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DETERMINING THE LEVEL OF TRUSTWORTHINESS OF INFORMATION IN SOCIAL MEDIA

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ABSTRACT

The social media are increasingly becoming the main reference and having important implications on virtual community. Parts of the information published in the social media could be useful and some could be misleading. Therefore, there is a need to develop an approach that can verify the trustworthiness of online information to minimise the dissemination of misleading information. This paper presents a study that develops an objective approach to determine the level of trustworthiness of information. Based on four parameters derived from literature and empirical data, an algorithm to determine the level of trustworthiness has been developed. This algorithm measurement of trustworthiness was then realised through an automated tool called TrustCrawler. The functionality of the tool was demonstrated using online information on Government Service Tax (GST) of Malaysian drawn from Twitter. It was found that the tool is able to provide consistent results on the level of trustworthiness of online information based on the four parameters. It is anticipated that this tool is able to help social media users to determine level of trustworthiness of the information, hence becoming informed, safe and ethical users of media content.

Keywords: *Degree, Information Trustworthiness, Social Media*

1. INTRODUCTION

The increasing usage and reliability on information from social media has been a major concern as it is very difficult to determine the trustworthiness of information shared by various and anonymous parties. Serena et al. mentioned that trust is a mechanism for managing uncertain information in decision-making, taking into considering the information source [7]. Although information sharing that helps to make better decision is an important process in human society, the truthfulness of information should not be taken for granted. Therefore, information should not be arbitrarily disseminated considering information are sensitive and private.

Media social users may have difficulties to decide the trustworthiness of information due to the huge information available on social media. Further, it has become a taken for granted practice for mobile or social media users to rely and believe information on social media without considering the truth of the information. Jarutas et al. stated that it is necessary to aid users in assessing the trustworthiness of Web information they consume [13]. As such, there is a need to develop a method or approach that validates and verifies information from social media.

Serena et al. argued that trust minimizes the uncertainty in the interactions among the information sources. They provide a focused representation of trust about the sources, in which trust concerns not only the sources but also the information items. Ricardo et al. posit that the level of specific quality is determined by the quality of context in relation to a specific entity. As such, trust is determined based on a certain range of preciseness and accurateness. In this case it is important to understand the degree of information trustworthiness to obtain more accurate result on verifying information trust.

This study aims to develop an objective approach to determine the level of trustworthiness of online information. For this

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purpose, two research questions will be addressed in this paper: i) what are the factors that determine the trustworthiness of information? and ii) how to determine the different levels of trustworthiness of online information? For presentation, this paper is organised into four sections. After the introduction, the paper presents the literature review which is followed by the methodology section. The next section is the results and discussion and the final section is the conclusion and future work.

2. LITERATURE REVIEW

Studies related to trustworthiness of online information are varied and they primarily focus on developing framework, model or approach to produce the degree of information trustworthiness. Aniket et al. developed an approach to identify the level of trust by exploring the question of how users' perceptions of trustworthiness of wiki system by specifying the low and high with quality [1]. Focusing on the static data rather than real data from the social network, Salvatore et al. outlined the breadth-first-search sampling and uniform sampling. Shafiza et al. emphasized on the credibility on the news on Twitter by applying several methods of analysing the data. The results however, produced the rating on its credibility based on topic, message and user-based category only. Carnegie et al. visualized the different degree of trustworthiness into a matric by utilising two types of data in their work: controversial and non-controversial with high and low quality. However, they did not specifically address the issue of trustworthiness of information. So far, studies that focus on the approach to systematically and objectively determine the level of trustworthiness of online information is still lacking.

We also found that studies of verifying trustworthiness of information are not related to social media. For example, Aniket et al. used a matrix design to verify the trustworthiness of wiki. They reported that the classification of the trust was based on the quality and the controversial of the wiki articles. However, this visualisation technique did not specify the evaluation criteria of the articles selected. Another similar study was conducted by Ricardo et al., in which he focused on the context information. According to him, context-aware service platforms use context information to adapt the current situation of the service users [6]. JaeHong Park et al. focus on investors' active and passive participation in message boards. Meanwhile, Kristin et al. highlighted that users with high social media self-efficacy tend to be more likely to trust information shared to other social information source. However, their work did not address the degree of trustworthiness of the information.

