Impact Analysis and Correlation Study on the Spread of Fake News During Pandemic COVID-19 in Malaysia

Ahmad Qayyim Nordin[1], Norziana Jamil[1], Zuhaira Muhammad Zain[2], and Md Nabil Ahmad Zawawi[1](✉)

[1] College of Computing and Informatics, Universiti Tenaga Nasional, 43000 Kajang, Selangor, Malaysia
ahmadqayyimm@gmail.com, {Norziana,MdNabil}@uniten.edu.my

[2] Department of Information Systems, College of Computer and Information Sciences, Princess Nourah Bint Abdulrahman University, Riyadh, Saudi Arabia
zmzain@pnu.edu.sa

Abstract. The issue of fake news spread on social media especially during the pandemic of COVID-19 has become a major threat to various sectors and agencies in Malaysia. It is observed that the new norm that requires Malaysian to work and stay at home during Movement Control Order (MCO) has contributed to the rapid spread of the fake news. In this research, we study the impact of the fake news during the COVID-19 pandemic in Malaysia and how the number of COVID-19 positive cases in the country would affect the number of fake news being spread locally. We also conducted a correlation analysis between the number of fake news and the number of COVID-19 cases. Result shows a significant strong positive correlation between the two studied variables. Besides, we built a fake news prediction model using linear regression algorithm to predict the number of fake news based the number of COVID-19 cases. However, the model did not show a good performance. This paper is targeted to assist the government, especially Majlis Keselamatan Negara, during the formulation of action plan and decision making in the effort to hinder the spread of fake news, by implying the constructed formula to predict the number of fake news in a day based on the number of COVID-19 positive cases.

Keywords: Fake news · COVID-19 · Correlation analysis · Impact analysis · Linear regression · Movement Control Order

1 Introduction

In this globalization era, news has been spread in second, reaching every people in the world. With the assist of highly advanced technology, people gained profits by providing data and information to their audience [13]. These people consist of [16] official reporters, newscasters, non-government bodies, academicians, influencers on social media, etc. They can earn real money through broadcasting information to the targeted patronage.

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This shows that people globally seek new information and are not restricted to a certain topic only. People look for something interesting or arguable, such as political issues, entertainment and celebrity, economic growth, healthcare, academic writing, sports update, and many more. With the advancement of information and communication technology (ICT), digital information spread faster than the non-digital information.

At the end of 2019, the world is shocked by a new pandemic that was perceived to be originated from Wuhan, China, known as COVID-19 [2]. The virus spread to the whole world rapidly as interstate travelling were allowed at that time. At the beginning of the outbreak, most of the countries were taking this newly born virus lightly, without taking any precautious measure to stop the spread of COVID-19. Malaysia is not excluded since we were still opening our airport for visitors from other countries, to enter our country.

While the world fights with COVID-19, people try their best not to get infected by the virus by staying at home. It was reported that were also people trying to prevent the infection by following some unofficial statements or steps to eliminate' the virus [4]. There were also videos and articles promoting unverified steps to kill the virus, which have attracted people to watch and some of them, to try the steps [8]. Some irresponsible people even spread false statistics, such as the number of positive cases in their state.

We represent the problem statement as research questions as follows:

1. What is the trend of fake news spread during COVID-19 pandemic?
2. What are the impacts of fake news to the country?
3. Is there any correlation between the number of COVID-19 cases and the number of fake news?
4. Can we predict the number of fake news based on the number of COVID-19 cases?

Hence, in this research, we aim at investigating further the impact of fake news during the COVID-19 pandemic specifically to our country. To do that, we gather the required data in our country, Malaysia and construct a new dataset that contains verified fake news and their enclosures.

This paper is organized as follows: Sect. 2 provides the literature review on fake news during the COVID-19 pandemic. Section 3 explains the materials and methodology involved in this study and how the impact analysis is conducted. Section 4 demonstrates how we can see the correlation between the number of COVID-19 cases and the number of fake news spread in a day. Section 5 accumulates the outcome of the findings from the research. Section 6 concludes everything throughout the research progress.

