

Political Polarization in the Media Landscape: The Case of Indonesian Elections

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Abstract

Political polarization has long been a central topic for political science. This study investigate the phenomenon of political polarization in Indonesian news media landscape during the 2019 Presidential Election. We represent the media landscape as a network of news media based on their shared audience, and implement community detection algorithms to extract media clusters. We also construct a time series of media network and explore the dynamics of polarization during the observation period. The study confirms the existence of political polarization in the global and temporal networks of Indonesian news media, and shows that Twitter users' news consumption behavior is highly polarized. We also reveal periods with higher and lower polarization throughout the observation period, namely the degree of polarization in the media landscape is already high from the start of the observation, relaxes quickly after the election, and then reaches its maximum prior to the announcement of the official results.

Introduction

The fragmentation of information environment on Twitter, with audience ensconced into echo chambers of information sources with limited exposure to crosscutting news, is attracting considerable attention for its potential to increase polarization of political views (Schmidt et al. 2017; Sunstein 2017; Quattrociocchi et al. 2018; Maulana and Situngkir 2021a). The combination of media bias (Bakshy et al. 2015; Stefanov et al. 2019; Maulana and Situngkir 2021b), the tendency of audience to focus on specific narratives (Bessi et al. 2015; Quattrociocchi et al. 2018), and mediation and personalization of information by online social networks (Olmstead et al. 2011), can lead to extreme polarization in public discourses (Sunstein 2017).

A large body of research has addressed political polarization on online social media and mostly focused on user networks (Conover et al. 2011). In this study, we seek to investigate political polarization in the news media landscape. We combine several aspects of media polarization, namely position of media in political spectrum (Bakshy et al. 2015; Maulana and Situngkir 2021b), interactions between politically-affiliated media (Adamic and Glance 2005; Maulana and Situngkir 2021a), and tendency of the audience to obtain political information only from the media on one side of the political spectrum (Del Vicario et al. 2017).

This research is based on the work of Maulana and Situngkir (2021a) who analyzed Indonesian news media networks on Twitter during the 2019 Indonesian Presidential Election. We extend their work by including time component in the analysis, in order to observe changes in the structure of news media network and investigate the dynamics of polarization throughout the observation period. First, we analyze news media clusters within the global structure of the Indonesian news media landscape during elections. We implement a community detection algorithm and investigate whether political polarization occurred within the network. Second, we construct a time series of media network and examine the dynamics of polarization during the observation period. The contributions of this paper are as follows:

- We confirm the existence of political polarization in the global and temporal networks of Indonesian news media on Twitter during the 2019 Indonesian presidential election. We also point out that Twitter users' news consumption behavior is highly polarized and that their attention is limited to a single media community.
- We reveal periods with higher and lower polarization throughout the observation period: degree of polarization has been high since the beginning of the observation, relaxed quickly after the election, and then reached the maximum before the announcement of the official results.

In the rest of the paper, we summarize related work in “Related work”, present our methodology in “Methodology”, perform detailed analysis of the news media network in “Political Polarization in media networks”, analyze temporal network characteristics in “Polarization dynamics”. Finally, we concluded in “Conclusions”.

Related Work

A large body of research has contributed both methodologies and empirical facts, for understanding news consumption in digital media environment. Schmidt et al. (2017) investigated fragmentation of news sources in the social media space by characterizing the information consumption patterns of millions of Facebook users over a period of time. This study report that Facebook users tend to focus on a limited set of news pages, producing a sharp community structure among news outlets. The study of news consumption patterns on Twitter by Gaol et al. (2020) also shows the same thing. They found that news consumption patterns on Twitter are fragmented based on information sources.

The combination of a fragmented media landscape and individual tendency for confirmation bias on specific narratives can lead to extreme polarization in public discourses. Conover et al. (2011) investigated the retweet network of Twitter users during the 2010 midterm elections of the US Congress, and showed that the network exhibits a highly segregated partisan structure, with extremely limited connectivity between left- and right-leaning users. Soares et al. (2019) identified asymmetric polarization in the Twitter user network during the 2018 Brazilian Presidential Elections. By analyzing a large longitudinal Twitter dataset, Garimella and Weber (2017) provided evidence that polarization on US Twitter-sphere has increased over the past eight years.

Polarization studies on media network are often constrained by the difficulty of measuring the political tendencies of news media. One of the seminal studies to describe political polarization in media networks was Adamic and Glance (2005). The authors show that USA political blogs tend to be connected with other blogs with the same ideology, and form an information echo chamber in the 2004 USA Elections. By measuring the political alignments of online news outlets during 2019 Indonesian Presidential Election, Maulana and Situngkir (2021a) reveal that Indonesian news media landscape is politically fragmented.

