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Comparison of the Accuracy of Sentiment Analysis on the Twitter of the DKI Jakarta Provincial Government during the COVID-19 Vaccine Time

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ABSTRACT

Currently, the Government is intensively utilizing social media, one of which is Twitter as a place of interaction with the community. The results of these interactions can be used as feedback to determine whether public opinion on public policies is positive or negative. Tweets from users can be a supporting parameter for the government in evaluating future policies and decision making by applying the sentiment analysis method. This study aims to determine positive or negative sentiments on user tweets against the official twitter account of the DKI Jakarta Provincial Government during the COVID19 vaccine period. The data obtained are 1658 lines from March 30 to April 5, 2021 with queries on tweets containing words or mentioning the username @dkijakarta, which will be grouped by sentiment class, namely negative and positive using the TF-IDF Vectorizer for word weighting and classification using several methods, namely, nave Bayes with accuracy values. 82.50% with class recall on positive sentiment 88% and negative 77% and in class precision showing positive at 79.28% and negative at 86.52% in the rapid miner application then k-NN with an accuracy value of 81.50% with class recall on positive sentiment 85% and negative 78% and class precision shows positive at 79.44% and negative at 83.87% in the rapid miner application. And the accuracy value of the best method in this training data classification comparison is nave Bayes, the results the end of testing the sample dataset using the nave Bayes method with 84.80% accuracy with class recall at 85.01% positive sentiment and 84.59% negative sentiment and at c lass precision shows positive at 85.21% and negative at 84.38% in rapid mining applications.

1. Introduction

In the current rapid development of internet technology, the dissemination of information through internet media has increased significantly, social media is one of the means of disseminating information through internet technology. Social media users are also not only consumers of information, but also as producers of information [1][2].

Social media Twitter is one of the popular media that is widely used in disseminating information. Tweets in Twitter are used by users to read and send text-based information. Twitter is one of the well-known micro blogging services where users can read and post messages that are 140 characters long [3][4]. Tweets can contain an opinion from the user on the events he experienced.

Government agencies currently use social media a lot to interact with the public, one of which is using Twitter. The DKI Jakarta provincial government, one of which has used Twitter social media which has the username @dkijakarta, is now a forum for interaction between the community and the community DKI Jakarta provincial government in social media. In its use, people can ask directly about government policies, public services or even just comment to socialize with the community. Opinions can be used as an assessment for a company or agency [5][6].

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Coronavirus disease 2019 was officially designated by the World Health Organization as a global pandemic on March 11, 2020 [7]. The pandemic that has hit the world to date has paralyzed several sectors due to strict interaction restrictions, until finally a vaccine was found at the end of 2020. Vaccinations have been carried out in Indonesia, including the DKI Jakarta province, the vaccination was opened by the Governor of DKI Jakarta Anies Baswedan on January 15, 2021 then. The DKI Jakarta Health Office has provided 474 health service facilities spread across six cities/districts in the capital city which has become an interesting issue. From the amount of information on social media, the author will try to process text data from one of the social media, namely Twitter which will be appointed as scientific research in Data Mining [8][9].

Sentiment analysis is part of machine learning and natural language processing that can be used in classifying a text mining into categories of positive, negative opinions [10][11]. In the process, the tweet data will be taken by the author using the Twitter API (Application Programming Interface) crawling method in the Indonesian-language Rapidminer 9.9 application within a certain time, then the data that has been taken will be processed by the author using the text mining method using the nave Bayes algorithm and k-Nearest Neighbor (k-NN) to measure the value of positive and negative tweet sentiment, the author will compare the accuracy value of the algorithm used, from the highest algorithm accuracy value will be used as a reference to the parties in need[12][13].

2. Method

The stages of the research can be seen in Fig 1:

