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Twitter Sentiment Analysis as an Evaluation and Service Base On Python Textblob

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Abstract. The development of technology in the current era is very rapid, this is indicated by the many social media that have sprung up. One popular social media is Twitter. Twitter initially became a forum for social media users as a place to preach activities, discuss, and share stories between users. However, now Twitter is even a place for complaints for customers of a company, one of which is PT Telkom Indonesia. Some customers prefer not to contact the call centre that has been provided by the company to be contacted if there is a problem, but prefer to complain via Twitter. According to data taken during a certain period, 3324 tweets were obtained, which included the keywords indihome, myindihome, useetv, and wifi.id. The tweets data that has been collected, if processed properly, will be valuable information for the company. For example, as a reference to assess brand image, customer feedback, and marketing opportunities. This study classifies tweets where the keywords indihome, myindihome, useetv, and wifi.di. Furthermore, several data preprocessing techniques were carried out, sentiment analysis, and visualization in the form of histograms, pie charts, and word clouds. From 3324 tweets that have been analyzed, it is found that there are 34.4% positive tweets, 16.1% negative tweets, and 49.6% neutral tweets

Keywords: sentiment analysis, twitter, telecommunication company services, complaints

1. Introduction

Social media is an online media capable of exchanging information and sharing stories to multiple people without being limited by time and space [1]. Currently, social media is no longer just a place to share daily life of its user. It becomes a place for clashing opinions between each other in the Internet, which according to them is important. On Twitter, PT Telkom Indonesia, [2] later on called as TELKOM, said there are many twitter users who express their opinions about TELKOM's products and services, in which are indihome, useeTV, wifi.id and myindihome.

So far, TELKOM has not done deep analysis to see how these twitter user's opinions about their products and services. It's a shame because their opinions are related to TELKOM's brand thus



required a deep analysis to find information, which may be useful for the company.

2. Related Work

In this section, there are some previous researches for sentiment analysis study. These researches are talking about sentiment analysis on various topics and classifications. The previous researches are the following: Sentiment analysis study done by Nur [3]. The object researched is documents about cellphone brand in Indonesian. The purpose of the research is to find accurate comparison between two classifications, which are used in the analysis. Sentiment analysis research using machine-learning approach known as Support Vector Machine (SVM) and specified on text document in Bahasa Indonesia.

Other research study about sentiment analysis done by Ismail Sunni [4], by studying twitter data about public opinions on political figure. The topic about political figure became the research domain. Using F3 (F3 is Factor Finder) method to handle language model. Whereas Naive Bayes Classifier were chosen to do sentiment analysis using frequency based selection to minimize spelling errors from too many words. The analysis result said that case folding actually lower the accuracy because word equalization program which appears as news and opinion from Twitter users.

In 2014, Ahmad Fathan [5] also did a sentiment analysis study. His study's object was tweets talking about public figures with a purpose of knowing about a topic related to public figures or event which caused public sentiment to decline. Public figures chosen are the ones with highest survey result according to surveys done by competent institutions in Indonesia. Naive Bayes Classifier then used to find classification result from sentiments about said public figures.

In 2016, Syahmia, Kartina, and Muhammad Ihsan [6] studied about public opinion about services and products of an online shop. To do sentiment analysis, they used methods starting from collecting data's, pre-processing, feature selection, naive Bayes classification, and k-fold Cross Validation accurate measurement and Confusion Matrix.

In 2017, Ghulam Asrofi [7], studied public opinions about Governor candidate of DKI Jakarta 2017 on twitter. To do the pre-processing data, this study used tokenizes, cleansing and filtering method to determine sentiment class using Lexicon Based method. For the clarification proses, this study Naive Bayes Classifier (NBC) and Support Vector Machine (SVM) method.

Based on previous studies, researcher tries to do deep analysis about twitter users opinions about TELKOM's products and services based on text blob and visualize data's into work cloud, by using acquired data's from twitter therefore able to be classified and visualized. Classification then done in that twitter sentiment analysis which is split into three categories, which are tweets about positive opinions, neutral opinions and negative opinions. Tweet classification is done using one of python library called textblob. Later on, the result from that analysis can be used as consideration and comparison to see how are twitter opinions about TELKOM.