Background and Data

Background

During the 2019 Presidential Election, Indonesia faced one of the most controversial political periods in its history. In this election, incumbent president Joko Widodo (JW) running for re-election with senior Muslim cleric Maaruf Amin (MA) as his running mate against former general Prabowo Subianto (PS) and former Jakarta vice governor Sandiaga Uno (SU) for a five-year term between 2019 and 2024. The election was a rematch of the 2014 Presidential Election, in which Joko Widodo, who was supported by a Progressive Nationalist political group, defeated Prabowo Subianto who is supported by parties with Islamic and Conservative ideologies. Since then political polarization has continued to increase and reached its peak in the 2019 election. Indonesian Twitter-sphere has been constantly stirred up by debates and hashtag wars between supporters of the two political camp. A number of news media also did not hesitate to show their political alignment, and at the same time took advantage of this polarizing situation to attract audiences through a sensational reporting strategy that sided with one political camp. In general, Islamic news media, e.g. portal-islam.com, republika.com, and the opposition news media, e.g. rmol.id and gelora.com, tended to side with Prabowo Subianto. Table 1 shows the candidates in the 2019 Indonesian Presidential Election, and the abbreviations to be used in this paper.

Table 1 Candidates for president / vice president in the 2019 Indonesian election.

Presidential / vice presidential candidates	Abbreviation	Keywords
Joko Widodo / Maaruf Amin	JW-MA	joko widodo, jokowi, maaruf amin, kiyai maaruf
Prabowo Subianto / Sandiaga Uno	PS-SU	prabowo, sandiaga, sandiaga uno

Tweet Datasets

We collected tweets related to the 2019 Indonesian Presidential Election using a number of keywords associated with the names of the candidates (see Table 1). The data collection process took place between March 27th to May 20th 2019 using the TCAT application (Borra and Rieder 2014). The observation period covered campaign stage, Voting Day (April 17, 2019) and result announcement (May 20, 2019). In this study, we only processed tweets that contain news URLs from Indonesian news media. We resolved shortened URLs to full URLs and extracted the primary domain of each URL, which after link resolution yielded 700 distinct domains. However, in this study we only elaborate on 560 domestic news media whose news links have been shared by at least 10 Twitter users. Table 2 shows the statistics of our tweet dataset.

Table 2. Descriptive statistics of the dataset.

Statistics	Count
Number of tweets	13990975
Number of tweets with a Url	667821
Number of hashtags	74515
Number of unique users	3958817
Number of news media	560

The political affiliation of Indonesian news media

We used data on the political affiliation of Indonesian news media, obtained from Maulana & Situngkir (2021b), to evaluate the composition of the partisan media in each media cluster. As explained in Maulana & Situngkir (2021b), the political stance of a news media was identified based on partisan behavior of their audience, assuming that people tended to be selective about information, i.e. only reading and sharing news articles in accordance with their political preferences. The identification process resulted in a political alignment score in the range of -1 to 1. The score is then split into five equal size band, where the media is leaning towards the PS-SU candidate if the score is lower than -0.2, leaning towards the JW-MA candidate if the score is greater than 0.2, and has a moderate stance if the score is between -0.2 and 0.2. Table 3 shows the descriptive statistics of partisan media in our data.

Table 3. Political alignment of Indonesian news media.

Classification	Number of media	Number of share	Number of user
JW-MA	330	373932	39806
Moderate	29	228522	87074
PS-SU	201	404058	61966

Methodology

Network construction

News consumption activity on Twitter can be modeled as a bipartite network between Twitter users and information sources. Following Maulana and Situngkir (2021a), we projected the bipartite network into a unipartite weighted network of news media where the weighted edge represents the size of their shared audiences.

We validated the media network using a method proposed by Tumminello et al. (2011). With this method, we filtered out the edges whose presence is merely a random interaction between a user and the news sources. Specifically, in detail in (Tumminello et al. 2011), we attached a p-value to each edge in the

network, then applied multiple hypothesis testing using a statistical threshold value of 0.01, and made moderate corrections using the False Discovery Rate (FDR) method (Benjamini and Hochberg 1995). In this study, we focus on the largest connected component of weighted media network, which is composed of 528 media nodes and 55662 edges. Table 4 shows the statistics of the network.

Table 4. The characteristics of Indonesian news media network.

Statistics	Pre-filtered network	Final network
Number of nodes	559	528
Number of edges	55662	27192
Diameter	3	6
Average path length	1.64	1.953

In this study, we also analyze the dynamics of media networks throughout the observation period. We construct a time series of media network with a rolling window technique, where the observation period is divided into a number of overlapping intervals of the same size. Each interval overlaps with the next one on a fixed subinterval, where the difference in their starting dates is a constant step size. We chose a window of ten days and a one-day step, in order to aggregate sufficient data in each window and to preserve daily resolution in the time series. In each observation window, we construct the media network and record the dynamics of media polarization during the period of observation.