There are some studies that emphasise the credibility of the information. These studies, however, did not discuss the information trustworthiness evaluation criteria. It is important to understand the evaluation technique in order to gain the trust of users on how the trustworthiness of information will be generated.

3. METHODOLOGY

This study advocates the importance of identifying the components of trust when determining the level of trustworthiness of online information. Specifically, it is crucial to identify the most reliable component that contributes to verify the degree of trust. Further, to ensure objective determination of the trust, a weightage to calculate the degree of trust degree should be developed. Therefore, this study formulates a combination of attributes of trust to calculate the degree of information trustworthiness. By computing the percentage of trust, it is easier for us to determine the level of trust of information.

As shown in Figure 2, this study adopts a research design approach, which involves six stages in the research process. The research process shown in Figure I shows the stages involved in the formulation of the algorithm to determine the level of trustworthiness of online information.

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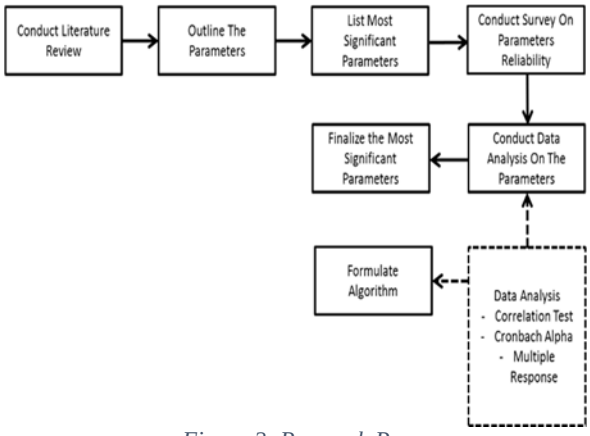

Figure 2: Research Process

relation of the trustworthiness parameters as a group. In another word, it is considered to be a measure of scale reliability where it is coefficient of reliability.

4. RESULTS & FINDINGS

The determination of the parameters that objectively measure the trustworthiness of online information is based on a two- stages process, which is the literature review and survey. The two- stages processes which are the parameters of trustworthiness drawn from the literature and the parameter drawn from the survey. The first stage was conducted earlier to

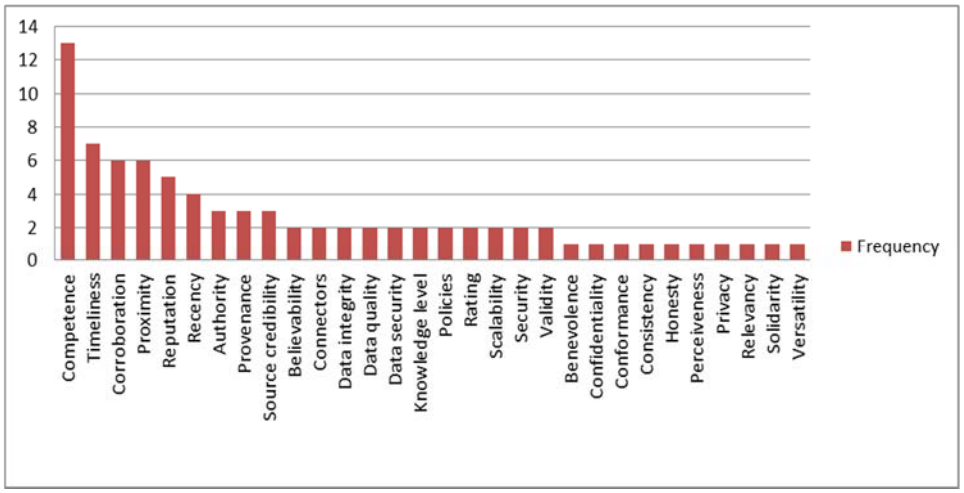

Figure 1: Factors Influencing Information [33]

It begins with the conduct of the literature review to determine the significant parameters for determining the trustworthiness of online information. The identification of the parameters drawn from the literature review are presented in the next section. The next stage involved the conduct of the survey. The purpose of the survey is to verify the parameters based on empirical data. Out of 300 surveys distributed, 200 were selected. 100 responses were rejected due to non-response errors (Some respondents did not provide any answer or the answer were irrelevant for the study).

