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Cosmetic Product Review Sentiment Using K-Nearest Neighbor

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Abstract: Indonesia, with a population of about 250 million, is a promising market for cosmetics companies. Aiming for women as the main target group for consumers, most of the cosmetics industry has recently begun to innovate products for men (Ministry of Industry, Republic of Indonesia, 2013). According to the Indonesian Cosmetics Companies Association (Perkosmi) of the Ministry of Industry of the Republic of Indonesia, sales of imported cosmetics reached IDR 2.44 trillion in 2012, an increase of 30% compared to IDR 1.87 trillion in 2011. In 2013, sales of imported cosmetics are expected to increase by another 30% to Rs 3.17 trillion. One of the most popular cosmetics is the MS Glow brand. MS Glow is an acronym for Magic For Skin, the brand's motto, which reflects Indonesia's most brilliant products. The data is from WebFemaleDaily, where users review Indonesian MS Glow cosmetics. The results of the analysis are intended to determine the positive and negative reactions of users of MS Glow cosmetics. The classification process uses the K-nearest neighbor (K-NN) algorithm. The accuracy value of K-NN with k = 1 is obtained from the result of 63.64% confusion matrix test.

Keywords: Review, Web Female Daily, Sentiment, K-Nearest Neighbor

1. Introduction

Increased use of the internet is affecting the lives of people all over the world. Through the internet, people can get a lot of information about everything that is happening. Apart from getting information, you can also send your opinions and suggestions about the latest information in the internet world. Opinions given can be positive opinions or negative opinions. The amount of data available on the internet allows us to process this data for new insights [1].

Indonesia, with a population of around 250 million, is a promising market for cosmetics companies. By targeting women as the main target group of consumers, most of the cosmetics industry has recently begun to innovate products for men [2]. According to the Association of Indonesian Cosmetics Companies (Perkosmi) of the Ministry of Industry of the Republic of Indonesia, sales of imported cosmetics in 2012 reached IDR 2.44 trillion, an increase of 30% compared to IDR 1.87 trillion in 2011. In 2013, sales of imported cosmetics reached IDR 2.44 trillion. Imported cosmetics are expected to increase by another 30% to Rs 3.17 trillion. expansion [3].

Skin and facial care has become a lifestyle trend in several circles, both women and men, because it really supports your appearance and daily activities. As a result, there are many different brands of facial and skin care products on the market. One of the most popular cosmetics is the MS Glow brand[4].

MS Glow is an acronym for Magic for Skin, the brand's motto, which reflects the most brilliant products in Indonesia. MS Glow skin care products are specifically designed for women's facial and skin care. MS Glow has

also released a men's facial and skin care product called MS Glow For Men. Founded in 2013[5], MS Glow is owned by two friends, Mahalani Kemala and Shandy Purnama Sari. Meanwhile, the owners of MS Glow For Men were first evacuated in December 2019. MS Glow For Men was first launched on April 10 2021. In fact, the grand launching scheduled for March 2020 was not possible due to Covid-19 restrictions. MS Glow skin care products are halal certified by BPOM and MUI so they are proven safe.

Sentiment analysis is part of data mining science and aims to analyze and extract textual data in the form of a person's opinions, judgments, attitudes, emotions, judgments and emotions about objects, people, organizations and problems[7]. is. In this research, the process of labeling the mood of a response is carried out by counting the number of positive and negative words in each response. [8]A large number of positive words counts as a positive answer, but a large number of negative words counts as a negative answer. [9].

The method used to classify positive and negative responses in this sentiment analysis is the K-nearest neighbor method (K-NN) algorithm. This is a case finding approach by comparing the proximity of new and old cases, and calculating based on this. Balance the weights of a set of functions[10]. There is. Another view states that the K-nearest neighbor method is an algorithm for classifying objects based on the data closest to them. Data is displayed in a multidimensional space, and each dimension reflects the characteristics of the data. The optimal k value for this algorithm depends on the data. In general, increasing the k value reduces the effect of noise on the classification, but blurs the boundaries between each classification[11].

This research provides consumer opinions to determine the percentage level of positive and negative comments from femaledaily.com forum account users regarding MS Glow cosmetic products in Indonesia[12]. Through this research, we can find out how to classify consumer responses to cosmetic product reviews as input and evaluation material for cosmetic companies by applying the K-Nearest Neighbors algorithm so that they can develop cosmetic products so that people continue to use them. Therefore, by extracting user review data from femaledaily.com and carrying out preprocessing to get more precise accuracy values and find out positive and negative values[13].