3. Methods

3.1. Theoretical Basis

Python is one of programming language with multiple paradigms [8], which support object, procedural, and functional oriented programming [9] [10]. This allows a program to be written in several approaches at once. For example, graphical interface made in a form of orientation object, while the processing is made in functional or procedural form. Python was arranged by Guido van Rossum started in late 1980 decade in Centrum voor Wiskunde en Informatica, Netherlands [11]. Since then, Python is famous amongst the programming community [12]

Sentiment analysis itself is a research branch in Text Mining domain [13] [14], which is gaining popularity in the early 2002. According to a paper by B. Pang and L. Lee by the title of "Opinion mining and sentiment analysis" [15]. Generally, this sentiment analysis is split into two major categories.

1. Coarse-grained sentiment analysis

Coarse-grained sentiment analysis does analyzing process in document level, which is trying to

classify orientations of a document as a whole. There are three kinds of orientations: Positive, Neutral, and Negative. However, there are also things, which make these orientations value continuous or non-discrete.

2. Fined-grained sentiment analysis

Fined-grained sentiment analysis does classification not on the document level, but on a sentence in a document.

Twitter is a service made for friends, families, and co-workers to communicate and stay connected by fast and frequent message exchanges [16]. Users post Tweet, which can be a photo, video, link, or text [17]. Micro blog [18] is one of online communication tool in which the users can update their status, about thinking something or doing something, what are their opinions about an object or a particular phenomenon. Tweet is publicly visible, however the sender can limit who can see it only to their friends. The user can also sees other person tweet, which is known as follower.

TextBlob is a Python library (2 and 3) to process textual data's. This feature provides simple API to dive into the tasks of general Natural Language Processing (NLP) such as part-of-speech marking, noun phrase extraction, sentiment analysis, classification, translation, and some more [19] [20]

3.2. Research Methods

This research uses a flowchart methodology as shown in Figure 1. Figure 1 is a flowchart from a sentiment analysis program as a whole. The detailed steps in the research is explained as follows:

1. Taking tweet data using Twitter API and classifying it using Textblob.
2. Preparing tweet data and negation dictionary to correct non-standard words.
3. Pre-processing tweet data.
4. Exploring data using histogram and pie chart.
5. Visualizing tweet data using word cloud.
6. Interpreting and drawing a conclusion based on the result of the analysis.

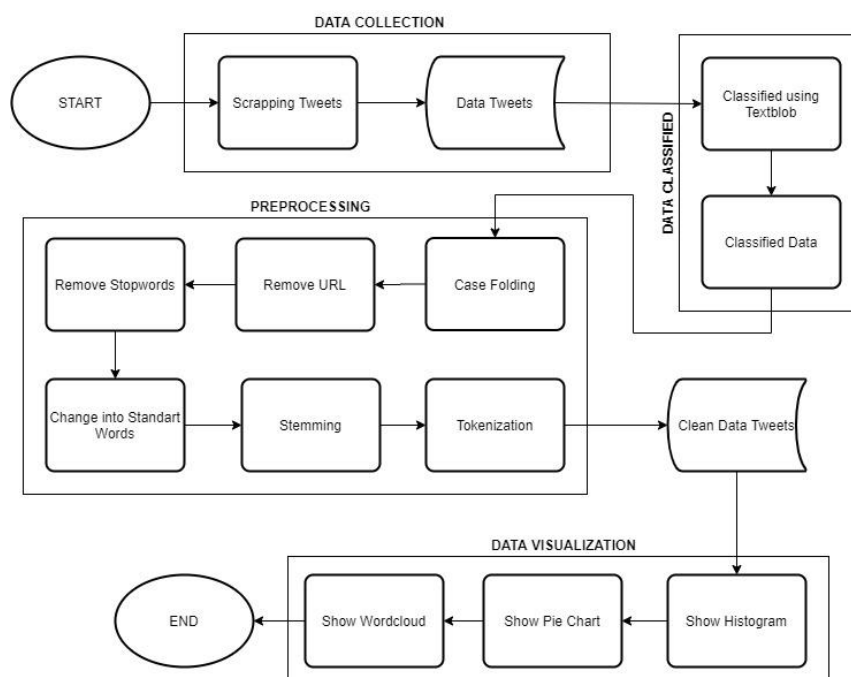


Figure 1. Research Methodology Flowchart

Performing regular data retrieval means there are 2-3 times data retrievals in a day, which then gathered and compiled as one. After the data have been gathered, a classification process starts. Using library textblob, the purpose of this step is to differentiate positive, negative, and neutral data. After

