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ICECoT 2021

International Conference on Emerging Computational Technologies

"Future Trends of Emerging Computational Technologies in the 21st Century"
"Strategizing IR4.0 in Conquering Covid-19 and Beyond"

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Preface

This e-book describes the research papers presented at the International Conference on Emerging Computational Technologies (ICECoT 2021), organised by Faculty of Computer and Mathematical Sciences (FSKM), UiTM Cawangan Melaka. The main discussions of the conference is on the technological advances that help shape the skills that are required to cope with the Fourth Industrial Revolution (IR 4.0). Considering that this is our first attempt at organising a conference, we are therefore greatly honoured that the Universitas Negeri Semarang (UNNES), Indonesia, Mahasarakham University (MSU), Thailand and University of Hail (UoH), Saudi Arabia have all agreed to become our partners by contributing several reseach papers as well as providing reviewers to assess the quality of the papers.

Out of the numerous research works that had been submitted and reviewed, the Editorial Board have selected 22 papers to be published in the e-book. The discussions of these papers pertain to the use of technologies within the broad spectrum of Computer Science, Computer Networking, Multimedia, Information Systems Engineering, Mathematical Sciences and Educational Technology. It is hoped that the research findings that are shared in this e-book can benefit those who are interested in the various areas of computational technologies; such as graduate students, researchers, academicians and the industrial players, to name a few.

As the Project Manager, I would like to thank all of the committee members from the bottom of my heart for their tireless efforts in ensuring the success of ICECoT 2021. Without their continual support and excellent teamwork, this conference would not have come to fruition. In fact, holding this major event has been a good learning experience for us all, and I sincerely believe that our future conferences will become more outstanding if the same spirit is maintained.

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The Visual Analysis of Twitter Sentiment and Crude Oil Price Movement in The West Texas Intermediate Market

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Abstract— **The main purpose of this research is to determine the association between the Twitter sentiment data and the price of West Texas Intermediate (WTI) crude oil platforms through a text mining technique. The research utilized data from Twitter and WTI crude oil closing prices data, during August 10th to November 8th, 2020. The Twitter Sentiment Analysis to analyze perception and employ Graph Association Analysis to explore the relationship of two selected platforms using data virtualization techniques. The initial results show the negative association, explaining that Twitter data and the WTI crude oil price have the relationship in the opposite direction. The results may support decisions in crude oil trading in the WTI market. Furthermore, the developed method might be suitable to forecast in other oil markets.**

Keywords—crude oil prices, graph association analysis, twitter sentiment analysis

I. INTRODUCTION

Crude oil is a very important commodity in the trading market. Crude oil play a significant factor driving the economy in every country. Petrol is now used in our daily life most travelling and transporting. Thailand still relies on fuel-powered vehicles. With news reports from the Energy Policy and Planning Office revealed that statistics of domestic fuel demand in January 2020 compared to the same period of 2019, the average consumption of petrol was 31.8 million liters per day, an increase of 1.8%, while the average consumption of diesel was 64.1 million liters per day. It was down 2.5% from the same period last year, while the average daily use of Jet A1 fuel was 22.1 million liters per day. Crude oil was an important commodity for the economy, increasing 3.0% over the same period last year [1]. This is because the crude oil has been refined and divided into various energy products such as petroleum, gas, diesel, kerosene and lubricating oil. As a result, oil is essential to both industrial, transport, fishing and transport sectors, and the movement of crude oil prices is also related to the global macroeconomic economy. Especially towards inflation and gross product in Thai's economy [2].

While the expansion of the Internet network users, including the behaviour of accessing or searching for information has changed from the past that used to search from textbooks and documents to search for information on the website. Moreover, the consumption of news that has been through newspapers and television then transformed into social media actions. There is also an exchange or expression of opinions on various matters. That is becoming a trend quickly, such as economy, politics, marketing, education and entertainment by expressing feelings. Social media users give comments and express current situations or events of interest and then users spread more rapidly than traditional media [3]. This causes many researchers to interest in analysing various aspects of social media comments. Those messages are structured and have no exact patterns (unstructured text) up to 80% -85% of the total data [4]. Social networks are enormous and complex. And for the benefit of the use of text or opinions, sentiment analysis is used to analyse. This is the study of how Twitter users feel in various situations, including the price of crude oil that the researcher has analysed as well.