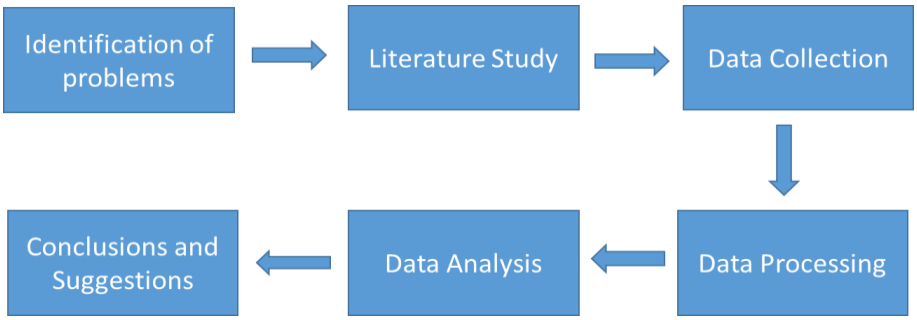

Fig 1. Research Stage

2.1 Research Stages

- Identification of problems
  Based on the background of the problem that has been known, the identification of research problems is formulated as follows: (i) With so many issues on social media that are currently trending, one of them is tweets from Twitter that have not been fully utilized. (ii) With so many algorithms in the text mining process, the writer wants to find the best algorithm from nave Bayes and k-Nearest Neighbor (k-NN) in the application of sentiment analysis on Twitter.
- Literature Study
  This literature study was conducted to determine the research model that occurred in the field of sentiment analysis, this literature study was conducted to review existing journals and used to determine case studies.
- Data Collection
  This data collection was carried out to strengthen the reasons why this research should be carried out, data collection was taken from a direct source, namely the official website twitter.com with the keyword @dkijakarta. Here are the stages of data collection that the author did in compiling this research using observation techniques, this was done to observe object to be studied. In this study, by observing comments from the DKI Jakarta City Government account, there are many kinds of comments given by users on this application

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which makes the author conduct research on the percentage of classification of public comments on the twitter.com website.

- Data Processing
  Data Processing Using the Rapidminer Application. After carrying out the data collection stage, the next stage is data processing using the Naïve Bayes method and k-NN, by analyzing the problem object based on predetermined criteria, the data that has been collected is then processed based on the method stages to produce output.
- Data Analysis
  The results of data analysis with the RapidMiner Application are information that can be understood and useful for problem solving, especially problems related to research, which can later be used in drawing conclusions.
- Conclusions and Suggestions
  The final stage of this process is drawing conclusions based on the results of data processing and analysis, as well as providing suggestions as proposed improvements to problems that are considered appropriate and more useful for users.

2.2 Research Instruments

In this Experimental Instrument, data is taken by using a crawling technique using the Twitter API on Rapidminer 9.9 which is in Indonesian language until April 5, 2021 with a total of 1658 tweets. After getting the crawled data and the data is used as test data and training data, the next stage is the labeling process on the training data by dividing the sentiment class into two classes, namely positive, negative by comparing the algorithm to be used, namely nave Bayes, and k-Nearest Neighbor (k-NN). From the results of the best method that will be used to predict sentiment in this observation..

2.3 Data Collection Method, Population and Research Sample

2.3.1 Method of collecting data

In this observation, the author observes the object to be studied in the comments of @dkijakarta's tweet, while there are many kinds of comments given by users on twitter which makes the author conduct research in the classification method. community comments on https://twitter.com. divided into two sentiments, namely positive and negative and processed manual in excel, using two comparison algorithms, namely nave Bayes and k-NN as an experiment.

2.3.2 Population

In the population of user tweet comments with the keyword @dkijakarta at https://twitter.com which will be used as a dataset and training data, the author sees a lot of data sources that can be processed by data mining so that it can generate data a number of 1658 tweets from 30 March to 5 April 2021, in processing data mining, the author tries to experiment with the sentiment analysis method sourced from tweets by measuring positive and negative values in tweet comment sentiment at the DKI JAKARTA City Government.

2.3.3 Sample and research

The data taken is tweet data from twitter users, at this stage the author takes a sample of data on tweets with the Rapidminer application with the keywords @dkijakarta and the Indonesian language. The following is a sample of tweets.

Table 1 Data Test

Text
Halo Sahabat Lingkungan, Kali yang bersih membuat pemandangan semakin indah. Lokasi ini berada di Kali BKB Jati Pulo Jl. Inspeksi BKB (Pompa Pondok Bandung)

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Kec. Palmerah Jakarta Barat. . Yuk jaga kebersihan kali kita. . @dkijakarta @aniesbaswedan @arizapatria https://t.co/mwbroqccK0
Kamis (1/4) lalu @PT_Transjakarta menggandeng Universitas Nahdlatul Ulama Indonesia (UNUSIA) dan Universitas Nahdlatul Ulama (UNU) Yogyakarta, untuk memberi masukan dan penelitian desain mushola di halte Transjakarta. https://t.co/6aQVTcvDpJ #dkijakarta #transjakarta #jaklingko https://t.co/TUX9zzBzPD
Yg lebih ngeri lagi, Gub @DKIJakarta sangat dekat, mendukung & mempromosikan FPI terus iya kan Nies @aniesbaswedan Terkuak! Husein Hasny (FPI) Biayai Perakitan Bom hingga Rancang Aksi Amaliyah https://t.co/I2D6IUjfyJ #KitaTidakTakut
RT @MardaniAliSera: Dari Rakerwil @pks_dkijakarta langsung menghadiri pernikahan putri Dr. K.H. Marsudi Syuhud (Ketua PBNU @nahdlatululama…
RT @Blood4LifeID: #BFL15_03042021 RD #BFL_GREEN #JakartaSelatan #DKIJakarta | B+ | Tn IR Zaitun https://t.co/kcxSZLIBrV | @poeticpicture cc…
#BFL15_03042021 RD #BFL_GREEN #JakartaSelatan #DKIJakarta | B+ | Tn IR Zaitun https://t.co/kcxSZLIBrV | @poeticpicture cc @jktinfo_id @jktinformasi @jktinfo_ @JKTinfo @BeritaJakarta @jakpost @Delta_FM TERPENUHI

