstly, a within analysis is a comparison of the ebbs and flows of online discussions of an event, aiming to observe the ways in which the inspectors inserted their influence before and after the online discussion of the elections. Secondly, a between analysis is a comparison of online discussions of a recurrent event in different years, looking to see if the network of the public online domain was indeed metamorphosed before (2016) and after (2018) the institutional change in the system. We implement the social network analysis using Gephi 0.9.2[25] and visualize the network with the Force Atlas 2 layout algorithm[26].

The Force Altas layout algorithm is useful for displaying large networks like the ones we have in this study. It pushes apart the most connected nodes with highest degree from each other and gathers nodes with lower degrees to these important hubs (nodes). The iterative plotting algorithm in the end chips away a hairball-like network into a more revealing and readable structure, which helps us identify influential nodes and groups within the network (see Fig. 2). Nevertheless, large networks like the ones we have in this study are not readable even after applying a layout algorithm. Hence, we filter nodes with only one connection after applying the Force Altas layout algorithm to display the networks.

Additionally, we choose several measures to evaluate the networks. Firstly, we calculate the degree of a node to demonstrate how many links it has to other nodes in the network. The higher degree a node has, the more

(a) January 14–16, 2016

(b) January 17–19, 2016

(c) November 22–24, 2018

(d) November 25–27, 2018
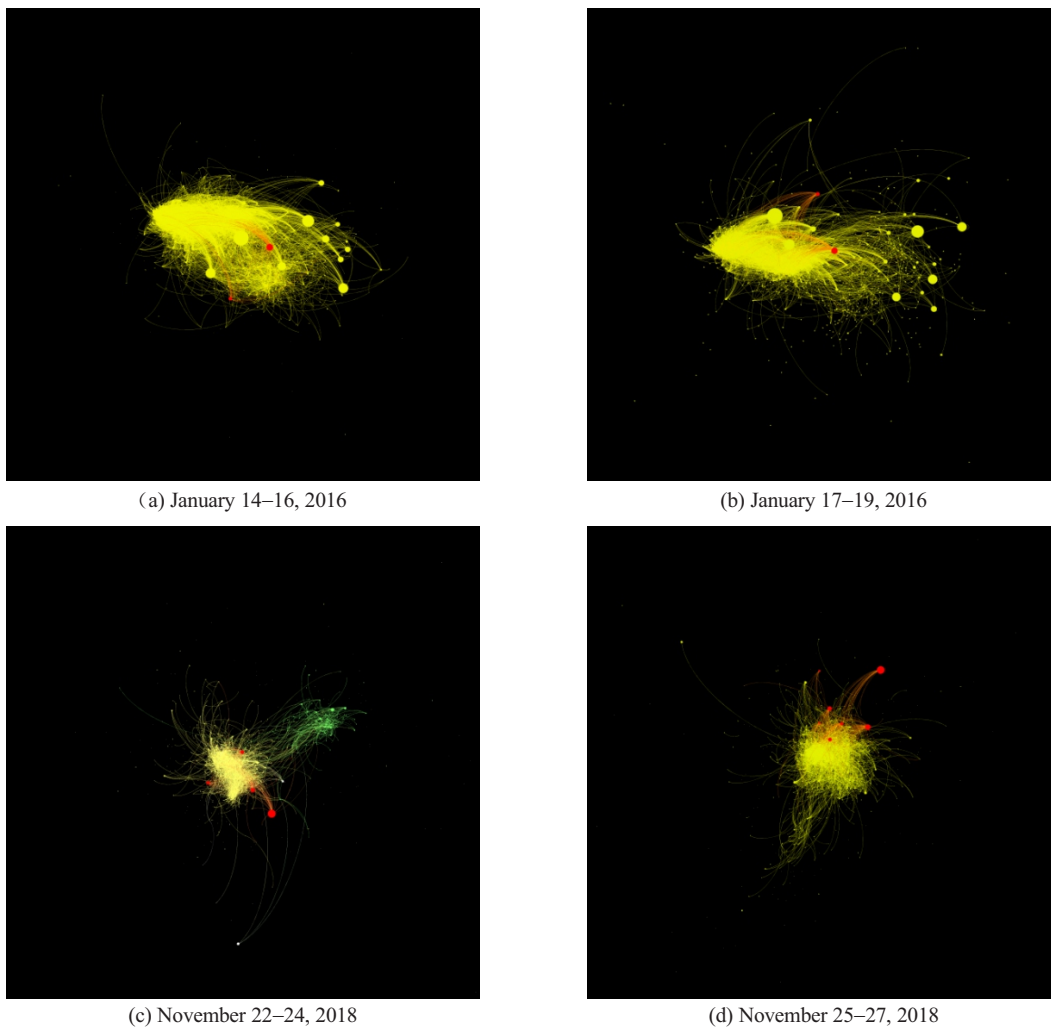
Fig. 2   Plots of the social network analysis. There is a clear pattern change between networks of 2016 (Figs. 2a and 2b) and networks of 2018 (Figs. 2c and 2d). Nodes with less than 1 degree are masked from the whole network to better reveal the whole network.