Community Structure

In this study we used Fast Greedy algorithm (Clauset et al. 2004) to investigate meso structure of Indonesian media network. Modularity value is used to evaluate the quality of media clusters, which formally is defined as follows:

$$Q = \sum_i (e_{ii} - a_i^2) \quad (1)$$

where $a_i = \sum_j e_{ij}$ is the fraction of edges incorporated in cluster i . Modularity value are in the interval $[0,1]$. We also applied two community detection algorithms, namely louvain (Blondel et al. 2008) and Walk Trap (Pons and Latapy 2006) algorithm, to validate partition results. The Adjusted Rand Index method (Rand 1971) was used to measure similarity between the partition results.

Political Polarization in Media Networks

Firstly, we investigate the emergence of media clusters in Indonesian news media networks. Fig. 1 shows the backbone of Indonesian media network where the colors indicate cluster membership, as detected by the Fast Greedy algorithm. The partition result statistics are shown in Table 4.

Table 5 The partition result statistics.

Number of communities	Modularity (Q)	Adjusted Rand Index	Cluster I	Cluster II
5	0.256453	0.8	202	313

Fig. 1 shows the presence of two dominant clusters, which account for about 98 percent of news outlets in the data. To validate community partitioning, we compare the partition results from other community detection algorithms using the Rand method and find a high degree of similarity. As shown in Table 5, Indonesian media network has a high modularity, which indicates that the network has a fragmented structure, consisting of a number of clusters, with the majority of outlets being in the two largest clusters.

Furthermore, we examine the activity of users inside and across the different clusters to understand the relationship between user behavior and the observed community structure of news media. We focus on the two largest media groups and measure the polarization degree of user activity as follows (Del Vicario et al. 2017):

$$p(u) = \frac{y-x}{y+x} \quad (4)$$

where $y(x)$ is a fraction of share a twitter user u has with outlets in media community $C1(C2)$. As shown in Fig. 2, the Probability Density Function (PDF) of user activity has a bimodal pattern, where it is less likely that the user will consume information from the media in both communities. In other words, user activity is highly polarized and their attention is limited to a single media community.

To understand relationship between the fragmented media landscape and the tendency of media to take sides politically in elections, we characterize composition of partisan media in the two largest clusters. Table 6 shows that media alignment in the both clusters tends to be politically homogeneous, where media tend to group with other media with the same political affiliation. This suggests that news media landscape during 2019 Indonesian Election was not only structurally fragmented, but also politically polarized.

Table 6 Composition of partisan media in the two dominant clusters

Clusters	Political alignment		
	JW-MA	Moderate	PS-SU
I	0.074	0.089	0.837
II	0.927	0.028	0.045

Polarization Dynamics

In this study, we also trace structural changes of media networks and quantify the dynamics of polarization in these networks during the election. In each observation window, we build a news media network and measure the modularity values for the two types of partitions: (i) structural cluster: media clusters found through community detection algorithm, resulting in the modularity score of Q_s ; (ii) functional cluster: media clusters based on their political affiliation, producing the Q_c modularity score. To simplify the analysis, we use the raw score of media alignment, which results in two types of political affiliation, namely pro JW-MA and pro PS-SU.

Fig. 3 shows the dynamics of polarization in Indonesian news media networks. During the observation period, the dynamic patterns of the two polarization indicators is relatively similar where the Q_c value was always smaller than the Q_s value. This indicates a mismatch between the media clusters identified through community detection algorithm and the media clusters based on political alignment. However, this mismatch does not neglect the fact that the values of the two polarization indicators are relatively high and do not differ much.

Including a time component in the analysis has the potential to reveal periods with higher and lower polarization. As can be seen in Fig. 3, since the initial period of observation, Indonesian media network shows a high level of polarization, fluctuating around the value of 0.2 to 0.25. This is not surprising given that political discourse has been polarized since before the 2019 elections. In general, the polarization value increased slightly before and shortly after Voting Day, then dropped sharply at the end of April to early May 2019. This is related to the significant reduction in polarized issues after the election, given that the official announcement of the results will take place on May 20 2019. However, in early May, political discourse heated up when PS-SU began to question the validity of the election process, in response to the quick count results of a number of election monitoring institutions that predicted JW-MA to be the winner of the election. This situation is captured by the polarization value that moves up and reaches its highest point on May 14, 2019. On that day, presidential candidate Prabowo Subianto made an official statement that he would not accept the result of the election by the General Election Commission, which is expected to show that incumbent President Joko Widodo secured his reelection, claiming his own campaign team has its own data showing that he won the race. From the point of view of interaction between politically affiliated media, this analysis shows that polarization is a dynamic property of the media landscape, which is responsive to politically relevant events.

We further explored the media clusters in four observation windows (see Fig. 3), namely April 13th (the last day of the campaign period), April 17th (Voting Day), May 14th (highest modularity), and May 19th (the day before The General Elections Commission announced the official result of the elections). Table 7 shows that the number of media clusters in each window of temporal network is greater than the partition result for the global network. However, as found in the global network, there are only two dominant clusters, with media membership reaching at least 70 percent. Table 7 also shows that political alignments in each cluster are relatively homogeneous, where media with the same political affiliation dominate each cluster. This confirms that political polarization also occurs in the temporal network of Indonesian news media.