2 Literature Reviews

2.1 Fake News Related to COVID-19 in Malaysia

To fight COVID-19, our government has officially announced that Malaysia will be going through a new phase of lifestyle to help flatten the curve of COVID-19 cases in Malaysia; "Perintah Kawalan Pergerakan (PKP)" or Movement Control Order (MCO). It started on the 18th of March 2020 [6]. During this phase, people were told to stay at home, workers will be working from home, and students will be learning from home.

The number of fake news was risen rapidly during MCO, most probably because of people having plenty of leisure time staying at home. People are using their gadgets almost 24 h per day, scrolling through social media and messaging apps. These communication platforms have been a great contributor to the spread of fake news. Since they are using social media leisurely, some people might accidentally spread the news that is not from the official body.

During MCO, the government has released numerous announcements to keep the people update regarding the nation's latest decision on the COVID-19 cases in Malaysia. For every announcement, there must be at least one fake news being spread to the netizen. Some people really wanted to have that feeling to be the first person to know about everything and be the one to spread it, no matter what the status of that news, and even if our Prime Minister quoted that information. This kind of fake news was commonly spread on WhatsApp (messaging apps).

Each day, new fake news is being spread, to the extent that Pasukan Respon Pantas (PRP) under Kementerian Komunikasi dan Multimedia (KKMM) had to filter and do checking on every news being spread on social media, especially Facebook, Instagram, Twitter, and WhatsApp. PRP had to take a maximum of 3 h to ensure that certain news is fact or fake. The result is then written into an official statement named "PEMAKLUMAN BERITA PALSU" and released on Majlis Keselamatan Negara (MKN) Telegram channel for the public to notice. This statement is published almost every day during MCO, showing that people still lack the sense to filter every information they received [7].

Our government needs to filter and detect every fake news on social media because, according to Malaysia Digital Marketing Statistics 2020 [11], average Malaysians spend their time surfing through the internet for 8 h and 5 min a day. The popularity of social media among Malaysian is as followed (Fig. 1):

The data above might have slight changes during MCO, but that does not mean the percentage is dropped since everyone stays at home. The usage time of Malaysian on social media is a big factor for the spread of fake news. When almost everyone is online, any news being published will be spread immediately and even reached someone that is not initially active on social media.

2.2 Detected Fake News by PRP

It is a commendable action of our government to publish the "PEMAKLUMAN BERITA PALSU" statement that contains the list of fake news on social media. The statement will lower the rate of fake news and bring a sense for Malaysian to not take every news without investigating first. Below are some of the fake news detected by PRP.

1.	YouTube	93%	6.	WeChat	47%
2.	WhatsApp	91%	7.	Twitter	44%
3.	Facebook	91%	8.	LinkedIn	29%
4.	Instagram	70%	9.	Skype	26%
5.	FB Messenger	64%	10.	Pinterest	25%

Fig. 1. Top social media app among Malaysia (2020).

From 24th March 2020, PRP has released the statement regularly. There are at least 2 confirmed fake news for each statement, and for some days, PRP had to release 3 statements to clarify which news is genuine or fake. This shows that MCO is a critical period for spreading fake news related to COVID-19 in Malaysia. The statements were released on MKN Telegram Channel, making it easy for Malaysian people to keep up to date with the trending fake news as the channel has more than 1 million subscribers. However, after June's month, the statements have stopped being released since the government announced that MCO would be changed to Condition/Recovery Movement Order.

2.3 Fake News Related to COVID-19 Worldwide

The impact of the coronavirus pandemic is not limited to Malaysia but the whole world. Hence, the crime of spreading fake news is happening in almost every nation [15] even though government and authorities have warned the people by giving a severe penalty and arrested those who were caught spreading fake news about the virus.

In Indonesia, some people believed that plentiful sunshine would help them ward off the virus. This is due to multiple claims suggested that warm weather might slow down the spread of the COVID-19 virus. As usual, this kind of claim is spread on social media. Dr. Dirga Sakti Rambe at Jakarta's OMNI Pulomas Hospital said that exposing your skin to sunlight is good to obtain Vitamin D. Still, it is not helpful indirectly preventing the disease [9]. Up in South Korea, the River of Grace Community Church in Gyeonggi Province believed that saltwater could help prevent coronavirus spread. We can see their church official spraying saltwater inside the followers' mouth without disinfecting the nozzle during a prayer. This resulted in 46 infected people, including the pastor and his wife [3].