We then analysed the data using SPSS. For this purpose, the analysis conducted was the Correlation, Cronbach Alpha and Multiple Response. We tested the internal consistency of the items based on the Cronbach Alpha. Correlation test to determine the statistical relationship between the parameters was also conducted. The purpose is to determine the identify the reliability of the parameters and the second stage was conducted after the tool; TrustCrawler was developed in order to prove the significant of the first stage.

4.1 Parameters of Trustworthiness drawn from the Literature

Several studies have been conducted to understand the verification of trustworthiness on social media. We found that there are many existing work with various terms used in determining the factors for verifying trustworthiness of information. The summary of the factors related to trustworthiness in relation to their frequency highlighted in the literature is presented in Figure 1. As shown in Figure 1, there are 30 factors that influence information trustworthiness ranging from competence with the highest frequency to versatility among the lowest frequency. By outlining all the factors, we

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have identified the factors that contribute to the verification of information trustworthiness. It is also found that most of the works do not represent the same factors as shown in Figure 1. From the literature review, the results showed that trustworthiness relates to the trust of network security, software and the data itself. Less works were found on the information trust from the social media. However, the terms and factors mentioned from the studies were almost similar to one another.

It was found that the four most influential factors in verifying information trustworthiness are proximity, reputation, competence and timeliness. Reputation is considered as one of the parameters of trustworthiness of information since most social media user will get attracted to information with high reputation or popularity. This can also be referred as trending information. In social media, the popularity of the information is when it becomes viral, retweets or shared. Competence or the level of knowledge in the Internet or social media refers to the individual, organisation or agencies that post or share the information. The reliability of the source of information is very important. At the same time, it could be biased on the source because the source of information could be personal and individual preference. However, source of information plays a major role in providing the trusted source of the information. Meanwhile for proximity, it shows the closeness, provenance, nearest in place, time, order, occurrence or relation of the information. Such information with the level of proximity will show the degree of relatedness of the information. The fourth parameter is the timeliness. The information in social media moves or changes fast every second. It is crucial to have the most recent and updated information. News feed of information is considered outdated after 48 hours. So far, there were none existence work to justify the period of expire of a post of an information. Most studies focus on the length to user stay on the Internet or website. Therefore, only most recent information is considered to be trustworthy.

4.2 Parameters of Trustworthiness drawn from the Survey

In order to get a precise and more accurate parameter, a survey with 300 respondents was conducted. As shown in Figure 3.1 to 3.4, reputation, proximity, and timeliness shows the highest responds, while competency has an average value.