Table 7 The composition of the partisan media in 4 observation windows.

Date		Total cluster	Cluster	Cluster	Cluster I		Cluster II	
			I	II	PS -SU	JW -MA	PS -SU	JW -MA
A	April 13th	10	0.49	0.38	0.04	0.96	0.69	0.31
B	April 17th	8	0.46	0.38	0.05	0.95	0.8	0.2
C	May 14th	7	0.34	0.38	0.69	0.31	0.11	0.88
D	May 19th	7	0.44	0.44	0.78	0.22	0.02	0.99

Fig. 4 shows the Probability Density Function of user polarization in each window, and we find that the distribution is bimodal, as found on the global network. This finding suggest that Twitter users who are interested in election-related news are highly polarized, preferring and favoring news from a single media cluster according to their political preferences.

Conclusions

Political polarization is a feature of the political process in a democratic system, but too much of it can hinder the functioning of democracy itself. In this study, we show the presence of political polarization in the global and temporal landscape of Indonesian news media during the 2019 Presidential Election. The media landscape is represented as a network between news media based on a shared audience on Twitter. Using a community detection algorithm, we show that the media landscape in Indonesia has a fragmented structure, in which Twitter users are highly polarized on two dominant media clusters and their attention is confined to outlets that are members of the same media cluster. Furthermore, we use media alignment data to show that the composition of partisan media in each cluster are relatively homogeneous, where media with the same political affiliation dominate each cluster s. This suggests that media landscape during 2019 Indonesian Election exhibits a highly segregated partisan structure. We conducted further investigations at a number of windows in the time series of media networks and found that the temporal landscape of Indonesian news media is also politically polarized.

By including time component in the polarization analysis and using modularity as a polarization metric, we reveal periods with higher and lower polarization during the election. In general, degree of polarization in Indonesian news media landscape has been high from the beginning of the observation, relax quickly after the election, and then reach maxima before the announcement of the official results. From the point of view of interaction between politically affiliated media, this analysis shows that polarization is a dynamic property of the media landscape, which is responsive to politically relevant events.

Abbreviations

JW-MA: Joko Widodo-Maaruf Amin;

Declarations

Acknowledgements

Not applicable.

Authors' contributions

AM designed the study, acquired the data, performed the data analysis. AM and HS interpreted the results and wrote the paper. Both authors read and approved the final manuscript

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Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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References

Adamic L, Glance N (2005) The political blogosphere and the 2004 U.S. election. Proc 3rd Int Work Link Discov

Bakshy E, Messing S, Adamic LA (2015) Exposure to ideologically diverse news and opinion on Facebook. Science (80-). <https://doi.org/10.1126/science.aaa1160>

Benjamini Y, Hochberg Y (1995) Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing. J R Stat Soc Ser B. <https://doi.org/10.1111/j.2517-6161.1995.tb02031.x>

Bessi A, Zollo F, Del Vicario M, et al (2015) Trend of narratives in the age of misinformation. PLoS One. <https://doi.org/10.1371/journal.pone.0134641>

- Blondel VD, Guillaume JL, Lambiotte R, Lefebvre E (2008) Fast unfolding of communities in large networks. *J Stat Mech Theory Exp* 10:. <https://doi.org/10.1088/1742-5468/2008/10/P10008>
- Borra E, Rieder B (2014) Programmed method: Developing a toolset for capturing and analyzing tweets. *Aslib J Inf Manag*. <https://doi.org/10.1108/AJIM-09-2013-0094>
- Clauset A, Newman MEJ, Moore C (2004) Finding community structure in very large networks. *Phys Rev E - Stat Physics, Plasmas, Fluids, Relat Interdiscip Top*. <https://doi.org/10.1103/PhysRevE.70.066111>
- Conover M, Ratkiewicz J, Francisco M (2011) Political polarization on twitter. *lcwsm*. <https://doi.org/10.1021/ja202932e>
- Del Vicario M, Gaito S, Quattrociocchi W, et al (2017) News consumption during the Italian referendum: A cross-platform analysis on facebook and twitter. In: *Proceedings - 2017 International Conference on Data Science and Advanced Analytics, DSAA 2017*
- Gaol FL, Maulana A, Matsuo T (2020) News consumption patterns on Twitter: fragmentation study on the online news media network. *Heliyon* 6:51–69. <https://doi.org/10.1016/j.heliyon.2020.e05169>
- Garimella VRK, Weber I (2017) A long-term analysis of polarization on Twitter. In: *Proceedings of the 11th International Conference on Web and Social Media, ICWSM 2017*
- Maulana A, Situngkir H (2021a) Media Polarization on Twitter During 2019 Indonesian Election. In: Benito RM, Cherifi C, Cherifi H, et al. (eds) *Complex Networks & Their Applications IX*. Springer International Publishing, pp 660–670
- Maulana A, Situngkir H (2021b) Media Partisanship During Election: Indonesian Cases. In: Benito RM, Cherifi C, Cherifi H, et al. (eds) *Complex Networks & Their Applications IX*. Springer International Publishing, pp 651–659
- Olmstead K, Mitchell A, Rosenstiel T (2011) Navigating news online
- Pons P, Latapy M (2006) Computing communities in large networks using random walks. *J Graph Algorithms Appl*. <https://doi.org/10.7155/jgaa.00124>
- Quattrociocchi W, Scala A, Sunstein CR (2018) Echo Chambers on Facebook. *SSRN Electron J*. <https://doi.org/10.2139/ssrn.2795110>
- Rand WM (1971) Objective criteria for the evaluation of clustering methods. *J Am Stat Assoc*. <https://doi.org/10.1080/01621459.1971.10482356>
- Schmidt AL, Zollo F, Vicario M Del, et al (2017) Anatomy of news consumption on Facebook. *Proc Natl Acad Sci U S A*. <https://doi.org/10.1073/pnas.1617052114>