While in Africa, various conspiracies on COVID-19 were created by the media. Some said that this virus is a biological weapon from which to break China's economic power against other nations. There were also claims saying that using sodium chloride mixture with citric acid may cure the virus. However, The American Food and Drug Administration said that this solution might cause life-threatening low blood pressure, acute liver failure, and severe vomiting [1]. Over in Arizona, United States, a couple, was hospitalized for taking chloroquine phosphate, believing that chemical is a treatment for the virus. This, however, ended up in death for both [5]. There were also beliefs such as Harvard Professor Charles Lieber sold the coronavirus to China.

All these beliefs and claims lead to confusion over what information is genuine or fake. This confusion has affected the whole world since every nation has positive cases of COVID-19. If one misinformation is spread within the country today, it is not surprising that people live 10,000 km away to receive that information the next day. Even though the information might sound ridiculous such as eating sea lettuce will help prevents you from getting COVID-19, some people will believe in that.

3 Materials and Methods

3.1 Materials

There are numerous public datasets available on the internet—for example, LIAR, BuzzFeedNews, BS Detector, and CREDBANK [12]. However, for this research, a newly design dataset is needed as we are trying to study the fake news in Malaysia only.

To construct a dataset, numerous data are needed in a large amount. Hence, we collected the fake news statements from MKN Telegram Channel to see the trend of fake news spread in a certain period. Apart from that, we also gathered the statistic for COVID-19 cases in the same period as the fake news.

3.2 Methods

Figure 2 shows the overview of the research methodology used in this study. It consists of 4 main phases: data collection, impact analysis, correlation analysis, and fake news prediction. The detail of each phase was described in the next subsection.

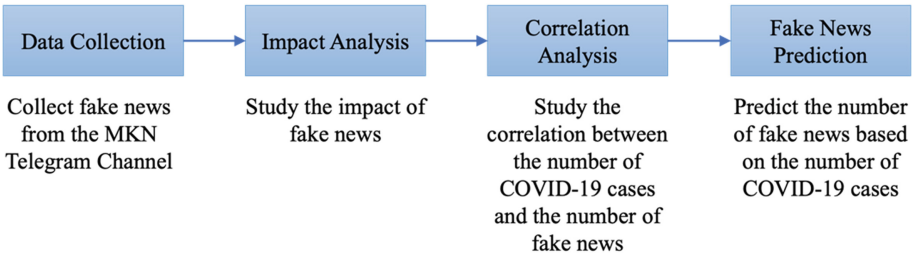

Fig. 2. Research methodology.

3.3 Data Collection

A total of 293 confirmed fake news had been collected from Majlis Keselamatan Negara (MKN) Telegram channel. An analysis has been done from the collected fake news to see the trend of fake news being spread during MCO. The confirmed fake news has also been used to see the correlation between the number of COVID-19 cases with the number of fake news being spread.

Collected Fake News from MKN. One of the initiatives that our government took to stop the spread of fake news during MCO in Malaysia is by releasing a statement containing the confirmed fake news that has been spread on social media. This statement is published for public information to confirm what news is fact or fake. In March 2020, 22 statements were published in the telegram channel, with 64 news confirmed to be fake from 24th March. The number has been rapidly increased to 72 statements being announced in the following month, with a total of 159 confirmed fake news. Fortunately, in May, the number has decreased to 20 statements with 43 fake news. Lastly, in June, 17 announcements have been made containing 27 confirmed fake news.

In only 99 days during MCO, a total of 293 fake news has spread widely on social media. In Fig. 3, we can see the trend of fake news spread on social media is dropping slowly day by day. In Malaysia, MCO officially begins on 18th March, and everyone is ordered to stay at home. Since everyone has nothing important to do at home, they spent most of their time using a smartphone, navigating through social media.

Simultaneous people spending their time on social media during MCO is a big factor why fake news spread faster than before. The government had to release an official statement to inform the people which news is genuine and fake. The graph reached its highest point at the end of March, the beginning of the MCO. The graph slowly dwindles as people may already have the common sense not easily to spread any information on social media.