then, the pre-processing step starts to clean tweets data. Pre-processing texts includes removing symbols (URL, special characters), negation handling (standardizing words), stemming (removing affixes and suffixes), tokenizing (separating chains of words in sentences), and case folding (changing into lowercase). Then the last step, which is data visualization, shows three types of it. There are histogram, pie chart, and word cloud.

3.2.1. Data Retrieval. In collecting data, the researcher used the Application Programming Interface (API) which is already available on Twitter developer and can be accessed free of charge. To find out the twitter API, researchers must create a twitter account and then register with the twitter developer. When you have successfully registered as a developer, Twitter will provide **Access Token** and **Consumer Key** as intermediaries to access the Twitter API. Furthermore, the token and key are used to retrieve data coded using the python language.

3.2.2. Data Classification. Data classification here is using a python's library called textblob. Textblob library is able to process three type of classification, which is positive, negative, and neutral. However in this textblob library, sentences in Bahasa Indonesia cannot be classified. Classification can only be done in English. Therefore there is a need to translate Bahasa Indonesia to English. After translation step is done, textblob will start to classify the tweets data. To get said classification, in textblob there are calculations which give result in a polarity value. If the polarity value is greater than 0 (Polarity value > 0), it is positive. If the polarity value is equal to 0 (Polarity value = 0), it is neutral. If the polarity value is less than 0 (Polarity value < 0), it is negative.

3.2.3. Data Pre-processing. Pre-processing tweet text data, which already been gathered, is a must. The aim is to reduce noise-heavy text data into cleaner version therefore become a better display at the word cloud. Pre-processing includes removing symbols (URL and special characters), negation handling, stemming, tokenizing, and case folding. Here is the tweet data structure before pre-processing.

Table 1 shows tweet still containing URL, username, and ASCII symbols which are not necessary or even get in the way of visualization, therefore they shall be removed first. Next step is negation handling to change abbreviated words into proper format. Afterwards, stemming is underway to change words into basic words and then to increase classification accuracy, the next step is tokenizing. Tokenizing changes each tweet into parts of words that make up sentences. Lastly, case folding is done to change tweet into lowercase.

Table 1. Tweets Data before Pre-processing

In Indonesian	In English
@IndiHome halo kenapa indihome saya dirumah error yah jd gabisa connect??? bales yah	@IndiHome hello why does my indihome at my house error? Can't connect now???
Notice sayaa mas/mbakk	Reply pls
@IndiHome	Notice me pleasee @IndiHome
@IndiHome dri kmrn gangguan atau apa main game gak stabil gini	@IndiHome Is it maintenance since yesterday or what... can't play game like this. So unstable
TOLONG CEK DM SAYA @TelkomCare @IndiHome	PLEASE CHECK UR DM! @TelkomCare @IndiHome

Table 2 shows tweet data after pre-processing therefore the data is easier to be processed into something informative. Here are text data after pre-processing.

3.2.4. Data Visualization. This study uses 3 kinds of data visualization. There are histogram, pie chart, and word cloud. In histogram, there is a graphic display visualization to show data distribution visually or how often a value differs in a set of data. For pie chart, it is a statistical graphic made of a circle divided into few slices which area is proportional to how much they have in numeric or quantity of the data. Lastly, word cloud. It is one of text document visualization method, which is used frequently. Word cloud is a graphical representation of a document, which is done by plotting words, which often appears in document in two-dimensional space. How often a word appears is shown by the size of said word. The bigger it is, the more often it appears in a document [21].