- Soares FB, Recuero R, Zago G (2019) Asymmetric polarization on twitter and the 2018 brazilian presidential elections. In: ACM International Conference Proceeding Series
- Stefanov P, Darwish K, Atanasov A, Nakov P (2019) Predicting the Topical Stance of Media and Popular Twitter Users. arXiv
- Sunstein CR (2017) #Republic: Divided Democracy in the Age of Social MediaTitle. Princeton University Press, Princeton
- Tumminello M, Miccichè S, Lillo F, et al (2011) Statistically validated networks in bipartite complex systems. PLoS One. <https://doi.org/10.1371/journal.pone.0017994>
- Adamic L, Glance N (2005) The political blogosphere and the 2004 U.S. election. Proc 3rd Int Work Link Discov
- Bakshy E, Messing S, Adamic LA (2015) Exposure to ideologically diverse news and opinion on Facebook. Science (80-). <https://doi.org/10.1126/science.aaa1160>
- Benjamini Y, Hochberg Y (1995) Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing. J R Stat Soc Ser B. <https://doi.org/10.1111/j.2517-6161.1995.tb02031.x>
- Bessi A, Zollo F, Del Vicario M, et al (2015) Trend of narratives in the age of misinformation. PLoS One. <https://doi.org/10.1371/journal.pone.0134641>
- Blondel VD, Guillaume JL, Lambiotte R, Lefebvre E (2008) Fast unfolding of communities in large networks. J Stat Mech Theory Exp 10:. <https://doi.org/10.1088/1742-5468/2008/10/P10008>
- Borra E, Rieder B (2014) Programmed method: Developing a toolset for capturing and analyzing tweets. Aslib J Inf Manag. <https://doi.org/10.1108/AJIM-09-2013-0094>
- Clauset A, Newman MEJ, Moore C (2004) Finding community structure in very large networks. Phys Rev E - Stat Physics, Plasmas, Fluids, Relat Interdiscip Top. <https://doi.org/10.1103/PhysRevE.70.066111>
- Conover M, Ratkiewicz J, Francisco M (2011) Political polarization on twitter. lcwsm. <https://doi.org/10.1021/ja202932e>
- Del Vicario M, Gaito S, Quattrociocchi W, et al (2017) News consumption during the Italian referendum: A cross-platform analysis on facebook and twitter. In: Proceedings - 2017 International Conference on Data Science and Advanced Analytics, DSAA 2017
- Gaol FL, Maulana A, Matsuo T (2020) News consumption patterns on Twitter: fragmentation study on the online news media network. Heliyon 6:51–69. <https://doi.org/10.1016/j.heliyon.2020.e05169>
- Garimella VRK, Weber I (2017) A long-term analysis of polarization on Twitter. In: Proceedings of the 11th International Conference on Web and Social Media, ICWSM 2017

Maulana A, Situngkir H (2021a) Media Polarization on Twitter During 2019 Indonesian Election. In: Benito RM, Cherifi C, Cherifi H, et al. (eds) Complex Networks & Their Applications IX. Springer International Publishing, pp 660–670

Maulana A, Situngkir H (2021b) Media Partisanship During Election: Indonesian Cases. In: Benito RM, Cherifi C, Cherifi H, et al. (eds) Complex Networks & Their Applications IX. Springer International Publishing, pp 651–659

Olmstead K, Mitchell A, Rosenstiel T (2011) Navigating news online

Pons P, Latapy M (2006) Computing communities in large networks using random walks. J Graph Algorithms Appl. <https://doi.org/10.7155/jgaa.00124>

Quattrociocchi W, Scala A, Sunstein CR (2018) Echo Chambers on Facebook. SSRN Electron J. <https://doi.org/10.2139/ssrn.2795110>

Rand WM (1971) Objective criteria for the evaluation of clustering methods. J Am Stat Assoc. <https://doi.org/10.1080/01621459.1971.10482356>