Table 2. Data Training

Text	Sentimen
Halo Sahabat Lingkungan, Kali yang bersih membuat pemandangan semakin indah. Lokasi ini berada di Kali BKB Jati Pulo Jl. Inspeksi BKB (Pompa Pondok Bandung) Kec. Palmerah Jakarta Barat. . Yuk jaga kebersihan kali kita. . @dkijakarta @aniesbaswedan @arizapatria https://t.co/mwbroqccK0	Positif
Kamis (1/4) lalu @PT_Transjakarta menggandeng Universitas Nahdlatul Ulama Indonesia (UNUSIA) dan Universitas Nahdlatul Ulama (UNU) Yogyakarta, untuk memberi masukan dan penelitian desain mushola di halte Transjakarta. https://t.co/6aQVTcvDpJ #dkijakarta #transjakarta #jaklingko https://t.co/TUX9zzBzPD	Positif
Yg lebih ngeri lagi, Gub @DKIJakarta sangat dekat, mendukung & mempromosikan FPI terus iya kan Nies @aniesbaswedan Terkuak! Husein Hasny (FPI) Biayai Perakitan Bom hingga Rancang Aksi Amaliyah https://t.co/I2D6IUjfyJ #KitaTidakTakut	Negatif
@DzakwanFirst @FNurhuda28 @DKIJakarta @aniesbaswedan Drun, berapa banyak Mesjid2 di jakarta yg dipasang spanduk Intimidasi mayat sm teamnya anies ? Apa itu gak bikin ketakutan warga sekitarnya? Kasus Nenek Hindun karena viral, makanya direspon sm anies. Goblok loe sdh akut drun. Nih strategi teamnya anies.	Negatif

http://dx.doi.org/10.36596/jcse.v3i1.249

https://t.co/lyInOfK0Xh	
RT @bank_indonesia: Transaksi digital terus tumbuh seiring meningkatnya minat masyarakat akan sistem pembayaran yang mudah. #SobatRupiah, j…	Positif
Halo #SobatRupiah #AnakJakarte jangan lupa ikutan rangkaian acara FEKDI 5-8 April 2021 ?? Kunjungi https://t.co/g02kRxzd85 untuk informasi acara lebih lanjut. https://t.co/py97X6s0Rb	Positif

After carrying out the data collection techniques above, the comments that have been obtained from tweets must have standard words. There are several everyday words that appear in this study which have meanings with irregular or shortened writing, therefore the author changes these everyday words into standard words according to the dictionary used, namely Liu's word list. In this study using the manual change method. Here are the words that are converted into standard words.

Table 3. Raw Words

Before	After
tdk	tidak
ga	tidak
tak	tidak
gak	tidak
belm	belum
blm	belum
bl	belum
bgt	banget
knp	kenapa

2.4 Data analysis method

In the Fig 2, author will explain that the flow of the analysis method has 4 steps that run sequentially.

Fig 2. Analysis Stage

2.4.1 Crawling

The data collection method is carried out using a crawling technique using the Twitter API key. The data is taken with the keyword @dkijakarta and filtered only those in Indonesian.

2.4.2 Preprocessing

There are several stages used in text preprocessing:

- **Case Folding**: Transforms all letters in the document to lowercase.
- **Cleaning text**: Removal of unnecessary characters, symbols, username (@username), URL and punctuation.
- **Tokenize**: Splitting of existing text documents or sentences into word pieces called tokens.
- **Stemming**: The process of stemming is the process of transforming a word into a root word. For stemming in Indonesian, change the words with affixes in Indonesian into the basic form of the word.
- **Stopword removal**: the removal of words contained in the stopword list containing unimportant or meaningless words such as conjunctions or prepositions.

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2.4.3 TF-IDF

Carried out for word weighting of each tweet data. The formula for TF-IDF is:

$$TF = \frac{Term\ frequency\ in\ one\ document}{Total\ Words\ in\ one\ document} \quad (1)$$

$$IDF = LOG \frac{Total\ Documents + 1}{Frequency\ Document\ contains\ Term} \quad (2)$$

$$TF - IDF = TF \times IDF$$

In this research in the implementation of TF-IDF to convert data into vector form.

2.4.4 Classification Test

- Naïve Bayes: This method uses a conditional probability calculation or commonly known as the Bayes theorem. In Text mining, the type that is suitable for use is Multinomial Naive Bayes [14].
- K-Nearest Neighbor (k-NN) this method is to classify objects based on training data using the closest distance or similarity to certain objects [15].

3. Results and Discussion

In chapter III the author will describe the results of the research and discussion based on the analytical method in chapter II in order to get the best accuracy value for the algorithm being tested.

3.1 Crawling

The image below shows the data crawling technique with rapid miner 9.9 which produces 1568 tweet data.