It is an applaudable act by our government during that time to verify which news and information is trustworthy and then publish it for public information. We can clearly see its effectiveness in Fig. 3.

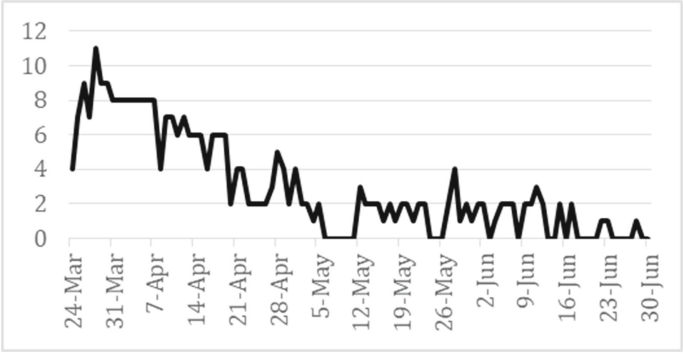

Fig. 3. Number of fake news from March to June 2020.

COVID-19 Cases in Malaysia. To investigate the correlation between fake news and COVID-19 cases using linear regression, we collected the daily data of COVID-19 cases in the same duration as the number of fake news.

For fake news, the duration is from 24th March until the end of June. Hence the same for the number of COVID-19 cases. In March, a total of 1248 cases have been reported. Followed by April, where the cases increased to 3236. In May, cases decreased to 1817 to 820 in June. Based on Figs. 3 and 4, we study its correlation and develop a fake news prediction model using RStudio.

3.4 Impact Analysis

An impact analysis was conducted to see which fake news' categories have the highest impact. First, the collected fake news from the MKN Telegram Channel was divided into several categories based on its purpose. Second, a bar graph (Fig. 4) was plotted to present the number of fake news based on the categories where each bar presents each category.

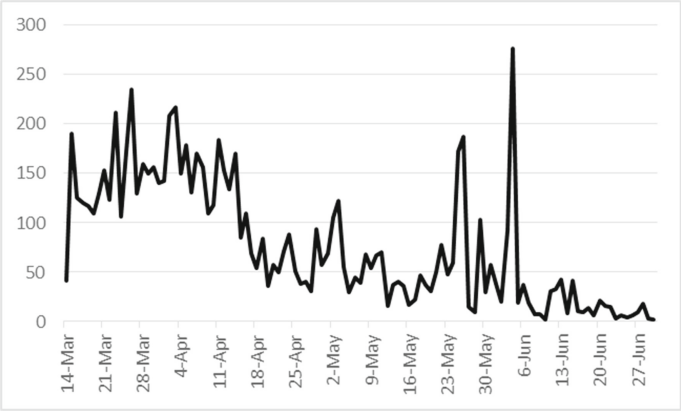

Fig. 4. Number of COVID-19 cases from March to June, 2020.

3.5 Correlation Analysis

In this phase, a correlation analysis was conducted using RStudio to investigate the association between the number of fake news and the number of COVID-19 cases. First, we plotted a scatter plot to see how the two variables correlate. The direction of the slope on the scatter plot represents the positivity or negativity of the relationship. An upward slope indicates positive relationships, while a downward slope shows negative relationships.

The correlation coefficient was then computed using the cor() function. The value of the correlation coefficient is always between −1 and +1. Table 1 shows how the correlation coefficient can be interpreted.

Table 1. Interpretation of correlation coefficient values.

Correlation coefficient value	Interpretation
−1	A perfect negative linear relationship
−0.7	A strong negative linear relationship
−0.5	A moderate negative relationship
−0.3	A weak negative linear relationship
0	No linear relationship
0.3	A weak positive linear relationship
0.5	A moderate positive relationship
0.7	A strong positive linear relationship
1	A perfect positive linear relationship

3.6 Fake News Prediction

In this phase, we built a simple linear regression model using R to predict the number of fake news based on the number of COVID-19 cases. Simple linear regression is one of the simplest algorithms when it comes to machine learning. Linear regression is a statistical way of measuring the relationship between variables [10, 14]. For instance, as time increases, so does cost. To put it simply, people can predict the future using linear regression.