Schmidt AL, Zollo F, Vicario M Del, et al (2017) Anatomy of news consumption on Facebook. Proc Natl Acad Sci U S A. <https://doi.org/10.1073/pnas.1617052114>

Soares FB, Recuero R, Zago G (2019) Asymmetric polarization on twitter and the 2018 brazilian presidential elections. In: ACM International Conference Proceeding Series

Stefanov P, Darwish K, Atanasov A, Nakov P (2019) Predicting the Topical Stance of Media and Popular Twitter Users. arXiv

Sunstein CR (2017) #Republic: Divided Democracy in the Age of Social Media Title. Princeton University Press, Princeton

Tumminello M, Miccichè S, Lillo F, et al (2011) Statistically validated networks in bipartite complex systems. PLoS One. <https://doi.org/10.1371/journal.pone.0017994>

Figures

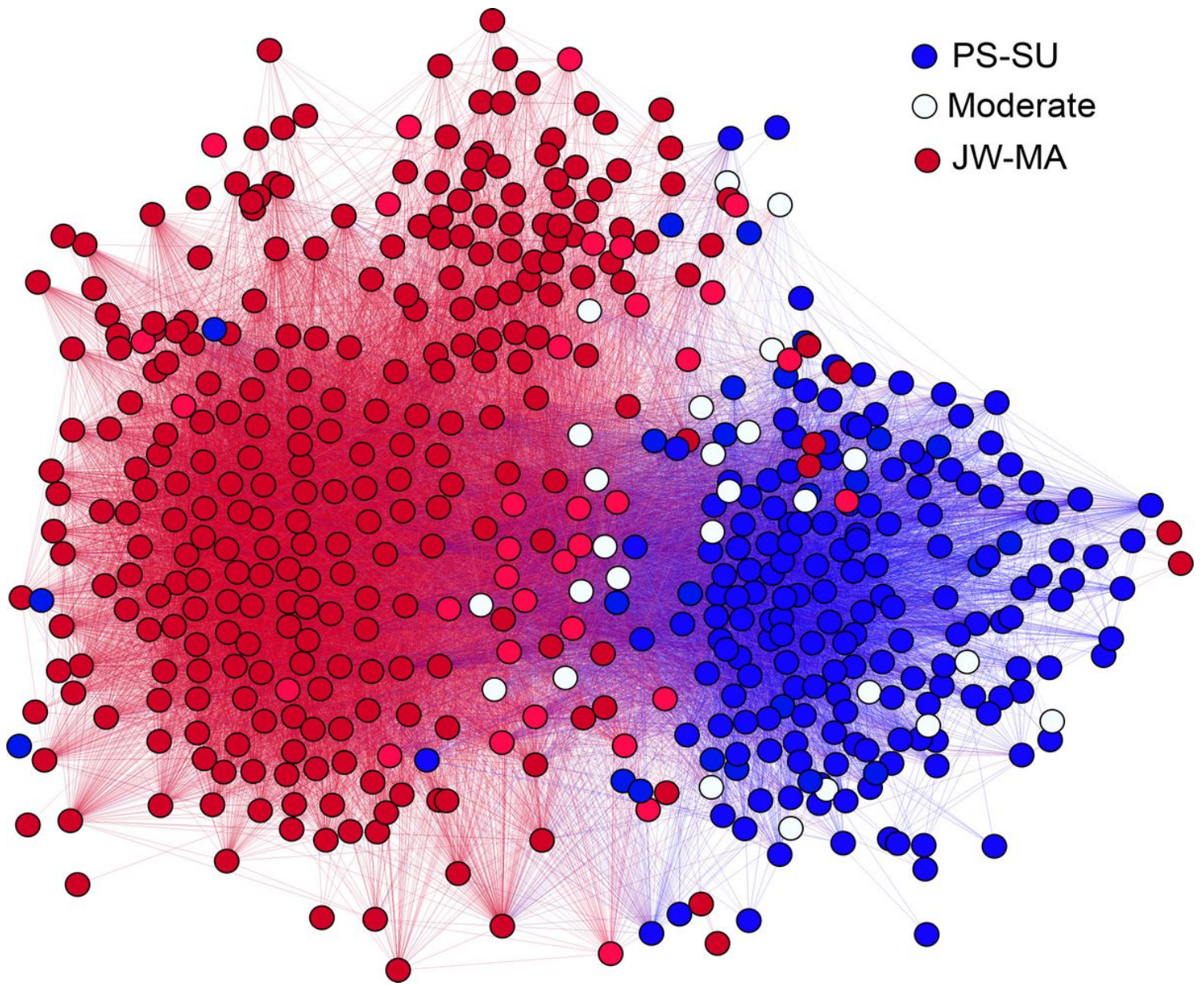


Figure 1

The backbone of Indonesian media network

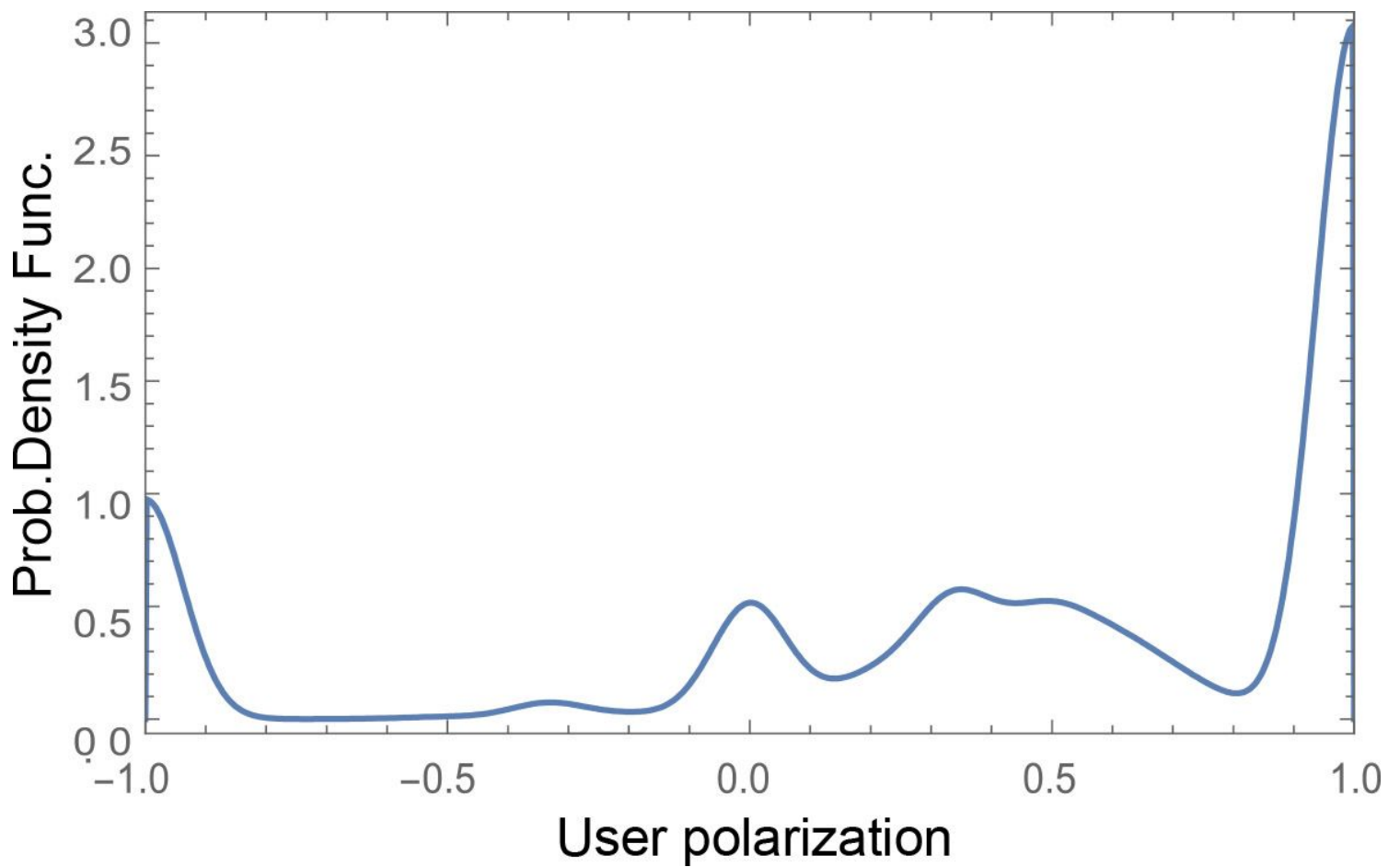


Figure 2

Users' activity across the two largest communities.