Therefore, the researchers aims to study the ever-changing crude price data and use it to analyze it in conjunction with messages or comments in the social network (Twitter) to predict future crude oil price tipping points and serve as a guideline of investment decisions and trade of crude oil in the world market. The purposes of this research are : (1) to study the positives and negatives of Twitter users about the price movement of crude oil and (2) to study the patterns of the relationship between Twitter and the movement of crude oil prices. The technique used in this research is the news sentiment analysis. This selection is conducted to provide all possible cases to predict the possibilities that are the best model to forecast the actual stock market turning point. The advantages of the research are (1) to identify the correlation between Twitter data and West Texas Intermediate (WTI) crude oil prices, and (2) to use as a guideline for investors to analyse the trends of the turning point of West Texas Intermediate (WTI) crude oil prices.

II. LITERATURE REVIEWS

A. Text Mining (TM)

Text mining is a technique for conveying large volumes of text data. That is in an unstructured form (Unstructured), which is different from data mining (Data Mining) through a new knowledge process. By taking the text data into a structured form through word extraction. Find patterns and hidden relationships in the dataset to generate new and useful knowledge [5]. It is data mining and human language analysis through natural language processing (machine learning) and statistics together.

B. Natural Language Processing (NLP)

The natural language processing or human language. This helps computers to understand human natural language from the term natural language (Natural Language Processing) refers to the language used by humans to communicate in everyday life [6]. This is different from the computer language that was invented. Computers need to be analysed to understand and interpret the normal language that humans can communicate with. The main elements are follows:

1) Syntactic Analysis

to check of the grammatical structure. Positioning words or word groups will be checked as sentence that it is grammatically correct or not, for example, "I at am school", this sentence has a grammatical structure, the computer will say it is a wrong sentence. Therefore, the grammatically correct sentence should be "I am at school".

2) Semantic Analysis

to verify the semantic correctness of the sentence by looking at the function of the words in the sentence and the grammatical structure. Some words may be written grammatically correct but there are ambiguous or impossible meaning. On the other hand, this does not mean anything at all. For example, "The pencil is swimming", this sentence is grammatically correct. But if you look at its meaning, this found that it is impossible. Because pencils are inanimate things, they cannot function "swimming".

3) Pragmatic Analysis

to interpret the questions which have been asked and interpreted according to the situation that arises, such as when asking how old you are. Those who answer the questions must understand what researchers' main points. And answer those questions truthfully, for example, "I am 15 years old", etc.

In the analysis of the movement of crude oil prices in the West Texas (WTI) market, two pieces of data were used to analyze the following text mining techniques. The conceptual framework for the research consisted of two data sources: the first data source. Collected data from Twitter is stored in Microsoft Excel and taken to the process. Prepare the data and then use the data to analyze sentiment (Sentiment Analysis) the second data source. Extracting crude oil price data from WTI Crude market and storing it in Microsoft Excel. Both parts of the data are analyzed for correlation of the turning point of the lead price and evaluated. As its further application is shown in Fig. 1.
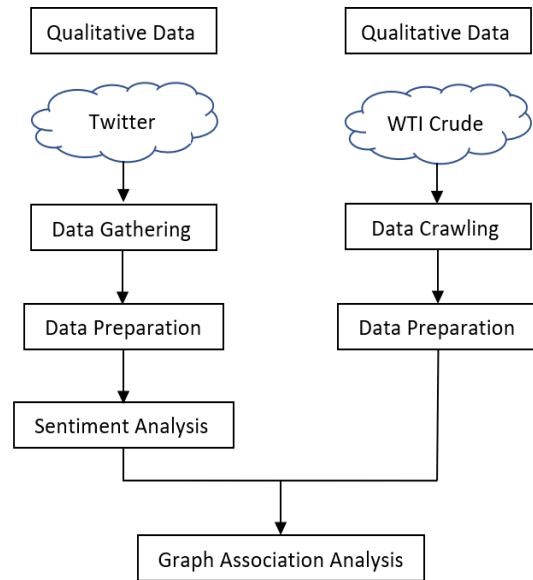

Fig. 1.   Conceptual framework

III. METHODOLOGY

In the analysis of the movement of crude oil prices in the West Texas (WTI) market, two pieces of data were used to analyze the following text mining techniques.