Table 2. Tweets Data after Pre-processing

In Indonesian	In English
<i>halo kenapa indihome saya dirumah error yah jadi tidak bisa connect bales yah notice sayaa masmbakk dari kmrn gangguan atau apa main game tidak stabil gini tolong cek dm saya</i>	<i>Hello why does my indihome at my house error cannot connect now please reply Notice me please Is it maintenance since yesterday or what cannot play game like this so unstable Please check your dm</i>

3.2.5. Data Source. Data used in this research is a set of *tweet* gathered from users of social media platform *twitter* using TELKOM products (indihome, useeTV, wifi.id, and myindihome) as keywords. Specifically ones that are accessed between July 11th 2019 and July 28th 2019. Data can be acquired through *Twitter API* (Application Programming Interface). In total, there are 3324 data taken which then compiled into one file.

The data structure used in this research is using data after being pre-processed. The *tweet* text data consist of predictor variable are clean *tweet* and response variable is the sentiment which is *tweet* classification (Positive, Neutral, Negative). Here is the example of data structure used in this research in Table 3.

Table 3. Tweets Data after Pre-processing

No	Clean Tweet		Sentiment
	In Indonesian	In English	
1	ini sudah 2 hari internet putus	it has been 2 days without internet	Negative
2	anak indihome plis ada yang bisa liat tidak ini ada apa	indihome boys pls anybody available to check on me	Neutral
3	nikmati promo tukar poin hut telkom ke54 sampai share pengalaman sobat menggunakan poin myindihome dapatkan hadiah menarik saldo	enjoy 54 th telkom point exchange hut promo share your experience using myindihome point get fancy prizes	Positive
4	ini di cikarang kok internet indihome tidak bisa ya dari tadi siang sampe skg belum konek2 juga ada apaan sih	this is in cikarang why indihome internet failed to connect since noon until now what happens	Neutral
5	selain informasi tentang paket berlangganan sobat juga dapat menanyakan informasi apapun yang berkaitan den	other than info about subscribed package you can also ask everything	Neutral
6	misalnya saja sobat bingung mengenai informasi cara berlangganan internet atau televisi kabel indihome hanya ya	for example if you are confused about how to have an internet package or cable tv only in indihome	Negative
7	gimana nih dari tsel dan indihome tidak connect2 terus giliran coba koneksi dari kartu lain bisa	what happens to tsel and indihome cannot connect to internet but other provider can	Neutral
8	aku bukan anak indihome tapi aku anak in	i am not indihome boy but i am indigo	Neutral
9	dalam rangka hut telkom yang ke-54	In commemoration of telkom 54 th	Positive

	indihome hadirkan promo seru bonus 2x54 108 poin myindihome diskon 54 minipack usee selain itu ada indihome sebagai pelengkap hiburan keluarga di indonesia memiliki layanan digital teknologi fiber optik	anniversary indihome offers interesting bonus promo 2x54 108 myindihome point discount 54 minipack use moreover there is indihome to complete the family joy in indonesia having digital fiber optic technology services	Neutral
...
3324	Tweet Bersih 3324	Clean <i>Tweet</i> no.3324	3324 th Sentiment

3.2.6. System Architecture. What is shown in Picture 2 above is the system architecture which can be found in existing program. In the beginning, user opens the program and extract the data (crawling). Next, the program will send request to Application Programming Interface (API). Afterwards, API server will send a new request to Twitter database. Then Twitter database will send data as a response which will be relayed by API server to the program.

Textblob is used to do sentiment classification from the *tweet* data sent back to program. It will classify the data into one of the possible classification (positive, neutral, or negative).

Figure 3 is clearer program architecture to describe what is left unexplained in Figure 2. In the program, *tweet* data sent by API server then begin to be pre-processed. After pre-processing is done, data will be visualized into three form of visualization, which are histogram, pie chart, and word cloud.

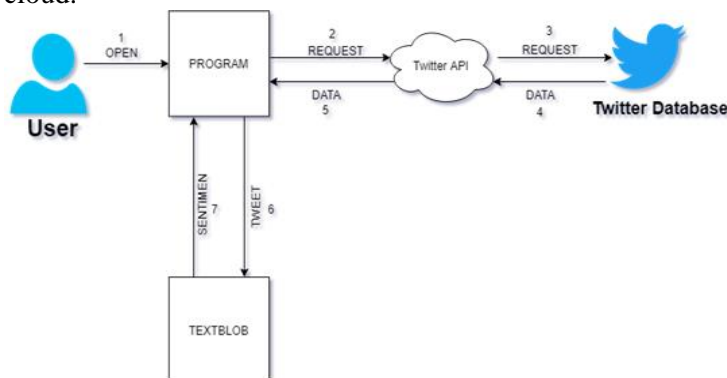


Figure 2. System Architecture.