The math behind linear regression is quite simple; the formula is shown in Eq. 1:

$$y = mx + b \tag{1}$$

where 'y' is what we are trying to predict, 'm' is the slope, 'x' is the input, 'b' is the bias.

For this study, we attempt to predict the number of fake news being spread in a day based on the daily number of COVID-19 cases. Hence, 'y' is the number of fake news as the dependent variable and 'x' is the number of COVID-19 cases as the independent variable. The simple linear regression model was constructed by using lm() function. The summary() function was then run to view the detailed information on the coefficients and performance of the model. 'm' and 'b' values could be obtained from the coefficients part of the model output.

4 Findings

In this section, we present the results in 3 subsections based on research questions 2–4. In the first subsection, we present the result of the impact analysis to see which fake news' categories have the highest impact. In the second subsection, we present result of the correlation analysis. In the third subsection, we came up with a model for predicting the number of fake news spread in a day based on the number of COVID-19 cases reported daily.

4.1 Impact of Fake News

The collected fake news was categorized into 7 main categories based on its purposes:

(1) Politic: Fake news with the attention to grow hate or threat to our nation's political issue. It might be related to an individual in the parliament or any government organization.
(2) Economy: Fake news with the attention to affect our nation's economic growth. The news might intentionally spread to increase or decrease the stock market.
(3) Social: Fake news with the attention to cause panic or uncontrolled movement among citizens. It could be corresponding to an individual's benefit.
(4) Politic + Economy: Fake news with the attention to grow hate or threat to our nation's political issue, at the same time, will affect our economic growth.
(5) Economy + Social: Fake news with the attention to affect our nation's economic growth, at the same time, might cause panic among citizens.

(6) Politic + Social: Fake news with the attention to cause panic or uncontrolled movement among citizens, at the same time, to grow hate to the government.
(7) Politic + Economy + Social: Fake news with the attention to affect our national political issue, economic growth, and citizens' social life.

Figure 5 shows the number of fake news based on seven categories. We can conclude that fake news related to COVID-19 in Malaysia has the highest impact on the social category. As mentioned, this fake news' purpose is to cause panic or uncontrolled movement among the citizens.

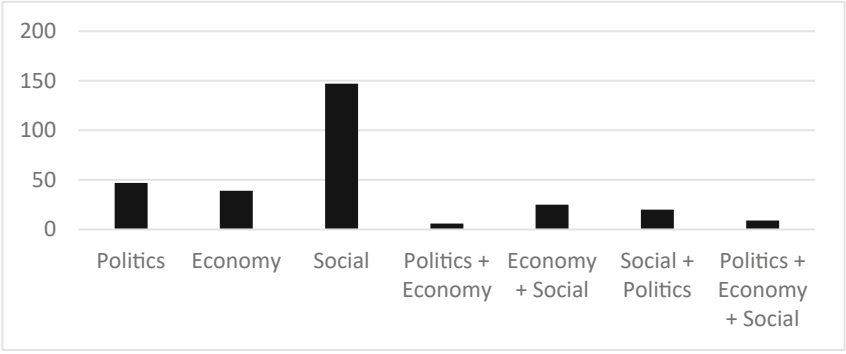

Fig. 5. Number of fake news based on categories.

4.2 Correlation Between COVID-19 Cases and Fake News

Using the fake news collected from MKN Telegram Channel and collected COVID-19 cases from March to June, the simple Linear Regression model was created using RStudio.

By importing the excel file consisting of several COVID-19 cases and the number of fake news spread in 99 days into RStudio, we plotted a scatter plot to visualize the correlation between the number of COVID-19 cases and the number of fake news.

From the upward slope on the scatter plot shown in Fig. 6, we can expect that there is a positive correlation between the number of COVID-19 cases with the number of fake news. To verify our expectation, we run 'cor' command to obtain the correlation value. The correlation value of 0.6636729 verifies that the number of COVID-19 cases has a strong positive linear relationship (correlation value close to 0.7) with the number of fake news. This indicates that the number of fake news will increase when the number of COVID-19 cases increase.