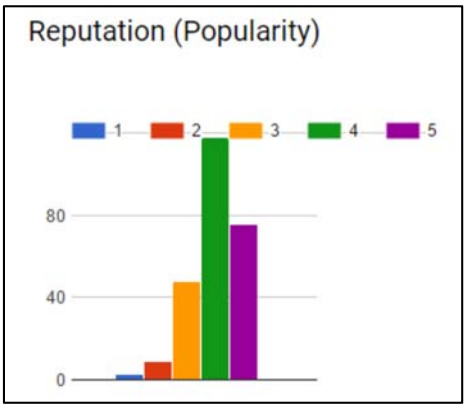

Figure 3.1: Survey on influential factor: Reputation

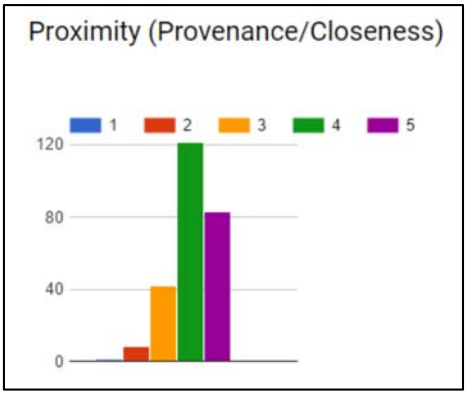

Figure 3.2: Survey on influential factor: Proximity

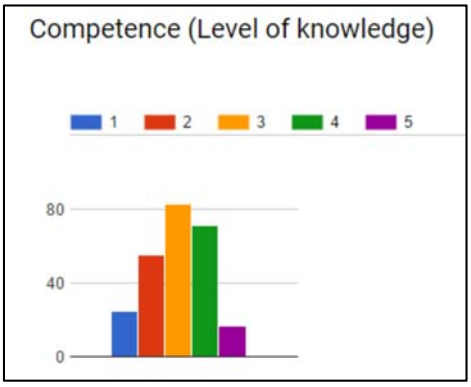

Figure 3.3: Survey on influential factor: Competence

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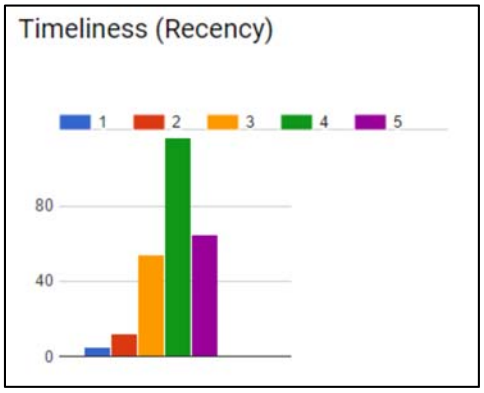

Figure 3.4: Survey on influential factors: Timeliness

The Likert Scale from 1-5, where 1 is most disagreed towards 5 is the most agreed of the four parameters which displayed a positive results of the parameters. Most of the respondent had provided the range of respond between most agreed and agreed. It showed a very strong requirement for the parameters in verifying trustworthiness of information as shown in Figure 3.1 to 3.4.

After the four parameters had been selected and empirically verified, a set of rules was assigned to each of the parameter. From the survey result from the respondents, we then find the relationship between the parameters using SPSS. SPSS is a mathematical tool to analyse the quantitative result from the survey. We computed the correlation matrix and the significance of the parameter and the results were very high. From the correlation matrix, the value were .000 for all the parameter which indicated that the parameter were all significant. Moreover, based the significant level, α=0.01, the correlation between all the parameter are significant as shown in Table 1. Furthermore, the Cronbach Alpha of the parameter is .901, which indicates high reliability as in Table 2. Therefore, it can be concluded that the four parameters are significant determiners of trustworthiness of social media information.

Table 1: Correlation Matrix

		Proximity	Reputation	Competence	Timeliness
Proximity	Pearson Correlation Sig. (2-tailed)	1	.721** .000	.621** .000	.613** .000
Reputation	Pearson Correlation Sig. (2-tailed)	.721** .000	1	.727** .000	.680** .000
Competence	Pearson Correlation Sig. (2-tailed)	.612** .000	.727** .000	1	.806** .000
Timeliness	Pearson Correlation Sig. (2-tailed)	.613** .000	.680** .000	.806** .000	1

** Correlation is significant at the 0.01 level (2-tailed)

Table 2: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.901	.901	4

4.3 Formulating Algorithm to Determine the Level of Trustworthiness

Certain rules were set to formulate the algorithm to provide an objective determination of the level of trustworthiness of online information. In multiple response, respondents are allowed to give more than one answer, this will result is more than one variable in the SPSS data file. However, since all the answers relate to the same question, we present them in a single table. We first defined this set of variables as belonging to a particular group; the technical term for this is a Multiple Response Set. There are two ways in which we can code a multiple response question, namely as dichotomies or categories. In our definition, we indicate which

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variables have to be joined to form a set. Here, the variables are the Proximity, Reputation, Competence and Timeliness. The set is the trustworthiness parameter. Then, we specify which of the two options in the dichotomy has to be counted. Table 3 shows the result of the multiple response computation.