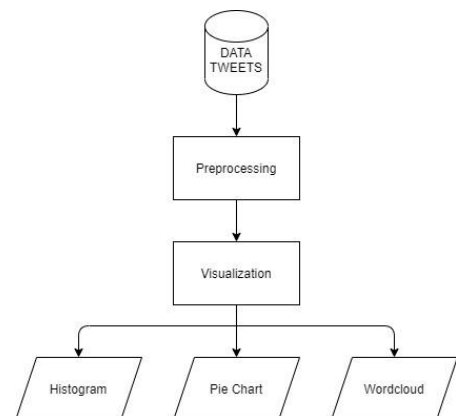


Figure 3. Detailed System Architecture of Program.

4. Results and Analysis

4.1. Testing Program

Python is one of programming language with multiple paradigms, which support object, procedural, and functional oriented programming [8]. To test the program whether or not it is capable to meet the preset demands, researcher did some tests as follows table 4. The results of program testing shown in Table 4 above includes:

1. Choosing *online* (getting new data) and *offline* (using pre-existing data), which is enclosed in Program Results as shown in Figure 5.
2. Retrieving *tweet* data, which is enclosed in Program Results as shown in Figure 6.
3. Pre-processing *tweet* data, which is enclosed in Research Method, Pre-processing Data section in Table 1 to Table 2.
4. Showing histogram, which is enclosed in Program Results as shown in Figure 7.
5. Showing pie chart, which is enclosed in Program Results as shown in Figure 8.
6. Showing word cloud, which is enclosed in Program Results as shown in Figure 9 to Figure 11.

7. Saving data, which is enclosed in Program Results as shown in Figure 12

4.2. Program Result

Python is one of programming language with multiple paradigms, which support object, procedural, and functional oriented programming [10]. From the research that has been done, it is apparent that researcher's IDE is Jupyter Notebook and researcher is using Python 3.6.8. as the programming language. Aiming to make the sentiment analysis application easy to use, researcher has made a program based on command prompt (CMD). Main menu interface of the program made by researcher is shown in Picture 4. There are the program's title, the name of people who made it, and the options which can be chosen by the user.

In Figure 5, the program asks the user to choose between using online data or offline data. In Figure 6, it is shown that the program is going for the online data retrieval route. In Figure 7, it is shown a histogram visualization of the data. In Figure 8, it is shown a pie chart visualization of the data. In Figure 9, it is shown word cloud visualization of the data with positive sentiment classification. In Figure 10, it is shown word cloud visualization of the data with neutral sentiment classification. In Figure 11, it is shown word cloud visualization of the data with negative sentiment classification. In Figure 12, it is shown when the program is saving the data which is freshly taken.

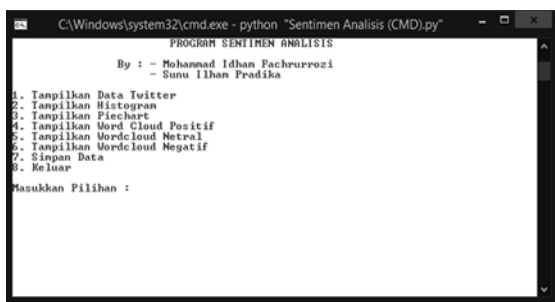


Figure 4. Main Menu Interface

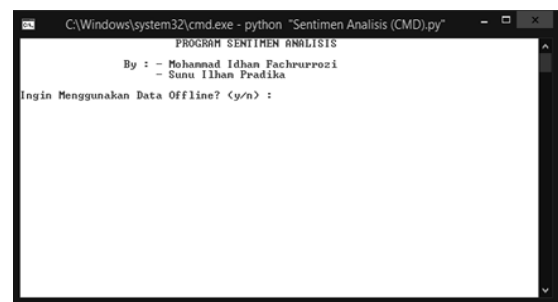


Figure 5. Data Usage Options Interface.