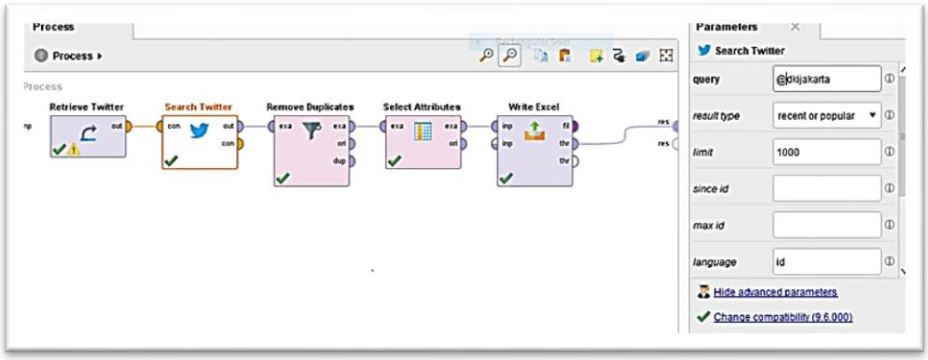

Fig 3. Crawling

Table 4. Crawling Results

Text
@DKIJakarta Kenapa saat saya klik disebut no laporan tidak valid? https://t.co/JzWqxr5gw7
RT @DKIJakarta: Saat ini, banyak UMKM online yang memotret produknya dengan smartphone dikarenakan kemudahan dalam pengoperasian. Meskipun…
RT @Uki23: Kalau mengikutkan data BPBD tahun 2016, 2017, 2018 ada fakta yang disembunyikan Pemprov DKI. Jumlah pengungsi meningkat 2016: 7…
RT @humasjakfire: Salah satu unit yang diturunkan Dinas Penanggulangan Kebakaran dan Penyelamatan DKI Jakarta untuk menanggulangi kebakaran…
Monitoring Kondisi di Underpass Angkasa, Matraman, Senen, Dukuh Atas dan Senen Extension Wilayah Jakarta Pusat, Terpantau dalam Kondisi Aman, lancar dan Cuaca Mendung, Senin (05/04/2021) #AniesBaswedan #DKIJakarta #BinaMarga

http://dx.doi.org/10.36596/jcse.v3i1.249

#HariNugroho #kominfotikjp #underpass #binamargajakpus https://t.co/w4adSjxqiV

3.2 Preprocessing

3.2.1 Case Folding

Transforms all letters in the document to lowercase.

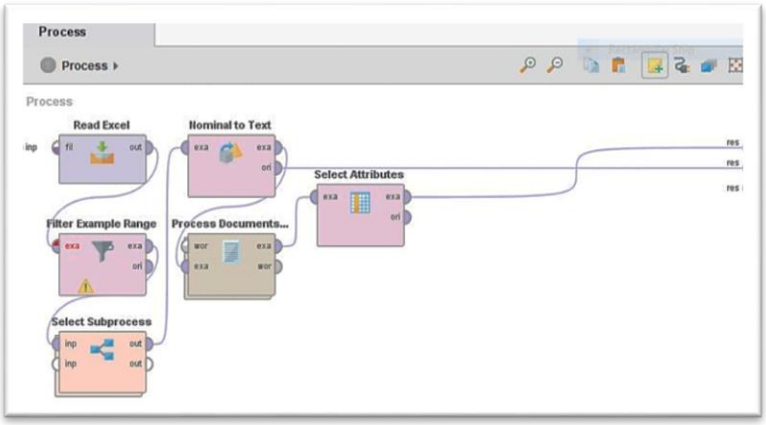

Fig 4. Case Folding Process

Table 5. Results After Case Folding

Text
@dkijakarta kenapa saat saya klik disebut no laporan tidak valid 3/3
rt @dkijakarta: saat ini, banyak umkm online yang memotret produknya dengan smartphone dikarenakan kemudahan dalam pengoperasian. meskipun…
rt @uki23: kalau mengikutkan data bpbd tahun 2016, 2017, 2018 ada fakta yang disembunyikan pemprov dki. jumlah pengungsi meningkat 2016: 7…
rt @humasjakfire: salah satu unit yang diturunkan dinas penanggulangan kebakaran dan penyalamatan dki jakarta untuk menanggulangi kebakaran…
monitoring kondisi di underpass angkasa, matraman, senen, dukuh atas dan senen extension wilayah jakarta pusat, terpantau dalam kondisi aman, lancar dan cuaca mendung, senin (05/04/2021) #aniesbaswedan #dkijakarta #binamarga #harinugroho #kominfotikjp #underpass #binamargajakpus

3.2.2 Cleaning text

Removal of unnecessary characters, symbols, username (@username), URLs and punctuation marks and Tokenize: Splitting existing text documents or sentences into chunks of words called tokens.