4.3 Fake News Prediction Based the Number of Covid-19 Cases

A linear regression model was built by using the 'lm' command to predict the number of fake news based on the number of COVID-19 cases. We run 'summary' command

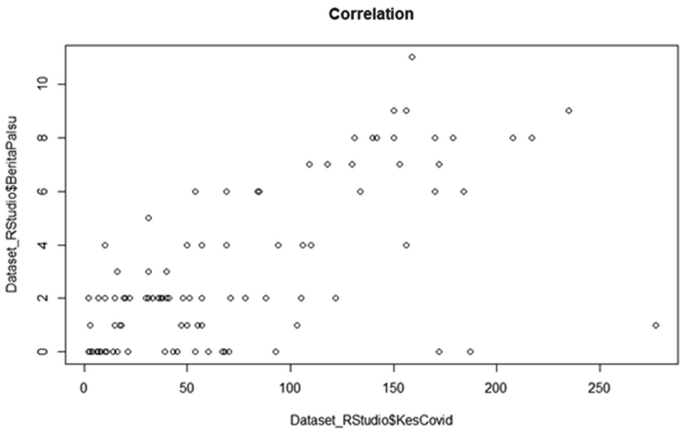

Fig. 6. Scatter plot of the number of fake news based on the number of COVID-19 cases.

to summarize the linear regression model (Fig. 7). The summary shows six important outputs for the built fake news prediction model: Call, Residuals, Coefficients, Residual Standard Error, Adjusted R-squared, and F-statistic.

The Call section shows the formula used by R script to fit the data. In the formula, the number of COVID-19 cases daily is set as the predictor and the number of fake news is set as the target.

The Residuals section shows the descriptive statistics about the residuals of the model. Residuals are the difference between the actual observed target values (the number of fake news) and the target values that the model predicted. The residuals must be in Gaussian distribution where the mean or median is approximately 0. In our case, the median = 0.0725 which is close to zero indicates that the distribution of the residuals is somewhat symmetrical.

The Coefficient section helps us in determining the value of m (slope) and b (intercept) from Eq. 1 to predict the number of fake news when the number of COVID-19 cases is given. The first row of the Coefficient-Estimate shows the intercept value, and the second row shows the slope value. The small p-values of the intercept (0.0221) and slope (7.08e-14) corroborate the correlation result we obtained in the correlation analysis that there is significantly strong positive relationship between the number of COVID-19 cases and the number of fake news. After substituting m = 0.030420 and b = 0.771475 in Eq. 1, we finally get the linear regression model for predicting the number of fake news being spread in a day based on the number of positive COVID-19 cases on a particular day as in Eq. 2.

$$y = 0.030420x + 0.771475 \tag{2}$$

If the number of COVID-19 cases in a day is 100, the predicted number of fake news being spread is 4.

The residual standard error is a measure used to assess how well a linear regression model fits the data. The residual standard error is the average amount that the real values of the number of fake news differ from the predictions provided by the regression line.

The residual standard error = 2.164 indicates that for 100 COVID-19 cases, the true number of fake news that can be predicted is between 2 – 6.

The R-squared is another measure to assess how well is the model fitting the data. The adjusted R-squared of 0.4347 shows that roughly 43% of the variance found in the number of fake news can be explained by the number of COVID-19 cases. Taking into consideration 0.5 as a threshold of a good model, we can conclude that our model still needs an improvement.

The F-statistic of 76.36 (>1) with p-value = 7.7077e−14 (<0.05) again validates the significant relationship between the number of COVID-19 cases and the number of fake news.

```
Call:
lm(formula = Dataset_RStudio$BeritaPalsu ~ Dataset_RStudio$KesCovid)

Residuals:
    Min      1Q  Median      3Q     Max
-8.1979 -1.1252  0.0725  1.1409  5.3917

Coefficients:
                       Estimate Std. Error t value Pr(>|t|)
(Intercept)            0.771475   0.331673   2.326   0.0221 *
Dataset_RStudio$KesCovid 0.030420   0.003481   8.738 7.08e-14 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.164 on 97 degrees of freedom
Multiple R-squared:  0.4405,    Adjusted R-squared:  0.4347
F-statistic: 76.36 on 1 and 97 DF,  p-value: 7.077e-14
```

Fig. 7. Summary of the linear model.

