Malaysia’s 14th General Election via Twitter: An analysis using the epidemiological model

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Abstract. Twitter has been prominently used during the electoral campaigns. Twitter helps the politicians to spread and share their political agenda. Through Twitter, every information is accessible to anyone and anybody around the world in keeping up with the latest information like a manifesto and others that relate to political issues. However, the popularity of political parties and leaders that could raise the winning opportunities in the election is not fully understood. This study aims to analyse the spreading of information during Malaysia’s 14th General Election via Twitter. This study employed an epidemiological model which is a system of differential equations known as Susceptible-Infected-Recovered (SIR). The model involves three state variables, which are active Twitter users (S), the transmission node (I) and immune Twitter users (R). The Twitter accounts owned by two political parties and two political leaders have been followed before and after the election. The influence of contact rate between active Twitter users and the transmission node of Twitter users on Malaysia’s 14th General Election was analysed. The results showed that the contact rate between active Twitter users and the transmission node of the Twitter users has a significant influence on Malaysia’s 14th General Election.

1. Introduction

Twitter is the most prominent microblogging social networking site which enables users to transmit information from mobile applications or via short message service messages. Starting in 2015, Twitter acquires more than 320 million active users that generate an average of 500 million tweets per day [1]. The significant roles of Twitter can be seen through many aspects such as celebrity endorsement [2] and emergency [3,4].

The popularity of Twitter has also considerably contributed as a communication strategy by politicians in disseminating manifesto and political agendas. Before the emergence of social media, the electoral candidates resorted to a traditional method of conducting a political campaign to attract voters to support and vote them. This kind of campaign is carried out by touring or visiting from one place to another or from one state to another. Unfortunately, not everyone is able to attend these campaigns and participation of people especially voters is undersized.

The voters will be informed and alerted on the latest issues about the election via Twitter no matter where they are. As claimed by [5], Twitter permits the candidates to straightforwardly grasp to supporters, assemble the supporters and inspire the nation itinerary. The majority of Twitter users are openly noticeable and also reachable even for unlisted viewers. This is because Twitter features like a
retweet helps in disseminating political news. During the United States presidential election in 2016, Trump overtook Clinton as his tweets have been retweeted about 12 million times as compared to Clinton who had only been retweeted 5.5 million times. Moreover, Trump also admitted that Twitter had become a vital platform in his political victory [6].

In Malaysia, since its independence in 1957, the traditional media has been practically engaged by the contesting candidates in their political campaigns [7]. The utilization of social media as a political war avenue during Malaysia’s 13th General Election (GE13) in 2013 cost a huge swing among voters that lead the long-supreme ruling party, Barisan Nasional (BN) only won with a slight majority [8]. Before Malaysia’s 14th General Election (GE14), it was revealed that Twitter located two hashtags made by the users which are #SayNOtoPH and #KalahkanPakatan. The hashtags were consumed 44,1000 times by 17,600 users [9].

In literature, most of the previous studies only focus on Malaysia’s General Election from the perspective of sociology. Hence, the spreading of information during the electoral campaign is not fully understood mathematically. This study attempts to investigate from the mathematical point of view on the spreading of information during GE14 via Twitter based on the count of retweets, likes, replies, followers and following of the political parties and leaders.

2. Mathematical model

2.1. The Epidemiological Model for Infectious Disease

The epidemiological model was originally formulated by Kermack and McKendrick in 1927 to investigate the dynamic of infecting disease. It is assumed that, in a closed system, once the healthy person infected by a disease, he or she can transfer the disease to another healthy human being. After some time, the infected person has been immune to the disease and would be no longer infected by the disease. The dynamics of infectious disease is governed by a system of differential equations

$$\frac{dS}{dt} = -\beta SI,$$
$$\frac{dI}{dt} = \beta SI - \gamma I,$$
$$\frac{dR}{dt} = \gamma I,$$  \hspace{1cm} (1)

where $S$, $I$ and $R$ denote the number of susceptible to the disease, the number of infected and the number of recovered respectively. $\beta$ represents the contact rate between the susceptible and the infected person and $\gamma$ is the rate of recovery from the disease. Equation 1 is known as the Susceptible-Infected-Recovered (SIR) model.