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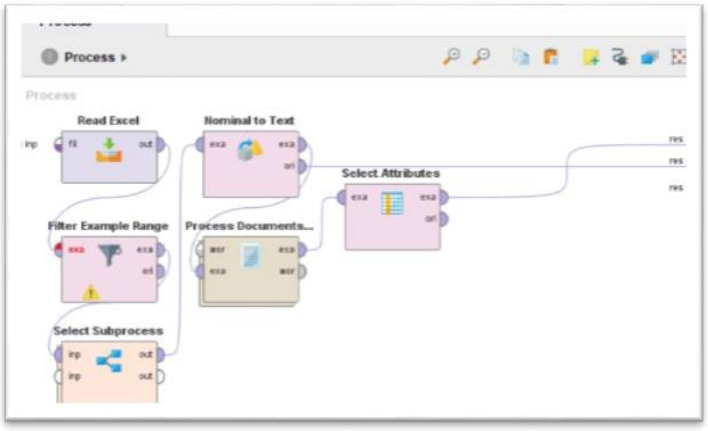

Fig 5. The process of cleaning text and tokenize

Fig 6. Process documents from data

Table 6. Results After cleaning text and tokenize

Text
dkijakarta kenapa saat saya klik disebut laporan tidak valid
dkijakarta saat ini banyak umkm online yang memotret produknya dengan smartphone dikarenakan kemudahan dalam pengoperasian meskipun
uki kalau mengikutkan data bpbd tahun ada fakta yang disembunyikan pemprov dki jumlah pengungsi meningkat
humasjakfire salah satu unit yang diturunkan dinas penanggulangan kebakaran dan penyalamatan dki jakarta untuk menanggulangi kebakaran
monitoring kondisi underpass angkasa matraman senen dukuh atas dan senen extension wilayah jakarta pusat terpantau dalam kondisi aman lancar dan cuaca mendung senin aniesbaswedan dkijakarta binamarga harinugroho kominfotikjp underpass binamargajakpus

The table above is the result after cleaning text and tokenize in the rapid miner application.

3.2.3 Stemming

The process of transforming a word into a root word. For stemming in Indonesian, changing the words with affixes in Indonesian into the basic form of the word.

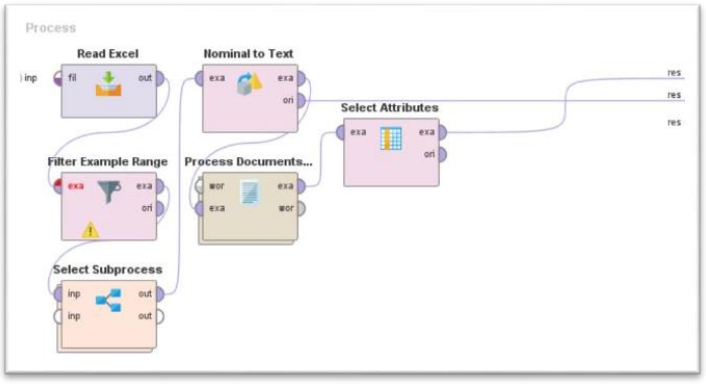

Fig 7. Stemming Process

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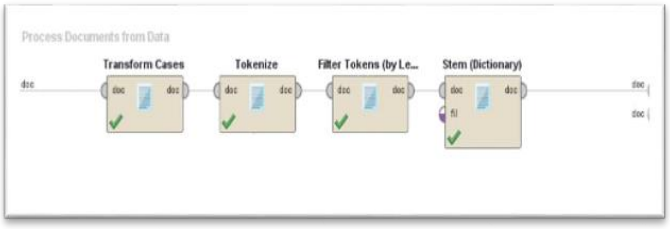

Fig 8. Document Stemming Process

In the picture above is part of the stemming process in process documents by adding operators transform cases, tokens and filter tokens by length and Stem (dictionary)

Table 7. Results After Stemming

Text
dkijakarta kenapa saat saya klik sebut lapor tidak valid
dkijakarta saat ini banyak umkm online yang potret produk dengan smart phone karena mudah dalam oprasi meski
uki kalau ikut data bpbd tahun ada fakta yang sembunyi pemprov dki jumlah pengungsi meningkat
humasjakfire salah satu unit yang turun dinas penanggulangan bakar dan selamat dki jakarta untuk menanggulangi bakar
monitor kondisi underpass angkasa matraman senen dukuh atas dan senen extension wilayah jakarta pusat pantau dalam kondisi aman lancar dan cuaca mendung senin aniesbaswedan dkijakarta binamarga harinugroho kominfotikjp underpass binamargajakpus

3.2.4 Stopword removal

Deletion of words contained in the stopword list containing words that are not important or have no meaning such as conjunctions or prepositions.