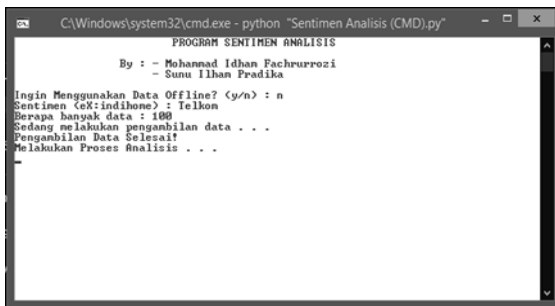


Figure 6. Data Retrieval Interface.

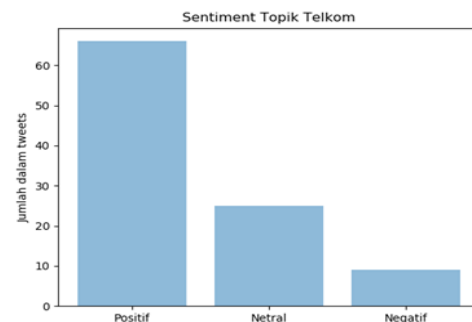


Figure 7. Histogram Visualization Interface.

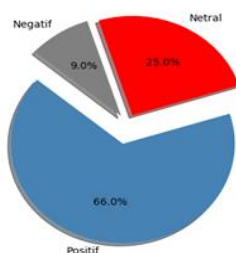


Figure 8. Pie Chart Visualization Interface



Figure 9. Word Cloud Visualization showing Positive



Figure 10. Word Cloud Visualization showing Neutral



Figure 11. Word Cloud Visualization showing Negative



Figure 12. Saving Data Interface

4.3. Descriptive Statistics Analysis

Pre-processed data can be descriptively analyzed. The comparison between *tweet* classification types is shown in the following diagram.

Figure 13 shows as many as 1648 *tweet* classified as neutral, 1142 *tweet* classified as positive, and 534 *tweet* classified as negative. According to the data in Picture 3.19, *tweet* classified as neutral has more quantity because there are many TELKOM customers who are still asking about the products and services. Positively classified *tweet* being larger in number than negatively classified *tweet* means overall results for TELKOM customer's responses are positive.

Figure 14 shows that the majority of *tweet* classified as neutral are as many as 49.6%. This is because there are many TELKOM customers who are still asking questions about TELKOM's products and services. Overall responses from TELKOM's customers shows positive sentiment responding to TELKOM's products and services, because there are more positive *tweet* than negative *tweet*, with 34.4% for the positive *tweet* compared to 16% for the negative *tweet*.

Word cloud is used to find out words that are most often appears. The more often a word appears, the bigger it's size, and vice versa, the less it appears, the smaller it's size. This makes it easy to understand and find information about each problem's topics for each category. For overall work cloud about TELKOM's products and services, including positive, neutral, or negative category is shown as follows figure 15. From Figure 15, it can be concluded that for negative category, TELKOM customers complain about frequent disturbances appears in TELKOM's products and services, mainly about accessing the internet. Therefore, there is a chance for TELKOM to do better, by checking and repairing TELKOM's line periodically, giving customers a heads up if TELKOM wants to do repairs on their line via email or myindihome, adding more manpower or technicians in the more frequently complained TELKOM's area, and periodic maintenance of wifi id corners.

From Figure 16, it can be concluded that for positive category, TELKOM customers are excited and enthusiastic when there are promotion or discount for TELKOM's products and services. Therefore

there are something that can be done by TELKOM to engage more positive responses by offering more promotions such as speed on demand, extra add on, minipack discount when its holidays, special soccer channels (such as Champions League, EPL, or World cup), and educational channel in their promoted packages.

From Figure 17, it can be concluded that for neutral category, there are many TELKOM customers who are still asking for information about TELKOM's products and services. Therefore, TELKOM can do better if they present information first to the customers when they do repairs or maintenances, create specific channel for downloading new myindihome application, periodical updates for myindihome application in app store and play store, put advertisement about how to purchase wifi id voucher in YouTube, Google Ads, etc.