Table 3: Parameter Frequency

	Responses		Percent of Cases
	N	Percent	
Proximity	104	23.9%	77.0%
Reputation	100	23.0%	74.1%
Competence	114	26.2%	84.4%
Timeliness	117	26.9%	86.7%
Total	435	100%	322.2%

4.5 TrustCrawler: An Automated Tool to Determine the Trustworthiness of Online Information

Based on the formulated algorithm, we have developed a tool called TrustCrawler to test the algorithm. In realising this, Figure 4 explains how the tool could provide the trustworthiness level. The tool is capable to generate the degree of trustworthiness of information. Specifically, users who want to identify the trustworthiness of social media information can feed in the information in the system. Once the information is inserted in the tool system, the tool will objectively determine the level of trustworthiness based on the algorithm. The level of trustworthiness identified as either high, average or low will then be displayed.

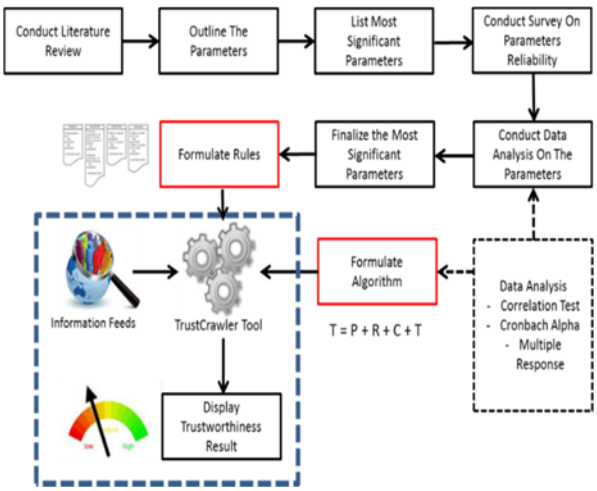

Figure 4: TrustCrawler Approach

Furthermore, Figure 4 demonstrates the overall approach conducted to achieve in obtaining the trustworthiness level. Identifying and confirming the essential parameters are the most crucial. Therefore, the two main stages play an important role for the development of the tool.

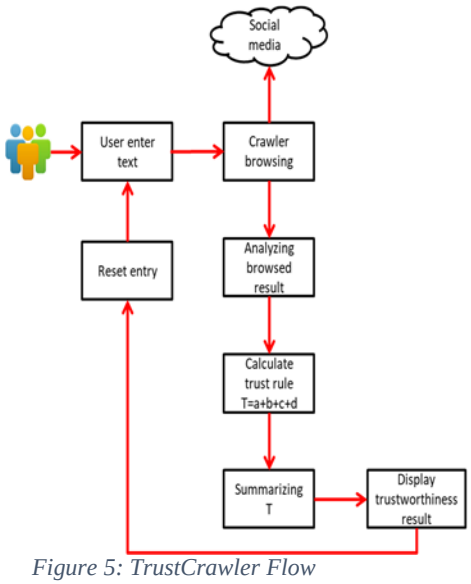

Figure 5: TrustCrawler Flow

TrustCrawler uses Ruby on Rail web framework to program the web application. TrustCrawler will grab information required from Twitter. Nowadays, Twitter has becoming the medium information is gathered and referred. In Malaysia, most of the agencies either government or private sector would have Twitter account. This would be one of the ways where information is disseminated to the user. Apart from that, Twitter is one of the social media most internet users refer to for the most updated news or information. Nevertheless, these feeds of information can be made viral or retweet or shared in different terms. Therefore, in applying the parameters of the TrustCrawler, Twitter provides such information required. Twitter search API is the library that TrustCrawler uses to search for tweets results. Since TrustCrawler is using Ruby, there is an available library.