1. Data collected from Twitter will be collected in a time series manner. It is collected at 6:00 pm every day and the data collected is 90 days text format with RapidMiner Studio program using the keyword "oil. price" in the search. From 10 August 2020 to 8 November 2020, each day there are about 100 - 300 tweets per day.

2. West Texas Intermediate crude oil price data, obtained from The New York Stock Exchange (NYSE), is stored in a time-series basis. It was collected at 6:00 pm every day and the data collected were quantitative data. The program R was used to retrieve data for a period of 90 days, starting from August 10, 2020 to November 8, 2020.

A. Data Preparation

Most unstructured data are in the form of text or natural language. Therefore, data must be prepared and checked through first for accuracy before analysing. This is to reduce the errors. Data preparation is necessary for research to use and analyse efficiently. This is because computers will not be able to understand human language. In which the preparation of data for further analysis has the following techniques as follows:

1) Data cleaning

is the process of reviewing and correcting or removing inaccurate entries. Most of the textual information is pulled from social media. There will be words that are cut off unnecessary characters such as html tags, URLs, quotation marks, punctuation, or eliminates.

2) Word wrapping (Tokenization)

is the use of text to wrap each word in the text. Into smaller words, called Tokens, by defining the scope of words such as 'kra' or 'sab → saber', to provide efficient classification.

3) Word eliminating (Stop word)

is to separate the text into words and cut out the unimportant words in the sentence to reduce errors that occur in the analysis of the data. And it is to reduce size of the word count and leave only necessary words. Types of stop word in Thai language are: prepositions, conjunctions, pronouns, adverbs, and interjections. For example, the words are eliminated are to, being, is, at, which, etc.

4) Word stemming

is the conversion of a word into the root of a word by cutting off the end of the word. The root of the word are 'paksa' or bird (bird run → bird) runs or running → run, etc. This is to reduce the number of words to a minimum.

B. Sentiment Analysis

This analysis technique was chosen because it can conduct all possible cases to predict the possibilities that are the best model to forecast the actual stock market turning point. Sentiment Analysis is a natural language processing. By analysing the feelings or emotion from a message to indicate how people feel about something in various places, either on the web board or on social media such as Facebook or Twitter. Various feelings which can be categorized as Feeling positive, negative, or neutral [7] by calculating the value of sentiment can be calculated from the WTI and Twitter [8].

C. West Texas Intermediate (WTI) Crude Oil Market

WTI Crude, also known as West Texas Intermediate, is an important reference crude in the United States. WTI is used as a benchmark for the US oil market because it is drilled from domestically in the United States. For example: Texas, Louisiana, and North Dakota The West Texas Intermediate (WTI) crude oil market is only auctioned Monday through Friday at 5:00PM [8].

Fig. 2, the WTI is primarily used as a benchmark for the American market. It uses different benchmarks depending on the composition and quality of the oil traded. This is the light sweet, easy-flowing oil at room temperature and sulfur levels below 0.5%. And Brent, sour oil is quite hard to get at room temperature and has sulfur levels above 0.5%, including Dubai crude and Omani crude. The benchmark is important in the oil market because it not only helps traders keep tabs on crude oil prices.
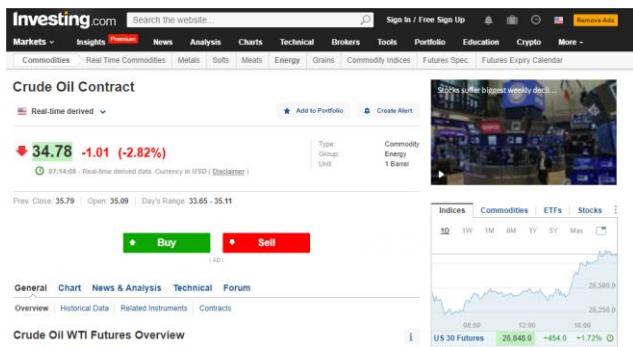