2. Method

2.1. K-Nearest Neighbors (K-NN)

K-Nearest Neighbor (KNN) is a machine learning method used in the classification process. The working principle of K-Nearest Neighbor is to classify based on the proximity of the location (distance) of data to other data. How close or far a location is (distance) can be calculated using one of the predetermined distance quantities, namely Euclidean distance, Minkowski distance and Mahalanobis distance[14]. However, in its application the Euclidean distance is often used because it has a high level of accuracy and productivity. Euclidean distance is the distance between a straight line that connects objects. The Euclidean distance formula is as follows [14]:

$$Distance(\bar{X}, \bar{Y}) = \sqrt{\sum_{n=1}^{d}(x_i - y_i)^2}$$

Information :
xi : testing data x
yi: testing data y
Distance (X,Y): Euclidean distance of x and y data
d : dimensions of the independent variable data

2.2. Term Frequency-Inverse Document Frequency(TF-IDF)

Term Frequency-Inverse Document Frequency (TF-IDF) is a numerical statistic that shows the relevance of keywords to certain documents or it can be said that it provides these keywords, so that certain documents can be identified or categorized. TF-IDF has two calculations, namely Term Frequency (TF) and Inverse Document Frequency (IDF). The following are the respective calculations for TF and IDF [15]*:*

$$TF = \begin{cases} 1 + \log_{10}(tf_{t,d}), & \text{if } tf_{t,d} > 0 \\ 0, & \text{if } tf_{t,d} = 0 \end{cases}$$

$$IDF = \log(\frac{N}{df_t})$$

Information :

Tft,d : number of occurrences of term (t) in document (d), if there is no term or t=0, then TF becomes 0.

N : number of text documents.

dft : number of documents containing the term (t).

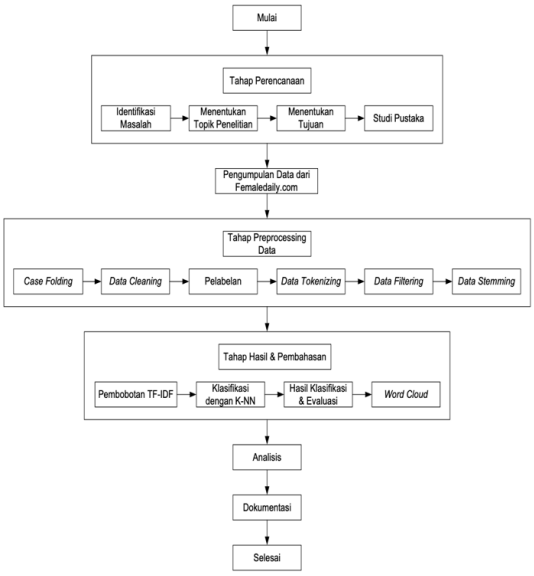

Figure 1. *Framework Research.*

This research uses the K-Nearest Neighbor (K-NN) algorithm because this method is effective in processing data on a large scale and the data classes are divided based on the k value so it is easy to implement. Comparison of the K-Nearest Neighbor (K-NN), Support Vector Machine (SVM) and Naïve Bayes algorithms:

Tabel 1. *Comparison of Methods*

Algorithm	Excess	Lack
K-Nearest Neighbor (K-NN)	Effectively process data on a large scale	Need to determine the exact K value
Support Vector Machine (SVM)	Effective on data sets with clear class separation margins	Difficult to use on a large scale

3. Result

3.1. Crawlin

Data collection in this research was carried out by crawling data on the Female Daily website. The first thing we have to do is look for data on the Female Daily website which contains reviews from MS Glow users.

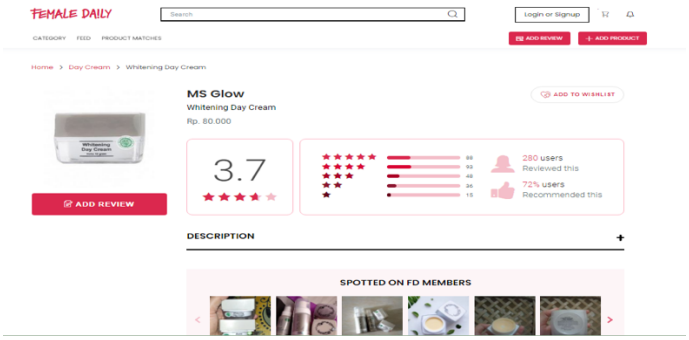

Figure 2. *Crawling Data Process*

The display above is the beginning of the data collection process on the Female Daily website. Data taken from June 2021 to December 2021 totaled