connected it is, which shows its relative influence to the network. In Table 2, we list nodes with top 20 highest degrees in the four periods we analyze.

Secondly, we detect the community structure of the network with the Blondel's modularity measure and partition nodes into different classes. The Blondel modularity algorithm outperforms other algorithms in terms of its efficiency and capability of handling larger

network[27]. Accordingly, if a network's modularity is high, it means its community structure is complex, indicating there is room for plurality and diversity. According to the institutional analysis in Section 2, we expect a higher modularity in 2018. The modularity scores of the four networks are displayed in Table 3.

Thirdly, we juxtapose the modularity with two other measures: the betweenness centrality measure[28]

Table 2   Lists of nodes of the top 20 degrees in four periods. Ind., Media., and Central. represent individual (personal), local media, and central media accounts, respectively. The accounts of the top 20 degrees before and after the elections are both labeled in bold font.

Date	Account type	Degree	Betweenness	Date	Account type	Degree	Betweenness
January 14 – 16, 2016	**Ind.01**	35 412	105 774	January 17 – 19, 2016	**Media.02**	35 838	0
	Ind.02	28 100	0		Ind.15	27 778	0
	Media.01	23 128	442 362		**Ind.01**	23 443	0
	Ind.03	22 670	0		Ind.16	20 766	224 092
	Ind.04	19 334	0		Ind.17	20 374	0
	Central.01	15 476	0		**Ind.04**	18 635	0
	Ind.05	13 134	28 291		**Central.01**	13 278	17 508
	Ind.06	13 091	37 352 565		Ind.18	12 300	0
	Ind.07	12 995	0		**Media.01**	11 297	78 751
	Ind.08	10 633	22 906 714		Central.03	7645	0
	Central.02	7598	0		**Media.03**	7553	125 235
	Media.02	6375	0		Ind.19	7429	0
	N/A	4828	0		Ind.20	7120	49 776
	Ind.09	4616	250 269		Ind.21	7048	0
	Ind.10	4160	0		Ind.22	6333	12 574
	Ind.11	4157	9 445 449		Ind.23	5273	0
	Ind.12	3695	6 574 185		Ind.24	5069	0
	Ind.13	3460	6 351 131		Ind.25	4742	31 264
	Ind.14	3271	111 463		Ind.26	4633	0
	Media.03	3149	8 568 137		Ind.27	4615	9828
November 22 – 24, 2018	**Central.04**	5296	0	November 25 – 27, 2018	**Central.04**	7245	0
	Central.05	2795	3549		**Media.01**	5086	0
	Central.01	2378	2487		**Central.03**	3936	0
	Central.03	2302	0		**Central.01**	3440	6116
	Ind.28	2132	0		**Central.05**	2906	0
	Media.04	1775	0		**Ind.30**	2313	0
	Media.05	1573	0		**Ind.35**	2275	0
	Media.01	1484	0		Ind.38	2193	0
	Ind.29	1326	1208		Ind.39	2024	0
	Ind.30	1316	0		Ind.40	2002	3926
	Ind.31	1261	0		**Ind.31**	1939	0
	Ind.32	1200	0		Media.07	1836	0
	Central.06	1163	0		Media.08	1732	0
	Ind.33	1044	0		**Central.06**	1638	0
	Central.07	1029	0		**Central.07**	1576	0
	Media.06	980	0		**Media.04**	1546	1786
	Ind.34	974	1854		Media.09	1471	0
	Ind.35	962	0		Ind.41	1355	17 833
	Ind.36	851	0		Ind.42	1307	0
	Ind.37	847	0		Media.09	1285	0

Table 3   Modularity, betweenness centrality, and E-I index of the whole networks and the subnetworks in 2016 and 2018.