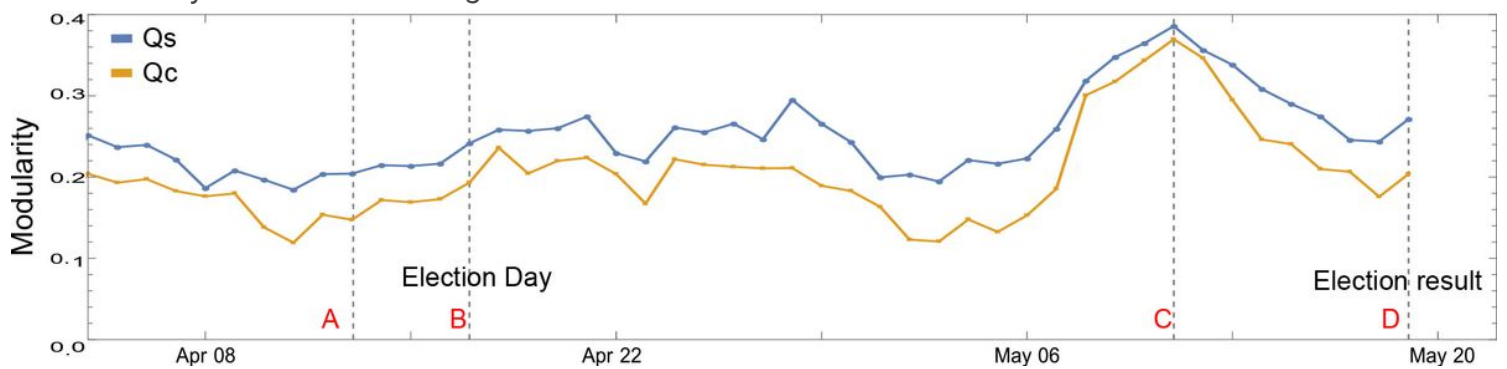


Figure 3

Dynamic of polarization. (A: April 13, 2019; B: April 17, 2019; C: May 14, 2019; D: May 19, 2019)

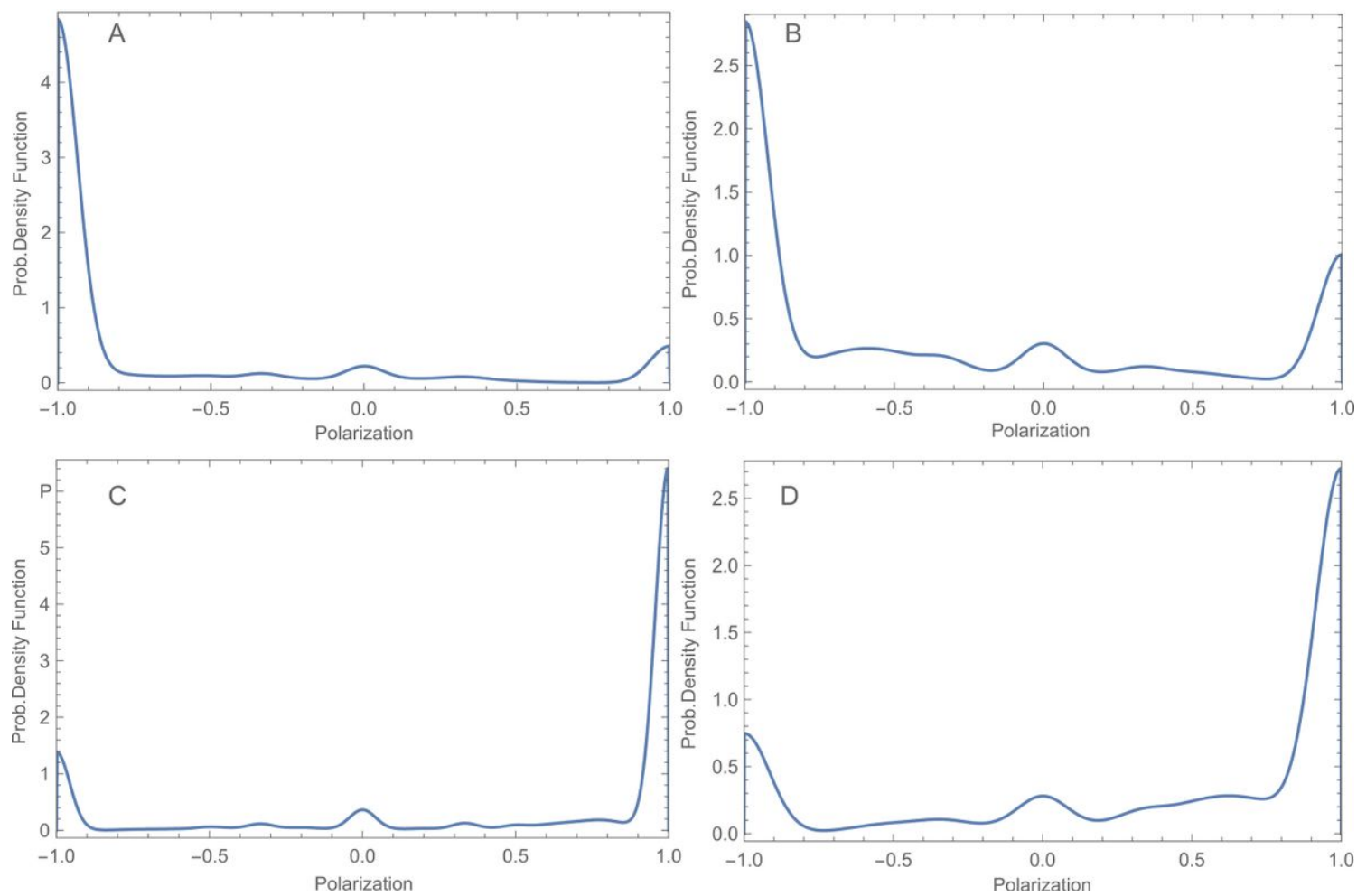


Figure 4

The polarization of user activity in four observation windows. A. April 13, 2019. B. April 17, 2019. C. May 14, 2019. D. May 19, 2019.