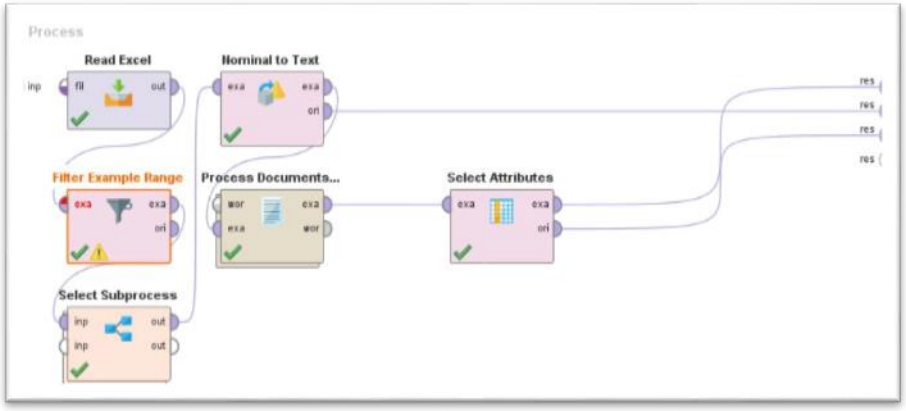

Fig 9. Stop Word Process

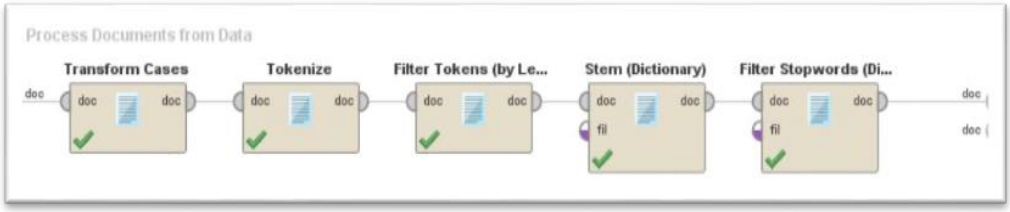

Fig 10. Stop Word Document Process

In the picture above is part of the stemming process in process documents by adding operators transform cases, tokens and filter tokens by length, Stem (dictionary) and filter stopwords (dictionary).

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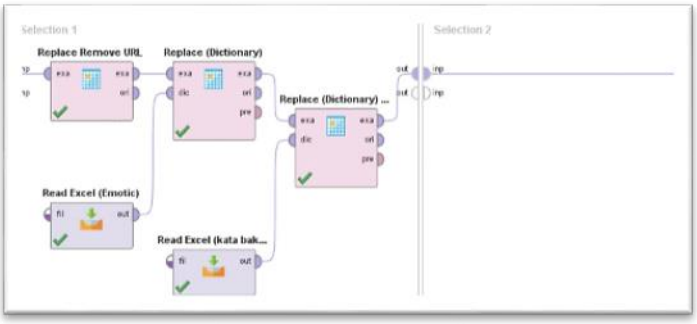

Fig 11. Stop Word Subprocess Process

In the picture above is part of the stop word process in select Stop Word subprocess by adding the operator Replace remove URL, replace (dictionary), read excel emoticons and standard words.

Table 8. Results After Stop Word

Text
dkijakarta kenapa klik lapor tidak valid
dkijakarta umkm online potret produk smart phone mudah oprasi
uki data bpbd fakta sembunyi pemprov dki pengungsi meningkat
humasjakfire salah unit turun dinas penanggulangan bakar selamat dki jakarta menanggulangi bakar
monitor kondisi underpass angkasa matraman senen dukuh senen extension wilayah jakarta pusat pantau kondisi aman lancar cuaca mendung senin aniesbaswedan dkijakarta binamarga harinugroho kominfotikjp underpass binamargajakpus

3.3 Extrasi Fiture TF-IDF

Carried out for word weighting of each tweet data.