Date	Number of nodes	Modularity	Number of communities	E-I index (whole network)	E-I index (between modules)
January 14–16, 2016	378 009	0.655	7231	0.979	–0.444
January 17–19, 2016	401 603	0.695	6771	0.986	–0.503
November 22–24, 2018	71 332	0.863	2065	0.971	–0.756
November 25–27, 2018	124 902	0.837	23 601	0.656	–0.746

implemented in Gephi 0.9.2 and the E-I (External-Internal) index[29] implemented in the isnar package[30] in R[31]. In large networks like the network we analyze in this study, there is a chance that the high modularity is a result of many disconnected communities. To address this issue, we calculate the betweenness centrality, which measures nodes that are connected to most different communities together and serve as the hub to these communities, to capture influential nodes with respect to the whole network. The E-I index, which measures the number of ties external to the communities minus the number of ties that are internal to the community divided by the total number of ties, is used to capture the cohesiveness of the communities in a network. We list the betweenness centrality scores in Table 2 and the E-I index in Table 3.

4   Result and Finding

The social network analysis on the recurrent event supports our hypothesis that there are structural changes which represent shifts in patterns in Chinese information management system. Visually speaking, the networks before and after the 2016 election (Figs. 2a and 2b) share a similar network structure. Some influential nodes with higher degrees (larger sized dots in the diagrams) are connected remotely to the dense center. This shows that these nodes (the opinion leaders), mostly individuals, played an active role in steering the online discussions in the 2016 election. Among these nodes of the top 20 degrees, only two were central media, indicating they have a relatively weak influence over the masses before and after the 2016 election (see Table 2).

Central media and local media played more significant roles in 2018 than in 2016. In the lists of nodes of top 20 degrees in Table 2, 25% of these nodes are central media and local media in 2016 and 45%–60% in 2018. This could be a sign of more involvement from the government in the online discussions in the 2018 election. In contrast, individuals found it hard to maintain the momentum in both years before and after the election. Only about one quarter of the individual

nodes managed to keep their importance after the elections in 2016 and 2018. We find that new individuals found themselves on the list of the top 20 nodes after the elections while the majority of the old ones fell out of the leaderboard. The networks before and after the 2018 election (Figs. 2c and 2d) demonstrate a clear shift from a polycentric network to a monocentric one. On the one hand, a polycentric network in the network before the 2018 election (Fig. 2c) implies a pluralist voiced domain was indeed permitted during November 22–24, 2018. The monocentric network after the 2018 election (Fig. 2d) suggests a sign of content filtering that some contents were trimmed off the network (the green cluster in Fig. 2c vanished in Fig. 2d). We identified the contents of these removed posts and found they are related to the LGBT issue, which was a prominent issue in the 2018 election (the LGBT issue is sensitive in China and considered as subverting to the traditional views [*san guan bu zheng*]. Nevertheless, the issue is ambiguous and complicated. In April 15, 2018, the *People's Daily*, China's political propaganda newspaper, appeared to criticize Sina Weibo for its over censorship on the LGBT issue by publishing a commentary emphasizing that it is a personal choice whether to approve of homosexuality. Clearly, there was no consensus among internet inspectors on the LGBT issue in 2018.). Similar to the networks before and after the 2016 election (Figs. 2a and 2b), the influential nodes are connected remotely to the dense centers, indicating a trait of these opinion leaders in dominating the online discussions on the 2018 election. Nevertheless, in the network before the 2018 election (Fig. 2c), these nodes contain central and local media as well as other important individuals. Comparatively speaking, both central and local media before and after the 2018 election demonstrated significant influence over the network. They were the top nodes with the highest degrees (see Table 2).

We further examine the differences of network structures in terms of their subnetwork between 2016 and 2018 by juxtaposing the modularity measure with

the E-I index (see Table 3). The two modularity scores of 2018 before and after the election are both higher than those of 2016. This means that relatively speaking there were more communities and room for plurality and diversity in 2018, which supports our conjecture that the online cyberspace became more multi-voiced as the Chinese government and the Sina Weibo made the pledge to formulate such a space in 2017.

The modularity scores we garnered could be illusory and misleading as we have large networks in analysis. Hence, we further examine the networks with the E-I index. In Table 3, the high E-I indices of the whole networks are close to 1, meaning there is significant external cohesiveness (more external ties than internal ties of nodes) of the networks in analysis, with a minor exception of the one after the election in 2018. This demonstrates that there are significant numbers of subgroups that spread over the network (as listed in the column of number of communities in Table 3). Nevertheless, we compute the E-I index of these subgroups (communities), which are partitioned according to the modularity measures, to explore the cohesiveness of these subnetworks. The E-I indices of -0.756 and -0.746 in 2018 are higher than the indices of -0.444 and -0.503 in 2016, indicating there is higher internal cohesiveness (more internal ties than external ties of nodes in a subnetwork) in 2018. This means the nodes of 2018 are highly connected with each other within different communities in the networks. These within connections are somewhat weaker in the networks of 2016. In short, synthesizing the findings based upon the modularity score and the E-I index, we conclude more diverse networks and higher cohesiveness within the subnetworks in 2018.