Fig. 2.   The WTI

D. Twitter

Twitter is a social media service for sending news and communicating in short messages (Short Message) was developed in March 2006 by Jack Dorsey, Noah Glass, Biz Stone, Evan William. And it was begun to open for service in July 2012. Head office is located at San Francisco, USA. The name of the twister comes from the sound of a bird. Twitter is one of the top 10 most visited websites. It is touted as a short messaging website as shown in Fig 3.
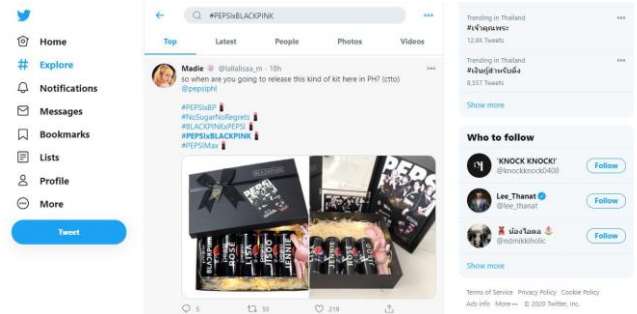

Fig. 3.   The Twitter

Where users can post and reply to messages. But the number of characters must not exceed 280 characters and can be tweeted on both websites. This can also tweet on the application. In mobile phones and smartphones, Twitter also opens up an Application programming interface (API) to allow people to connect and use data from Twitter [9].

E. Data Used in the Research

1) Data collected from Twitter

will be collected in a time series manner. Collected at 6:00 pm every day and the data collected is 90 days text style using the keyword "oil price" in the search. From August 10, 2020 to November 8, 2020, each day there are approximately 100 - 1200 tweets per day, which are stored in the database by @Atto. Three attributes are ID, Text, and Date Time.

2) West Texas Intermediate (WTI)

crude oil price data, obtained from The New York Stock Exchange (NYSE), is stored in time series. It was collected at 6:00 pm every day and the data collected were quantitative data. For a period of 90 days, starting from August 10, 2020 to November 8, 2020, which are stored in the database with 3 attributes including ID, Price and Date Time.

To analyze the price movements of West Texas Intermediate (WTI) crude oil using text mining techniques. Begin by collecting the information as mentioned earlier, the required data is obtained, then used to prepare data (Data Preparation) to clean the data before sentiment analysis and correlation analysis as shown in Fig. 4.

The researcher then used the data from Twitter to analyze the Twitter sentiment analysis to determine the Twitter Sentiment Score, where the data from Twitter is converted from the data without structure (Unstructured Data). This is a structured data by using text mining analysis process, and when receiving Twitter data in a structured format, it will be correlated with crude price data from West Texas Intermediate (WTI) with correlation analysis procedure as shown in Fig. 5.
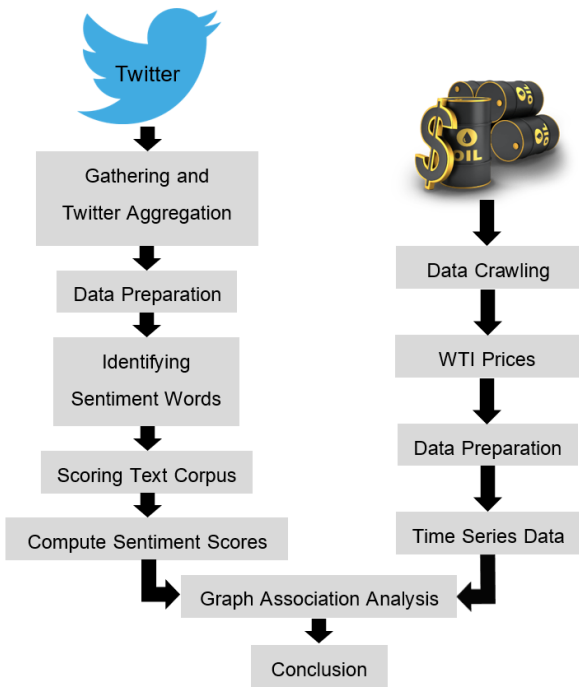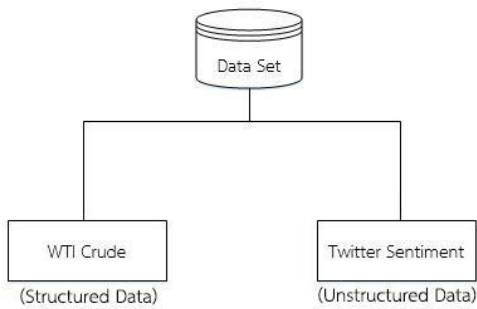
Fig. 4.   The research procedures