The SIR model has been modified to investigate the outbreak of fox rabies in Europe [10]. In doing this, the total population of foxes is not a constant but follows the logistic growth model

$$\frac{dN}{dt} = rN \left(1 - \frac{N}{M}\right),$$  \hspace{1cm} (2)

where $N$ is the total population of foxes, $M$ is the carrying capacity and $r$ is the growth rate. The total population of foxes has been divided into three groups which are susceptible ($S$), infected-but-not-yet-infectious ($I$) and infectious ($R$). This model did not include recovered because very few foxes recover once they have been infected. The interaction between the fox population and rabies is mathematically described as follows
\[ \frac{dS}{dt} = (a - b)S - \gamma SN - \beta SR, \]
\[ \frac{dI}{dt} = \beta SR - (\sigma + b + \gamma N)I, \]
\[ \frac{dR}{dt} = \sigma I - (\sigma + b + \gamma N)R. \] 

(3)

The parameters \( a \) and \( b \) represent the average per capita birth and death rates of foxes respectively, \( \beta \) is the transmission coefficient between fox contacts, \( 1/\sigma \) denotes the average incubating period and \( \gamma \) is the intrinsic growth rate.

2.2. The Epidemiological Model for Information Spreading via Twitter

Equation 3 has been employed by [11] to study the spreading of rumor on Facebook. In this study, we revisited the model established in [11] to analyze the dynamics of information spreading during Malaysia’s 14th general election (GE14) via Twitter. The Twitter users (\( P \)) are divided into three nodes, namely the active (\( S \)), the transmission (\( R \)) and the immune (\( I \)). The total number of Twitter user, \( P(t) = S(t) + I(t) + R(t) \) is changing over time. The rate of change of each node of the Twitter user is governed by the following system of differential equations

\[ \frac{dS}{dt} = \alpha S - (\beta + \sigma P)S - mSI, \]
\[ \frac{dR}{dt} = mSI - (\beta + \sigma P)R - nR, \]
\[ \frac{dI}{dt} = nR - (\beta + \sigma P)I. \] 

(4)

The description of each parameter is listed in table 1.

**Table 1. Parameters and their descriptions.**

| Parameter | Description |
|-----------|-------------|
| \( m \)   | The rate of interaction of Twitter users with the tweets for a period of time |
| \( n \)   | The ratio of total retweets made by the user and total users who are engaged with the tweet |
| \( \alpha \) | The monthly growth rate of the new registered Twitter users |
| \( \beta \) | The monthly inactive rate of Twitter users |
| \( \sigma \) | The intrinsic growth rate of Twitter users |

Since the total number of Twitter user is not a constant, by substituting \( R(t) = P(t) - S(t) - I(t) \) and
\[ \frac{dR}{dt} = \frac{dP}{dt} - \frac{dS}{dt} - \frac{dI}{dt} \] into equation 4, the dynamics of each node of Twitter users is equivalent to
\[ \frac{dS}{dt} = \alpha S - (\beta + \sigma P)S - mSI, \]
\[ \frac{dl}{dt} = n(P - S - I) - (\beta + \sigma P)I, \]
\[ \frac{dP}{dt} = \alpha S - (\beta + \sigma P)P, \]

subject to the initial conditions \( S(0) = S_0, I(0) = I_0 \) and \( P(0) = P_0 \). The statistic for worldwide internet users by October 2018 was recorded around 7 billion. This includes 4 billion active internet users and 3 billion active social media users. The internet penetration rate is 5471 users per 10000 people, whereas the social networking penetration rate is 4451 users per 10000 people [12]. The statistic of worldwide Twitter users up to June 2018 was reported to reach 261 million. The average monthly active Twitter users are approximately 120.06 million and the average monthly non-active Twitter users are 140.94 million [13].