Teks	Sentimen
caentik nyobain whitening creamnya dan ternyata ini tuh teksturnya kayak kelly gitu gasi tapi bagus bagus aja si apalagi ini punya spf nya jadi gaperlu pake ss lagi dong trua ada efek whitecast nya juga jadi kalau pakai ini gausah pake foundie juga bagus tapi agak minyakam di aku jadi biasanya kalau make ini masi di set pake loose powder setelahnya biar ga minyakan bangett	Positif
riendd Mukaku jadi lebih cerah tidak hanya cerah tapi putih Aku suka banget sih tidak ada efek negatif dimukaku Kalau pakai produk ini harus pakai serum atau essence atau pelembab dulu sih kalau saranku biar lebih gampang mengaplikasikan dimuka	Positif
rifah aku beli ini karenaa keracunan samaa kakak sepupu aku diaa pakai ini dan mukanya tuh glowing banget jadi aku tertarik buat pakai ini untuk creamnyaa menurut ku sih susah untuk di blend tekstur creamnyaa juga kayak cream mecco begitupun wanginya aku beli hargaa paket jadi menurut ku harganya affordable banget setelah pemakaian cream siang ini selama bulan aku ngerasa kulitku lebih cerahan dan sedikit glowing sih jadi aku recomend banget buat kalian yg ingin punyaa wajah cerah dan glowing oiyaa aku lupaa cepat atau lama nyaa hasilnya itu tergantung kepada kulit kalian masingmasing yah	Positif
Azkasy Uda sekitar bulanan si pake ini sepaket sm yg lain ini cream walopun kek kuning gitu warnanya tp pas dipake ke muka tu jd ngeblend sm kulit trs kl aga lama jd glowink gitu tp pas gak pake ni cream ya biasa aja sih muka Menurutku iyasi bikin cerah tp kalo glowing ya pas pake cream ini aja pas ga pake b aja muka	Positif
Ellyasari aku beli ms glow karena lihat kk iparku bagus pakai itu jd aku beli sepaket tp utk daycreamnya ini parahbanget malah bikin pori2 wajahku bengkak merah gatal panas perih sampe panik takut ga sembuh lg	Positif

110 data.

Figure 3. *Raw Data from Web Female Daily*

The review comment data that has been obtained is saved in excel or .csv format.

Selection and Labeling

From all training data that is successful in Crawling, data labeling is then carried out because the Crawling results are data that is not labeled (unsupervised data). Because there is a lot of data that needs to be labeled, a labeling process is carried out by determining words that have positive and negative meanings. Next, the total number of positive words and negative words in the comments is calculated.

1. Positive Label: has a word in its composition that is supportive, encouraging, praising certain parties, has words of persuasion (invitation) and reflects positive emotions such as happy or satisfied.

2. Negative Label: has a word in its composition that is complaints, sarcasm and reflect negative emotions such as anger, disappointment and annoyance.

Preprocessing

Preprocessing is an important step in conducting sentiment analysis which aims to clean the data from elements that exist but are not needed. The preprocessing process consists of several stages to remove several parts of sentences that are not useful. To carry out this preprocessing process, there are 4 process stages to obtain maximum results, as follows:

1. Cleaning, there are several cleaning processes in it, namely cleaning URLs, mentions (@), punctuation / symbols and numbers. This stage is the stage of eliminating non-alphabetical characters to reduce interference.

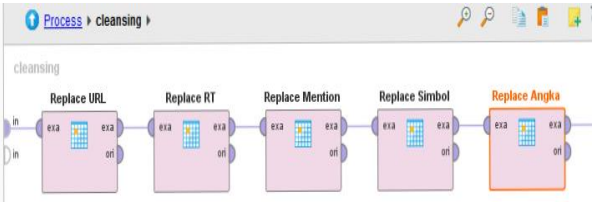

Figure 4. Cleansing Process

In this cleansing process, all tweets that have HTML or URLs, mentions, punctuation symbols and numbers will be deleted. This cleaning process is carried out because html or url, mention marks, punctuation symbols and numbers will not be used in the sentiment analysis process and have no influence. The following is a sample before cleaning and after going through the cleaning process:

Tabel 2. Differences Before and After Cleansing

Before Cleansing	After Cleansing
@quinnaddicts: When you first use it, it really makes your face really bright. But after a while, lots of bruises appeared around the chin. At that time I was still using it because I expected more from this product. Turns out it actually made the BO so bad that the scars are still there now, really items □□	When I first started using it, it really suited my face and made my face really bright, but after a while, lots of pimples appeared around my chin. At that time I was still using it because I was hoping for more from this product. Turns out it actually made it worse to the point that the scars are still there now.
@riendd_ : My face is brighter, not only bright but white. I really like it, there are no negative effects on my face. If you use this product, you have to use serum or essence or moisturizer first, my advice is to make it easier to apply on the face	My face is brighter, not only bright but white, I really like it, there are no negative effects on my face. If you use this product, you have to use serum or essence or moisturizer first, my advice is to make it easier to apply on the face.

The next stage in preprocessing is transforming cases or often called case folding, namely the process of changing all letters into lower cases (lower case).

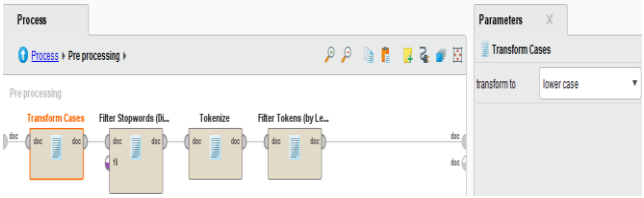

Figure 5. Sub-process Case Folding

The following are the changes before and after the transform cases process:

Tabel 3. Differences Before and After Transform Cases

Before transform cases	After transform cases
When I first started using it, it really suited my face and made my face really bright, but after a while, lots of pimples appeared around my chin. At that time I was still using it because I was hoping for more from this product. Turns out it actually made BO so bad that the scars are still there now.	When I first started using it, it really suited my face and made my face really bright, but after a while, lots of pimples appeared around my chin. At that time, I was still using it because I was hoping for more from this product, but it actually made my face worse, until the scars are still there, it's still really good.
My face is brighter, not only bright but white. I really like it. There are no negative effects on my face. If you use this product, you have to use	My face is brighter, not only bright but white, I really like it, there are no negative effects on my face. If I use this product, I have to use serum or

serum or essence or moisturizer first, my advice is to make it easier to apply on your face.	essence or moisturizer first, my advice is to make it easier to apply on my face.

Removal of Stopwords

At this stage, all words that lack meaning or have no effect will be included in the Indonesian language stoplist.

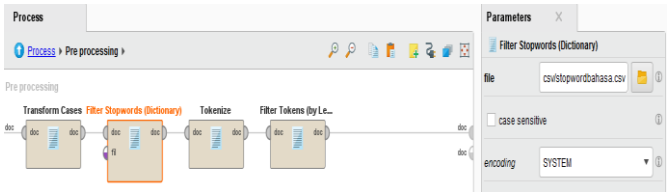

Figure 6. Sub-process Filter Stopwords

The stoplist is done manually in Indonesian because Rapidminer does not have an Indonesian dictionary.

Tokenization

The next stage is tokenization, which is the process of breaking sentences into several parts or tokens. This step is done to make it easier later to weight each existing word.

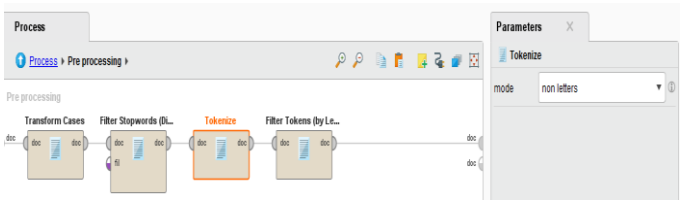

Figure 7. Sub-process Tokenisasi

Here is before and after tokenization:

Tabel 4. Differences Before and After Tokenization

Before tokenization	After tokenization
When I first started using it, it really suited my face and made my face really bright, but after a while, a lot of pimples appeared around my chin. At that time I was still using it because I was hoping for more from this product, but it actually made my face worse, until the scars are still there, it's still really good.	first – use – suitable – really – makes – face – bright – really – but – takes a long time – rashes appear – lots – really – around – chin – time – that – I still – use – because – hope – more – the same – This – product – turns out – actually – makes – worse – to the point where – traces – now – are still – there – items – really
My face is brighter, not only bright but white, I really like it, there are no negative effects on my face. If I use this product, I have to use serum or essence or moisturizer first, my advice is to make it easier to apply on my face.	my face – so – brighter – not – just – bright – but – white – I – really – really – don't – have – any – negative – effects – on my face – if – use – this – product – should – use – serum – or – essence – or – moisturizer – first – if – my suggestion – so that – it is – easier – to apply – on the face

Word Weighting

The next step is TF-IDF word weighting. In weighting words using the TF method, pure TF is used. At this stage, calculations are carried out to calculate the number of occurrences or frequency of occurrence of words in the document. If one text appears 2 times then the text will have a score of 2.