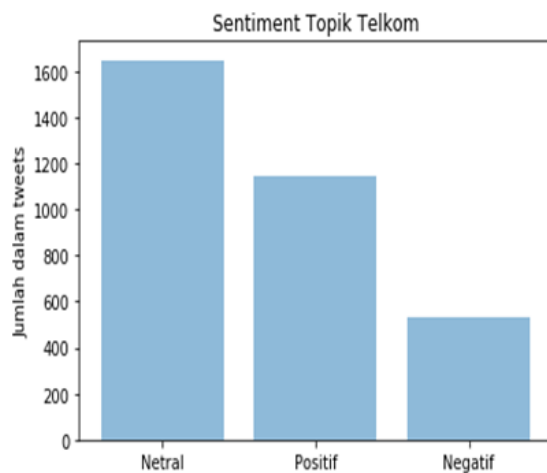


Figure 13. *Tweet* Classification Comparison in Histogram

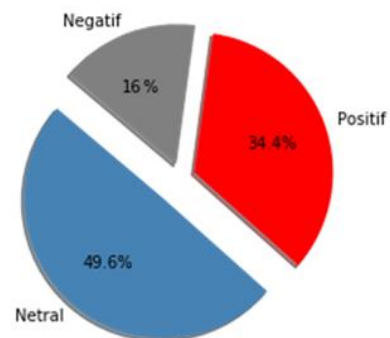


Figure 14. *Tweet* Classification Comparison in Pie Chart

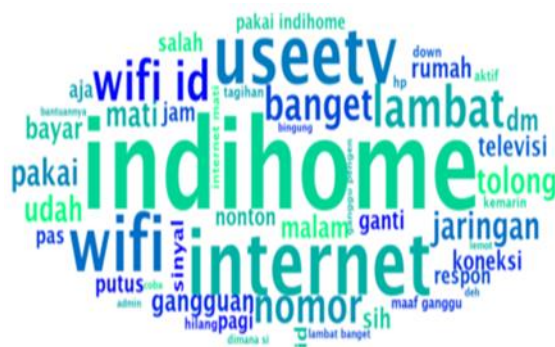


Figure 15. Overall Word Cloud for Negative Category.



Figure 16. Overall Word Cloud for Positive Category



Figure 17. Overall Word Cloud for Neutral Category

4.4. Confusion Matrix Calculation

Confusion matrix is one of the method used to measure the performance of a classification method. Basically, confusion matrix contains information that compares the classification results done by a system to how the results should be.

There are four terms to represent the results of classification process. There are True Positive (TP), True Negative (TN), False Positive (FP) and False Negative (FN). The value of True Positive or TP, is the number of positive data which is correctly classified by the system. The value of True Negative or TN, is the number of negative data which is correctly classified by the system. The value of False Positive or FP, is the number of positive data which is incorrectly classified by the system [22]. The value of False Negative or FN, is the number of negative data which is incorrectly classified by the system.

Confusion matrix testing uses this following formula 1 and 2.

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \times 100\% \quad (1)$$

$$Precision = \frac{TP}{FP + TP} \times 100\% \quad (2)$$

This research does calculations including accuracy and precision. Accuracy value shows how accurate the system can classify data correctly. Precision value shows the number of data, correctly classified as positive, divided by the total of positive data. For Precision Value, it is shown in these tables as follows Table 4.

Table 4. Neutral Data Precision Value

	Total	Valid Data (TP)	Invalid Data (FP)	Precision (%)
Neutral	1590	1266	324	80%
Positive	1082	858	224	79.3%
Negative	518	443	75	86%

For Accuracy Value of sentiment analysis program used in this research according to the formula in equation (1) (2) is as following:

$$Accuracy = \frac{2.567}{3.324} = 0.772 \cdot 100\% = 77,2\%$$

5. Conclusion

This research has successfully using *textblob* to classify *tweet* and researcher has also successfully visualize the data using word cloud.

The result for sentiment analysis is acquired. From 3324 *tweet* taken, there are 34.4% positive *tweet*, 16.1% negative *tweet*, and 49.6% neutral *tweet*. From said processed data, confusion matrix calculates that neural-classified precision value is 80%, positive-classified precision value is 79.3%, and negative-classified precision value is 86%.

As for the accuracy value of sentiment analysis program, it is calculated that it has accuracy value of 77.2%.

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