Fig. 5.   The correlation analysis procedure

IV.   RESEARCH RESULTS

Fig. 6 presents the Twitter users' sentiment with the West Texas Intermediate (WTI) crude oil price has a different starting point. The WTI crude oil price begins at its peak and tends to continue to decline until the 55th day, the price of crude oil tends to increase. While the sentiment of Twitter users is low and it tends to increase in the next time until the 55th, the sentiment of Twitter users is likely to decline [10]. This show that the trend of both two variables are added or decreased in opposite directions.

Due to the comparison between Twitter users' sentiment and WTI crude oil prices, the relationship between two variables may not yet be seen, so the researchers modified the two with various techniques. Which consists of Calculation based on real prices (Actual Prices) [11]. Calculation 1-day overlap (1-day overlap) Calculation using standard values (Standardized) to calculate of Trend change and Percentage change as shown in Fig. 7. It interpret Twitter user sentiment and West Texas crude oil price overlap for 1 day. Crude oil price will continue to decline. The results compare the Twitter users' sentiment and crude oil prices tended to increase, indicating that two variables increased or decreased in the opposite direction [12].
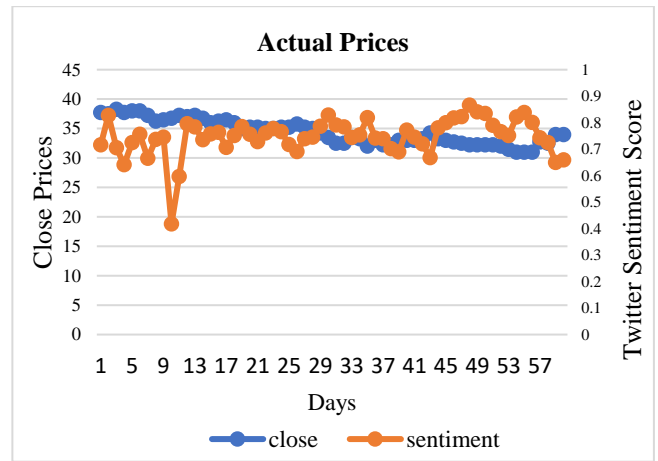

Fig. 6.   A comparison in actual prices between twitter users sentiment and wti crude oil prices
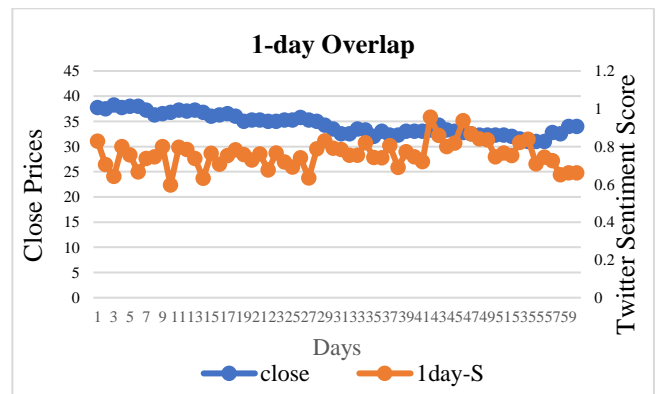

Fig. 7.   A Comparison in 1-day overlap between twitter users sentiment and WTI crude oil prices

Fig. 8 is a comparison between the benchmark of Twitter users' sentiment and the benchmark of the West Texas crude oil price. This can be seen that the crude oil benchmark is relatively high at the first period. But in a latter period, the standard value of crude oil tends to decline. Compared to the benchmark for user sentiment, Twitter tends to be a benchmark from relatively low at the initial period. But over time, the benchmark of Twitter users' feelings will likely continue to increase, indicating that both of these variables will increase or decrease in the opposite direction.