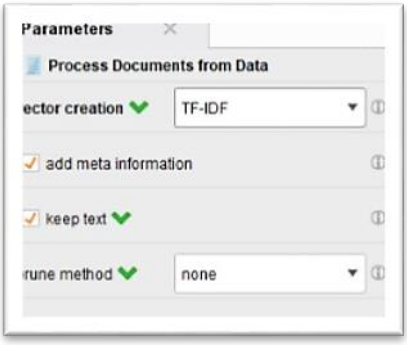

Fig 12. Vector Criteria TF-IDF

3.4 Classification Test

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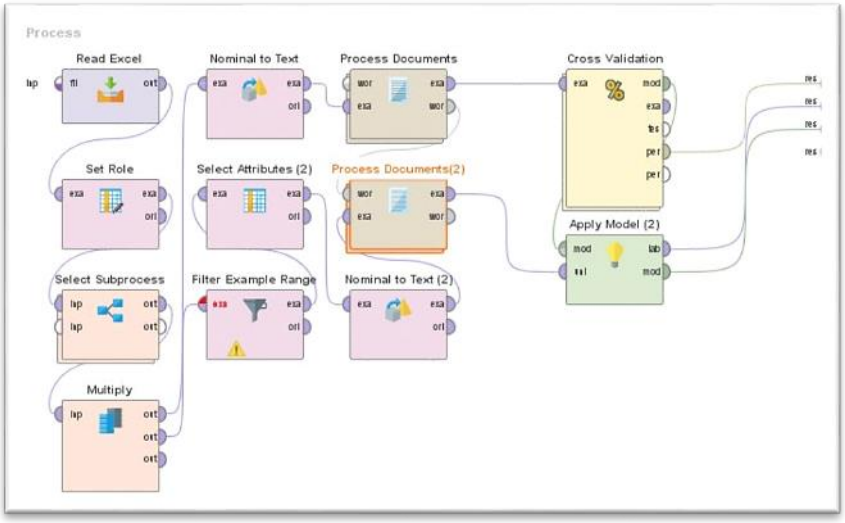

Fig 13. Training data comparison process

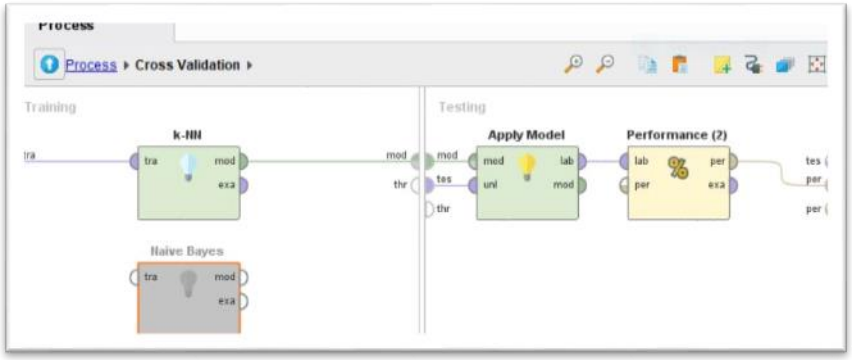

Fig 14. k-NN Cross Cross Validation Process

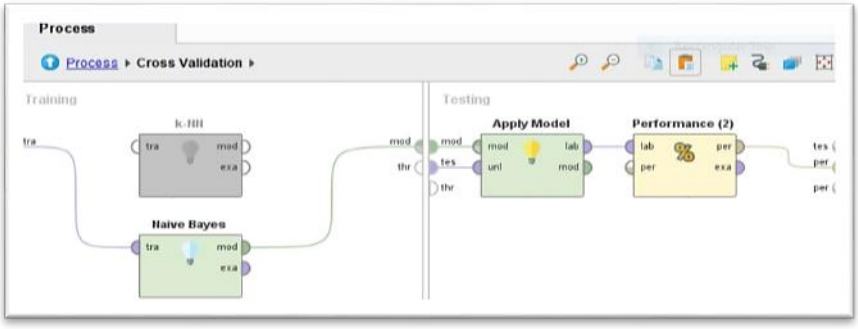

Fig 15. Naïve Bayes Cross Validation Process

3.5 Results

Table 9. Accuracy results of k-NN and Naïve Bayes training data

	Accuracy : 82,50 %					
	True.Positif NBC	**True.Negatif NBC**	**True.Positif k-NN**	**True.Negatif k-NN**	**Class.Precision NBC**	**Class.Precision k-NN**
Pred.Positif	88	23	85	22	79,28%	79,44%
Pred.Negatif	12	77	15	78	86,52%	83,87%
Class recall	88,00%	77,00%	85,00%	78,00%		

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The table above is the result of the accuracy of k-NN on 81.50% training data testing with class recall at 85% positive sentiment and 78% negative and in class precision showing positive at 79.44% and negative at 83.87% in the rapid application miner.

The table above is the result of the Naïve Bayes accuracy on the training data test which is 82.50% higher than k-NN with class recall at 88% positive and 77% negative sentiment and the class precision showing positive at 79.28% and negative at 86,52% in the rapid miner application, so it can be concluded that the nave Bayes method of testing the training data gets the best accuracy and will be used for further data set research. Graph of k-NN and Naïve Bayes Training Training Data Accuracy Results shown in Fig 16.