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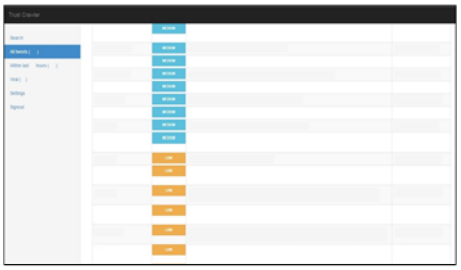

Figure 6: TrustCrawler Sample Output

Figure 5 shows that the process of TrustCrawler in delivering the trustworthiness of information results. First, the user of TrustCrawler will enter the keyword or information he/she desired. The crawler will get the information from the social media which is the Twitter. Matching of the keywords were analysed and calculated. The results then are compute to the trust rule. The display of the trustworthiness result would be in the form of percentage. Figure 6 is the example of the TrustCrawler wireframe to show the trustworthiness level of the information obtained.

To demonstrate the functionality of TrustCrawler, we use information on Government Service Tax (GST) of Malaysia. Figure 7 shows the result of the trustworthiness of information on GST. There were two sets of accuracy testing conducted by the tool. The first set was by using only one keyword, which is the GST. The second set was anything on GST or a sentence on GST. The results show that there is a consistence result generated from the tool. In this work, the data were obtained from Twitter.

In this result, we focus on the keywords, total tweets, trustworthiness time and the source. The respondents have several ways to provide the keywords but the keyword that they provide have to be in line on the search for the information on GST. When the keyword is specifically on GST, as shown in Figure 7, the tool will show a consistence result of 500 tweets, trustworthiness level of 49.9%, within 48 hours of 23%, viral 26% and there is no result on trusted source. Comparatively, if the keywords are different, the results provided by the tool are still consistent except the number of tweets.

Respondent	Keyword search	Total Tweets	Trustworthiness	Within last 48 hours	Trusted sources	Viral
1	gst	500	49.90%	23.00%	0%	26.90%
2	GST	500	49.90%	23.00%	0%	26.90%
3	GST	500	49.90%	23.00%	0%	26.90%
4	gst	500	49.90%	23.00%	0%	26.90%
5	GST	500	49.90%	23.00%	0%	26.90%
6	GST	500	49.90%	23.00%	0%	26.90%
7	gst	500	49.90%	23.00%	0%	26.90%
8	gst	500	49.90%	23.00%	0%	26.90%
9	gst	500	49.90%	23.00%	0%	26.90%
10	GST	500	49.90%	23.00%	0%	26.90%
12	GST	500	49.90%	23.00%	0%	26.90%
13	GST	500	49.90%	23.00%	0%	26.90%
14	GST	500	49.90%	23.00%	0%	26.90%
15	GST	500	49.90%	23.00%	0%	26.90%
17	GST	500	49.90%	23.00%	0%	26.90%
18	gst	500	49.90%	23.00%	0%	26.90%
19	gst	500	49.90%	23.00%	0%	26.90%
20	GST	500	49.90%	23.00%	0%	26.90%
21	GST	500	49.90%	23.00%	0%	26.90%
22	gst	500	49.90%	23.00%	0%	26.90%
23	GST	387	49.90%	23.00%	0%	26.90%
24	GST	500	49.90%	23.00%	0%	26.90%
25	gst	500	49.90%	23.00%	0%	26.90%
26	GST	500	49.90%	23.00%	0%	26.90%
27	gst	500	49.90%	23.00%	0%	26.90%
28	gst	500	49.90%	23.00%	0%	26.90%