Fig. 9 illustrates a comparison between the change in sentiment of Twitter users and the change in the price of crude oil in the West Texas market. The benchmark of Twitter user sentiment starts from the bottom of the Y-axis, while the benchmark of West Texas crude oil starts from the top of the Y-axis and the trend of both values moves in. The opposite direction, but there is a moment. From day 48 to day 52 where both values are in the same direction.
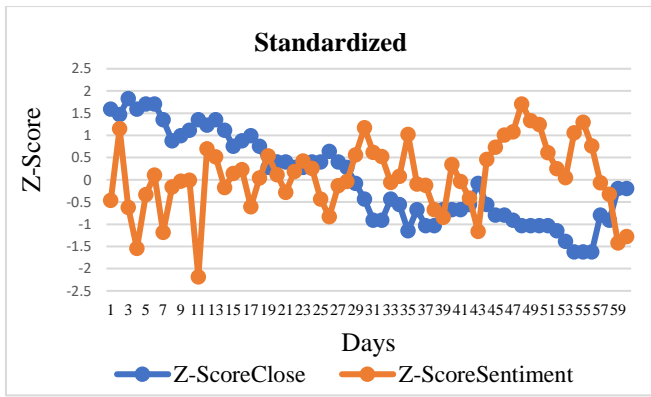
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Fig. 8. A comparison in standardized between twitter users sentiment and WTI crude oil prices
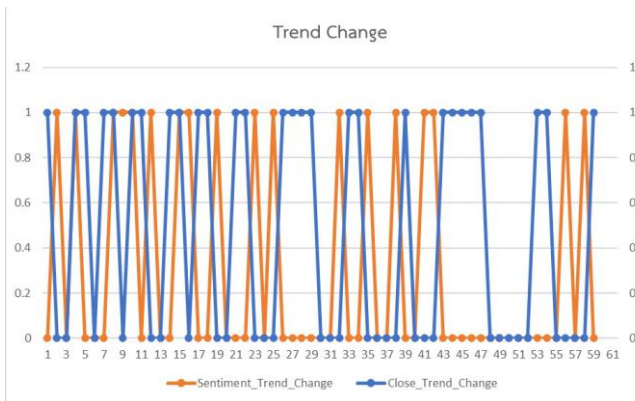

Fig. 9. A comparison in trend change between twitter users sentiment and WTI crude oil prices

The Percentage change calculation is analysed by observing the percentage change of how many percent increase or decrease in both variables [13]. When the change percentage value of the two variables is obtained, they are then used to compare these two data sources with line chart as shown in Fig 10 [14].
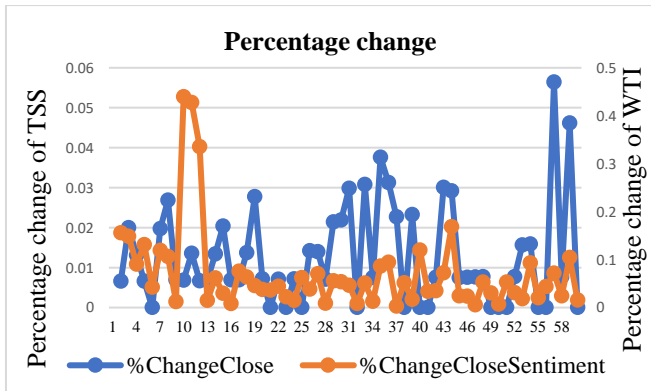

Fig. 10. A comparison between the percentage change in sentiment of twitter users and the wti crude oil

In the first period of the percentage change in Fig. 10, the sentiment of Twitter users and the price of crude oil in the WTI market is in the opposite direction up to date [15]. Then the percentage change trend of both variables is increased or decreased in the same direction [16].

V. CONCLUSION

The results show the negative relationship between Twitter sentiment and the WTI crude oil prices; however, the evidence might not be obvious. The news sentiment analysis technique was chosen to conduct all possible cases to predict the possibility model to forecast the actual stock market turning point. This can discuss the results of the problems encountered as follows: (1) this is because the data from Twitter was obtained from a search using the keyword Oil Price, which may not match the objective that the researcher wants to analyze. The information obtained is not the only information on the price of crude oil in the WTI market. But the information obtained also covers other markets; (2) the number of Twitter data obtained is quite different and overlapping too many days, for example, the number of data received on some days is only 20 to 30 records, others as many as 600 up to 1,000 records, thus the results from visualization may not meet the researcher's expectation; (3) The future research should also apply the statistical methods to investigate the relationships between these two interested variables to see whether there is a significant relationship.

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