We further study these communities with the betweenness centrality measure. The values for the betweenness centrality measure in Table 2 show quite significant differences between 2016 and 2018. Firstly, most nodes with higher degrees in 2016 have high betweenness centrality. This indicates these nodes are well connected and these connections are effectively link communities or groups together. These nodes are influential across the whole network. Looking at the betweenness centrality and the E-I index altogether, the nodes and the communities they belong to are globally influential in the whole network. The story is different in 2018. Most nodes with higher degrees do not have higher betweenness centrality, meaning they are well connected within the community they belong to, but are not well connected to other communities. The internal cohesiveness of the networks in 2018 is supported by the E-I index.

So far, our biggest claim is that there is no significant structural change in 2016 before and after the election, but the change is quite obvious in 2018. The evolutionary change from a polycentric network to a monocentric one we identified between and after the 2016 and 2018 election (Figs. 2c and 2d) is a clear proof for a structural shift. As a matter of fact, the network before the 2018 election (Fig. 2c) displays a structural gap where there is a sparse or blank space between the green and the yellow clusters (different communities as computed by modularity measure). We identify the bridge between these two masses to be ind.29 and ind.34 with the betweenness centrality measure, which are also highly influential (high degrees) in the green mass. They discussed the LGBT issue which is mildly sensitive topic. The fact that the two posts of these two accounts were suspended after the 2018 election brings about the vanishing of the polycentric network and the dissolving of the community that talked about the LGBT issues.

The role of individuals was nontrivial in 2016 but less salient in 2018. One thing in common between 2016 and 2018 is that before and after the elections in the 3 days period in our analysis, the degrees of individuals and their relative ranking vary significantly. Only a few individuals were able to maintain a high level of prominence after the elections. We revisited these nodes and found that they were either deleted or prohibited from further commenting and forwarding (e.g., ind.29 and ind.34). This is another sign of content filtering. Central media and relevant local media were immune from this filtering. If they were influential before the elections, they were highly likely to remain influential after the elections. In short, the content filtering is selective and targeting with precision.

5　Conclusion

Past studies on Chinese internet management system have revealed a smart internet management system that takes advantage of time to filter contents with collective action potential. Tracing the historical development of the information management system, we identify the critical juncture which led to the maturity of the system we observe today. The centralization of the command line to a single authority and the implementation of a discriminatory strategy to deal with the various online

expressions together formulate this intelligent system.

Theoretically speaking, we enrich the existing studies with a dynamic analysis. Specifically, we propose a pattern recognition framework for detecting changes in the information management system. The framework calls for a social network analysis on a recurrent political event across different time (the elections in 2016 and 2018). The structural changes in the networks between 2016 and 2018 are consistent with the institutional changes in the information management system.

In the essence, the changes involve two seemly contradictory actions. One is a tightening up action with a centralization of the management body at the central government. The other is a relaxing action aiming to create a multivocal domain. The relevant parties in this case are responsible for fighting new battles. Unlike the devolution paradox in the old system, these two actions work concertedly under the new system. Based on the evolutionary shift of the networks from a polycentric network to a monocentric one in 2018, we suspect that the relaxing action is a way for the government to learn from the discussions and forge a consensus on less sensitive issues. Therefore, the cyberspace discussions sometimes serve as a source of responsiveness of the government toward citizens on certain ambiguous topics. By providing restricted freedom and limited space[14,32,33], the system can offer a room for this maneuvering without risking the outburst of certain opinions.

Future studies can trace the role of the official media with respect to the other online expressions. Scholars have suggested that Chinese government is deliberately avoiding actively engaging in online discussions with netizens[5,8]. We find that this might not be the case in 2018 from our social network analysis. The official media was the primary opinion leader dominating the discussions in cyberspace in both 2016 and 2018 elections. Nevertheless, it played a more important role in 2018 than in 2016. A further analysis that pays special attention to the relationship between the official media and other netizens can help us better understand the function of the official media in this virtual public domain.

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