Respondent	Keyword search	Total Tweets	Trustworthiness	Within last 48 hours	Trusted sources	Viral
2	what gst	500	49.90%	23.00%	0%	26.90%
3	what gst	500	49.90%	23.00%	0%	26.90%
4	cost gst	60	49.90%	23.00%	0%	26.90%
5	Cost gst	60	49.90%	23.00%	0%	26.90%
6	gst milk	37	49.90%	23.00%	0%	26.90%
7	gst complaint	3	49.90%	23.00%	0%	26.90%
8	GST benefit	18	49.90%	23.00%	0%	26.90%
10	gst oil	5	49.90%	23.00%	0%	26.90%
11	gst of food	24	49.90%	23.00%	0%	26.90%
14	GST MALAYSIA	139	49.90%	23.00%	0%	26.90%
15	gst malaysia	139	49.90%	23.00%	0%	26.90%
16	GST cost	61	49.90%	23.00%	0%	26.90%
18	GST Product	31	49.90%	23.00%	0%	26.90%
19	Gst benefit	3	49.90%	23.00%	0%	26.90%
20	why gst?	55	49.90%	23.00%	0%	26.90%
21	what is gst	85	49.90%	23.00%	0%	26.90%
23	gst najib	255	49.90%	23.00%	0%	26.90%
24	gst for laptop	2	49.90%	23.00%	0%	26.90%
25	what is gst	141	49.90%	23.00%	0%	26.90%
26	GST good	275	49.90%	23.00%	0%	26.90%
27	gst food	71	49.90%	23.00%	0%	26.90%
32	GST and people	25	49.90%	23.00%	0%	26.90%
33	gst car	14	49.90%	23.00%	0%	26.90%
34	gst bread	4	49.90%	23.00%	0%	26.90%
35	gst implementation	16	49.90%	23.00%	0%	26.90%
36	gst watches	6	49.90%	23.00%	0%	26.90%
37	Gst kereta	5	49.90%	23.00%	0%	26.90%
38	gst of food	25	49.90%	23.00%	0%	26.90%
39	gst laptop	2	49.90%	23.00%	0%	26.90%
40	gst rate	176	49.90%	23.00%	0%	26.90%
43	GST profit	35	49.90%	23.00%	0%	26.90%
46	Gst reduce	24	49.90%	23.00%	0%	26.90%
47	why gst?	56	49.90%	23.00%	0%	26.90%
48	gst product	35	49.90%	23.00%	0%	26.90%
49	GST benefit	18	49.90%	23.00%	0%	26.90%
53	gst income	230	49.90%	23.00%	0%	26.90%
54	gst in malaysia	7	49.90%	23.00%	0%	26.90%
55	gst in malaysia	7	49.90%	23.00%	0%	26.90%
56	GST cost	60	49.90%	23.00%	0%	26.90%
59	GST benefits	18	49.90%	23.00%	0%	26.90%
60	gst complaint	3	49.90%	23.00%	0%	26.90%
61	GST cost	60	49.90%	23.00%	0%	26.90%
63	GST date	15	49.90%	23.00%	0%	26.90%
64	gst malaysia	139	49.90%	23.00%	0%	26.90%
65	gst food	68	49.90%	23.00%	0%	26.90%
68	GST product	31	49.90%	23.00%	0%	26.90%
69	gst benefits	20	49.90%	23.00%	0%	26.90%
70	GST watch	149	49.90%	23.00%	0%	26.90%
71	gst for food	16	49.90%	23.00%	0%	26.90%
72	GST benefit	18	49.90%	23.00%	0%	26.90%
73	Gst product	31	49.90%	23.00%	0%	26.90%
75	why gst?	55	49.90%	23.00%	0%	26.90%
76	gst najib	255	49.90%	23.00%	0%	26.90%
77	Gst Car	14	49.90%	23.00%	0%	26.90%
78	gst 6%	500	49.90%	23.00%	0%	26.90%
79	gst for food	17	49.90%	23.00%	0%	26.90%
80	product of gst	5	49.90%	23.00%	0%	26.90%

Figure 7: Result from the keyword GST

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Here, TrustCrawler tool is capable in providing the degree of information trustworthiness with consistent level of the parameters.

5. CONCLUSION

The degree in trustworthiness of information is very important when dealing with information from the social media. The degree of trust will assist and educate users on the level of trust for specific information. For this purpose, an approach that objectively determines the level of trustworthiness of online information has been developed. Further, an automated tool embedded with a crawler capability has been developed to realise the approach. It is anticipated that the adoption of this approach will help to educate and make the public users aware of the level of trustworthiness of the information, hence developing an informed, safe and ethical users of media content.

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