Data Classification

Before data classification is carried out, the data to be classified will be divided into testing data and training data. The 110 data were divided into 80% training data and 20% test data, so there were 88 data as training data and 22 data as test data. After dividing the training data and testing data, the next step is calculating the system classification using the K-Nest Neighbor (K-NN) method.

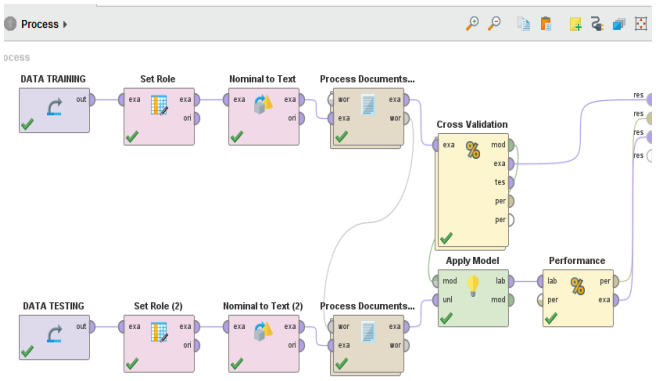

Figure 8. *Classification System Modeling Process*

There is a K-NN modeling process using Rapidminer. There is training data and testing data that has been divided and retrieved into the modeling process. And it will go through the Set Role operator where the sentiment column will be given rules as a "label". After that, it will pass the "Nominal to Text" operator which will change data of the Nominal type to the Text type. And it will also go through the document process.

A. Validation

The validation stage is used to assess how the classifier works and carry out optimizations so that the accuracy results obtained increase. Validation was carried out using K-Fold Cross Validation.

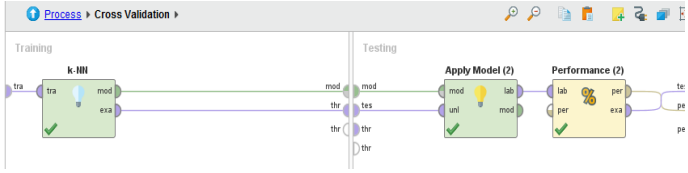

Figure 9. Cross Validation K-NN

Based on the image above, the training data will go through Cross Validation to estimate the performance of the model used, namely the K-NN classification model. After the training data has passed the classification process, the classification model will then be applied to the testing data. Then the performance is calculated.

System Evaluation

The next step taken after the classification system from the training data has been created is testing the system. Here we will see whether the system we have created has high enough accuracy so that it is suitable for use. The confusion matrix usually used in accuracy testing can test precision, recall and f-measure. In the confusion matrix there are 4 terms, including True Positive, True Negative, False Positive and False Negative. The following is the confusion matrix table:

1. Evaluation of K-NN Confusion Matrix

Tabel 5. Accuracy results from the evaluation stage

K (80:20)	*Accuracy*	*Precission*	*Recall*	*F-Measure*
1	*63,64%*	*66,66%*	*76,92%*	*0,869%*
2	*63,64%*	*66,66%*	*76,92%*	*0,869%*
3	*72,73%*	*60,00%*	*42,86%*	*0,868%*
4	*72,73%*	*60,00%*	*42,86%*	*0,868%*
5	*72,73%*	*57,14%*	*57,14%*	*0,726%*
6	*68,18%*	*50,00%*	*42,86%*	*0,598%*
7	*63,64%*	*42,86%*	*42,86%*	*0,299%*
8	*72,73%*	*57,14%*	*57,14%*	*0,726%*
9	*77,27%*	*66,67%*	*57,14%*	*0,724%*
10	*72,73%*	*57,14%*	*57,14%*	*0,726%*