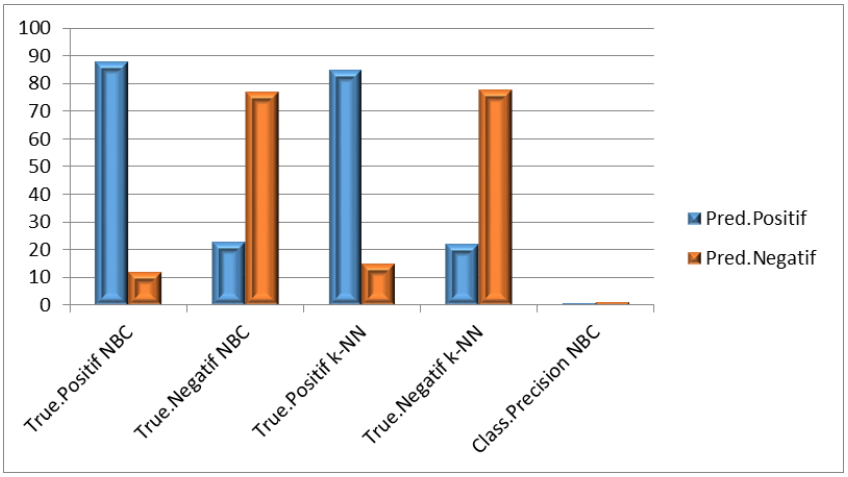

Fig 16. Graph of k-NN and Naïve Bayes Training Training Data Accuracy Results

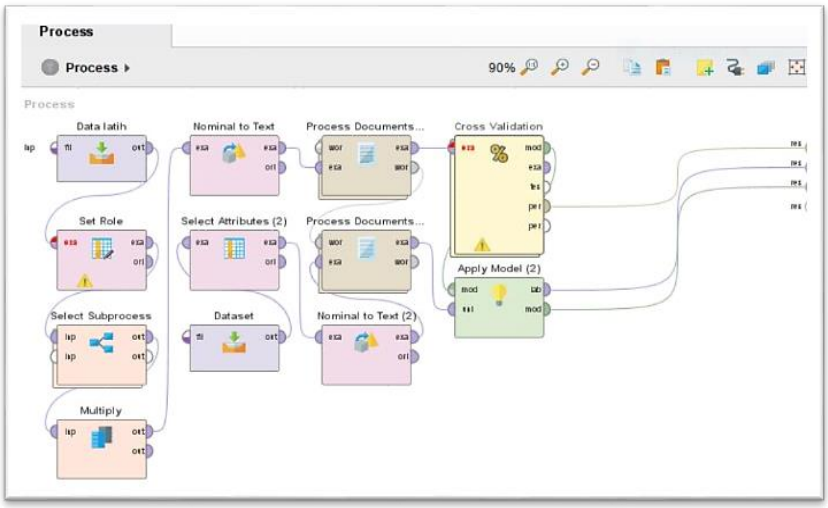

Fig 17. Nave Bayes Dataset Process

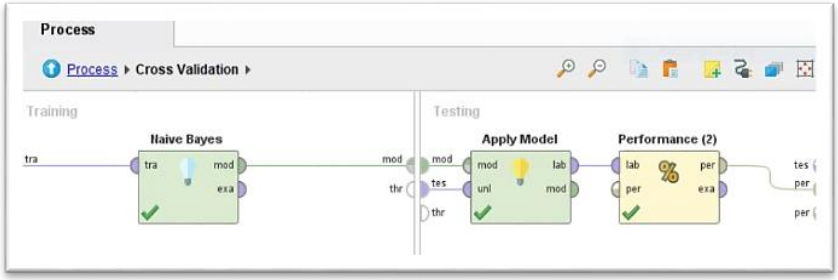

Fig 18. Process of Cross Validation Naïve Bayes dataset

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Table 10. Accuracy dataset results

Accuracy : 84,80 %			
	True.Positif	**True.Negatif**	**Class.Precision**
Pred.Positif	720	125	85,21%
Pred.Negatif	127	686	84,38%
Class recall	85,01%	84,59%	

The table above is the result of accuracy in testing the dataset of 84.80% with class recall at 85.01% positive sentiment and negative 84.59% and class precision showing positive at 85.21% and negative at 84.38% in the rapid application miner.

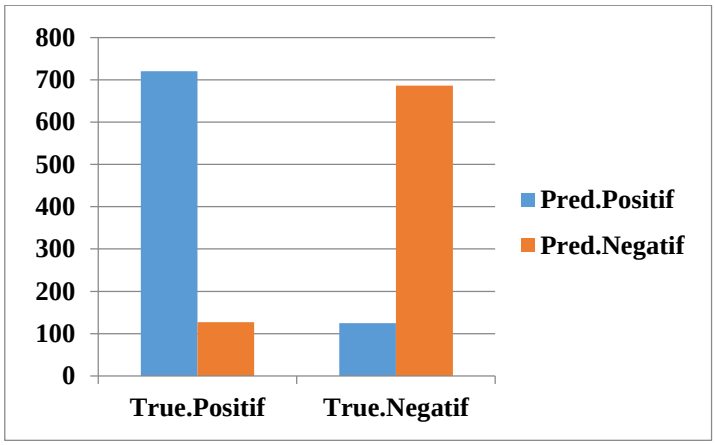

Fig 19. Graph of Accuracy Dataset Results

The Fig 19 above is the result of Graph in the dataset process with a comparison that shows that the number of positives is more than the number of negatives.

4. Conclusion

The final results of testing the sample dataset using the nave Bayes method with accuracy with an accuracy of 84.80% with class recall at 85.01% positive sentiment and negative 84.59% and in class precision showing positive at 85.21% and negative at 84 ,38% in the rapid miner application.

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