2.3. The equilibrium points
At equilibrium, \( \frac{dS}{dt} = \frac{dl}{dt} = \frac{dP}{dt} = 0 \). Solving the right-hand side of equation 2 yields two equilibrium points \( (S^*_0, I^*_0, P^*_0) = \left( \frac{\alpha - \beta}{\sigma}, \frac{\alpha - \beta - \sigma P_0^*}{m}, \frac{\alpha(n + \beta)}{mn - \alpha \sigma} \right) \) and \( (S^*_1, I^*_1, P^*_1) = \left( \frac{\alpha - \beta}{\sigma}, 0, \frac{\alpha - \beta}{\sigma} \right) \).

3. Result and discussion
The data of this study were obtained from Twitter starting from 4th April 2018 until 16th October 2018, which was before and after GE14. The Election Day was on 9th May 2018. The Twitter accounts owned by political parties and political leaders were followed through the researcher’s Twitter account. All of the usernames of the political parties were obtained from their official websites. From the official websites, the information regarding the followers of a user and the tweets published by a user has been crawled. Table 2 presents the number of retweets, likes, replies, followers and followings of the Twitter accounts that are related to GE14 for the selected two political parties and two political leaders. The Twitter accounts are @barisanasional, @KEADILAN, @NajibRazak and @chedetofficial.

|                        | Retweets | Likes | Replies | Followers | Followings |
|------------------------|----------|-------|---------|-----------|------------|
| @barisanasional        | 2687     | 6918  | 466     | 176058    | 1018       |
| @KEADILAN              | 2803     | 2964  | 131     | 119586    | 67         |
| @NajibRazak            | 17850    | 31779 | 4417    | 4098533   | 158        |
| @chedetofficial        | 56675    | 75442 | 2009    | 859784    | 130        |

Figure 1 and figure 2 show that the number of retweets and the number of followers help in spreading information during the election. The information spread faster on @KEADILAN as compared to @barisanasional despite the number of the followers of @KEADILAN was slightly lower than those of @barisanasional. The finding supports that social media tools become economical and effective campaign tools that contributed significantly to the victory of political parties in GE14 because the winning political parties delivered their political messages directly to their young voters [14]. The active participation of the young voters in the GE14 was noticeable even in the ones in foreign lands ensured their votes could be counted by crowd funding and self-support efforts [15].
Figure 1: Time evolution of the active node of Twitter users for @barisanasional.

Figure 2: Time evolution of the active node of Twitter users for @KEADILAN.

Figure 3 reveals that even though the number of followers encounters by @NajibRazak is the highest but the number of retweets is low that leads to the diminishing on transmission node. This contradicts the assumption that the higher number of followers, the higher number of retweets should be. Supposedly, the more peoples followed the account, the more retweets from the users and the information can be spread widely. But in this case, it is different. For @chedetofficial, despite the low number of followers, but the high number of retweets has led to the increased transmission node as presented in figure 4. Furthermore, although the number of followers of @chedetofficial is lower than @NajibRazak, the number of retweets is high and this made the information to be spread widely. Hence, this concludes why the transmission node of @chedetofficial is upsurge. Twitter enhances the credibility of the politicians and distribution of the politicians’ ideas among young voters during GE14 [16]. Although Barisan Nasional spent a lot of money on its online presence, it failed to garner the support of Malaysians in GE14 as the voters were updated with domestic issues and scandals through social media [17].
4. Conclusion
This study has investigated the spreading of information via Twitter during Malaysia’s 14th general election (GE14). The epidemiological model consists of a system of three differential equations to depict the three nodes of Twitter users has been employed. The dynamics of Twitter users satisfy the logistic equation. The Twitter accounts of @barisanasional, @KEADILAN, @NajibRazak and @chedetofficial have been selected. The number of retweets, likes, replies, followers and following have been obtained before and after GE14. The result showed that the contact rate between active Twitter users and the transmission node of the Twitter users has a significant influence on GE14.

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