5 Discussion

To validate the built fake news prediction model, it was tested on COVID-19 cases reported daily in December 2020 using Eq. 2. Figure 8 shows the trend of the expected/predicted fake news based on the number of COVID-19 cases in December 2020. The expected values were compared with the actual values of fake news in December 2020 obtained from sebenarnya.my (Fig. 9).

The results shows that the difference/error between the expected and actual values is high. There are 2 possibilities why the built model is not giving us a good result, although there is a significant strong positive correlation between the number of fake news and the number of COVID-19 cases:

(1) Malaysian netizens have taken precaution measures before spreading fake news.
(2) Majlis Keselamatan Negara has given less priority to update the fake news on their platform (Telegram and sebenarnya.my)

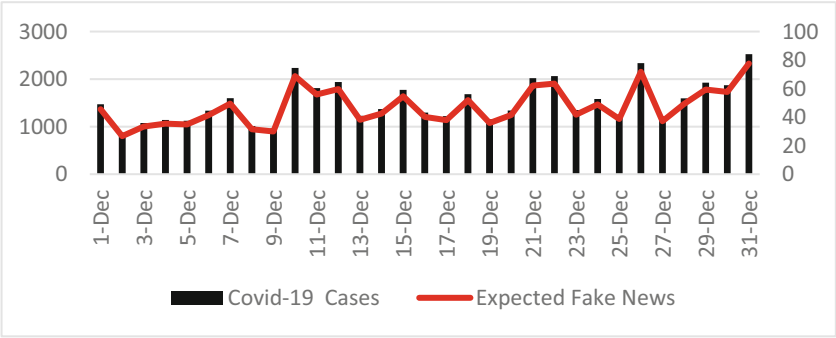

Fig. 8. Number of COVID-19 cases and expected fake news.

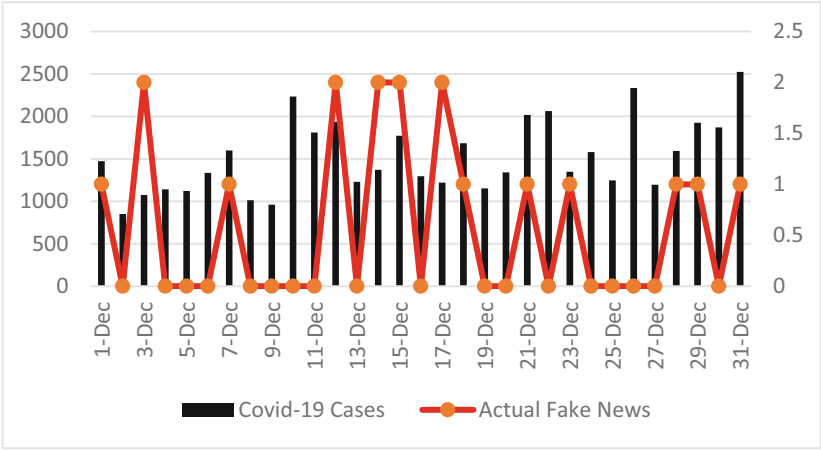

Fig. 9. Number of COVID-19 cases and actual fake news.

6 Conclusion

Most of the social media users in Malaysia tend to consume news from the internet without studying its status first. We must do our part in spreading awareness about the impact of fake news on our nation. This paper aims to study the impact of fake news during pandemic COVID-19 in Malaysia and to conduct a correlation study between the number of COVID-19 cases and the number of fake news spread in a day.

As mentioned, fake news can cause major problems to our community and environment, mainly in politics, economics, and society. The correlation study shows a significant strong positive relationship between the number of fake news and the number of COVID-19 cases. A fake news prediction model was built using a simple linear regression algorithm to predict the number of fake news based on the number of COVID-19 cases. However, because of our limitation in collecting more "Pemakluman Berita Palsu" from Majlis Keselamatan Negara after June 2020, it has caused our predicted fake news values to vary from the actual values.

For future works, we may have to do a correlation study using different variables by collecting the fake news from consistent sources such as sebenarnya.my only. The fake news prediction model can be optimized to increase its performance.

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