$$Accuracy = \frac{(TP + TN)}{TP + TN + FP + FN} X\ 100$$

$$= \frac{(10 + 4)}{10 + 4 + 5 + 3} X\ 100$$

$$= \frac{14}{22} X\ 100 = 63{,}64\%$$

$$Precision = \frac{TP}{TP + FP} X\ 100$$

$$= \frac{10}{10 + 5} X\ 100$$

$$= \frac{10}{15} X\ 100 = 66{,}66\%$$

$$Recall = \frac{TP}{TP + FN} X\ 100$$

$$= \frac{10}{10 + 3} X\ 100$$

$$= \frac{10}{13} X\ 100 = 76{,}92\%$$

$$F - Measure = 2.\frac{Precision\ .Recall}{Precision + Recall}$$

$$= 2.\frac{(66{,}66\%\ X\ 76{,}92\%)}{66{,}66\% + 76{,}92\%}$$

$$2.\frac{0{,}512}{1{,}179} = 0{,}869\%$$

Tabel 1.Confusion Matrix K-NN

Prediction	Actual	
	True Positive	True Negative
Positive	10	3
Negative	5	4

From the table above, it can be seen that true positive (TP) is all positive category data that has been successfully classified or predicted to be positive, namely 10 data. True negative (TN) is all negative category data that has been successfully classified or predicted to be negative, namely 4 data. There are false positives (FP), which means all data that is categorized as negative but is classified or predicted to be positive, namely 5 data. Meanwhile, false negative (FN) means all data that is categorized as positive but is classified or predicted to be negative, namely 3 data.

Accuracy is the amount of all data that has been classified correctly, both positive and negative data, divided by the total amount of data, resulting in a result of 63.64%. Precision is all true positive data divided by all data classified as positive, resulting in a result of 66.66%. Recall is the amount of data that was correctly classified as positive divided by all data that was classified as positive, both true positive and false negative, resulting in a result of 76.92%. And to calculate the f-measure, the product of precision and recall is divided by the product of precision and recall added and then multiplied by 2, and the result is 0.869%.

Visualization of Analysis Results

Visualization of the results of analyzing public sentiment towards MS Glow cosmetic products will be visualized in wordcloud graphs and pie charts.

Figure 10. Wordcloud Sentimen Positive

The display above is a visualization of the results of positive sentiment analysis. This visualization aims to display the most words or words that frequently appear in positive sentiment text documents. The intensity of the number of words used is indicated by the size of the letters on. In the display above, the letters in the word pake have the largest size, so the word pake is a word that often appears in positive sentiment. Next is a negative sentiment wordcloud display

Figure 11. Wordcloud Sentimen Negative

The display above is a Wordcloud visualization of the results of negative sentiment analysis. This visualization shows that the letters in the word pake have the largest size, so the word pake is a word that often appears in negative sentiment.

The pictures above show similarities such as positive sentiment wordclouds and negative sentiment wordclouds, but of course there is a difference, namely the word "cream" which shows that these comments have positive sentiments. There are also words in this visualization but their frequency of appearance is not very large. Web Female Daily users also

criticized the MS Glow cosmetic product as not being suitable for all skin types, but of course more users had a positive opinion.

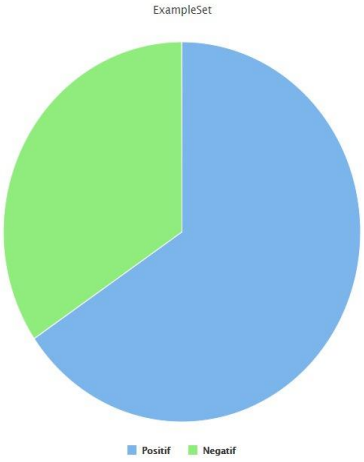

Figure 12. Diagram Pie Hasil Analisis Sentimen

The display above is a Pie Diagram visualization of the results of sentiment analysis regarding public responses to MS Glow cosmetic products. This visualization aims to display the percentage of positive and negative classifications. From the picture above, we can see that there are still many responses with positive sentiment compared to negative sentiment.

4. Conclusion

From the data that has been taken (crawled) from the Female Daily web in the period June 2021 to December 2021, there are 110 pieces of data in text form. So the results obtained are that there are more MS Glow product users who have positive opinions than those who have negative opinions. The evaluation results of the highest classification determination from the K-Nearest Neighbor (KNN) method are found in positive sentiment which is classified as positive (TP) at 10% of the data compared to negative sentiment which is classified as negative (TN) at 4% of the data. As well as the results of accuracy testing obtained from sentiment analysis of MS Glow cosmetic product users using the K-Nearest Neighbor (KNN) method obtained an accuracy value of 63.64% for K=1.

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