Sentiment Analysis of Food Order Tweets to Find Out Customer Demographic Profile using SVM

Syahril Efendi , Poltak Sihombing
Universitas Sumatra Utara, Indonesia

ABSTRACT

The use of online food ordering through food systems or applications continues to increase, requiring vendors to implement marketing and sales strategies through surveys, feedback. The problems that arise are building a system analysis model from a collection of tweets with hashtags or usernames for ordering food online . The Support Vector Machine (SVM) algorithm is used for text classification. Tweets are collected into data sets, training data, and testing data, then a classification model of the SVM Algorithm is built. Preprocessing data, tweets are cleansing, tokenized, and stopword remove. From the collected tweets, they are grouped into 10 variables to identify demographic profiles. The results of the analysis are classified as positive sentiments, namely residence, price range, using promos, paid types, halal food while negative sentiments are ethnicity, culture, vegetarianism, place. Classification accuracy is important to validate the results of the SVM model. From 500 train data tweet, the resulting classification is 66% positive sentiment and 34% negative sentiment. Overall accuracy model Linier SVM result 83.2% with accuracy 92.55%.

Corresponding Author:

Syahril Efendi,
Computer Science,
Univerisitas Sumatra Utara, Indonesia
Email: syahril@usu.ac.id

1. INTRODUCTION

Fast food has become a lifestyle today regardless of age, social class, age, gender, income, etc. The tendency to follow an all-online lifestyle due to the use of food messages during the pandemic has encouraged the expansion of the food industry not only in the form of true drive fast food restaurant, but also in the development of online food ordering [1, 2]. Generally fast food customers choose fast food service because it is practical, there are many menus available and prices are relatively affordable [3] Culinary businessmen must know market segments to achieve sales targets through surveys, off-line and online actual information that provides various research information [4]. The survey conducted by Databoks regarding fast food explained that online food orders are increasingly popular, the average method of ordering ready-to-eat food is for a week.

Gojek released the results of research on the food delivery service market conducted by Nielsen Singapore, entitled "Understanding Indonesia's Online Food Delivery Market". The survey results present some of the latest data on culinary consumer behavior [5]. The demographics of delivery service consumers differ for lunch and dinner times. Some employees at lunch time ordering food online at work, workers aged 26-35 years as executives or managers (22%), and private employees (44%).

Sentiment analysis functions to extract opinion data, understand and process textual data is directly analyzed to see the sentiments that arise in the opinion [6]. Each word of a sentence has a syntactic role that defines how it is used. Syntactic roles are also known as part of speech [7].

On Twitter, online motorcycle taxi companies have official accounts to inform services and receive tweet comments from the public and customers. Text polarity classification is done on documents, sentences [8, 9]. Sentiment analysis is tasked with classifying polarity, meaning check whether the text in a document, sentence, or opinion contains positive or negative aspects [10]. Support Vector Machine (SVM) the method used for learning is like a machine according to statistical science theory. Support SVM is the analysis stage in machine learning techniques by analyzing the sentiments that arise through system learning by utilizing the hypothetical space of the linear function of the feature space that has high dimensions of the application of learning sourced from the theory of learning knowledge of statistics [11, 12].

The process of learning stages in the SVM algorithm is used to get the results of the hypothesis in the form of the best divisor field which not only serves to produce minimal empirical risk, namely the average error in the data to be trained, but also serves to generalize good [13]. The ability of the hypothesis on generalization to classify data that is not contained in the training data correctly. The best way to ensure generalization is done, SVM uses the princip of Structural Risk Minimization (SRM). SRM by ascertaining the limits of generalizability to the test data through control of the results of the hypothesis [14].

Platform-based online transportation services create official social media accounts to inform the latest services and updates so as to facilitate communication with customers like Gojekindonesia's Instagram page using Frequency Document Reverse Frequency (TF-IDF). VSM (Vector Space Model) or Bag of Words BOW document or text representation how to make a model of the word order contained in the document as well as grammar. Empirical studies of halal food show that the quality of the final product is a determining factor in the strength of food producers in the industry. The research model uses a Structural Equation Model (SEM) [15].

It is very important for marketing food delivery services to find out customer profile data information aimed at increasing customer purchasing power. In this study, the analysis of customer profiles from tweet comments related to the identity of the customer profile. with the SVM algorithm can be identified displayed by the best hyperplane. The Support Vector Machine algorithm provides a feature that can ignore the presence of outliers and can determine the best hyperplane with the maximum margin value. Handling training data set errors using the principle of Structural Risk [16].

The sentiment analysis step begins with data validation through data cleaning, tokenizing sentences and words, and stopword remove. Data errors are corrected through the SRM principle of the SVM method. Forming an SVM model in order to be able to class tweets what positive or negative, in order to obtain any attributes that are classified as positive tweets or negative tweets through training, testing and validation. The resulting grouping of tweets can be used to examine the effect of each variable in the form of sentiment.

This study presents four parts, namely: introduction, this section explains the background of the problem, research gaps, and research objectives. the second part is the research method in this section the researcher explains how to collect information or data and perform data processing on the data that has been obtained. the third section Results and Analysis at this stage describes the results of testing and data validation using SVM, and the conclusions in this section explain the conclusions of the study and suggestions for further research.

2. RESEARCH METHOD

The analysis in this study was taken from a collection of online customer opinions stored in a document. Customer opinions including feedback comments are used as training data with labels and test data without labels. The details of the research stages are drawn as shown in Figure 1.
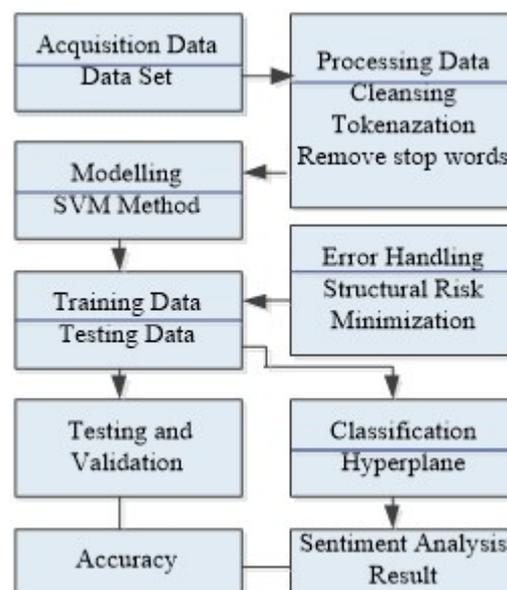

Figure 1. Research Flows

Explanation of research stages :

1. Acquisition Data

   Access twitter using the API using consumer key and consumer API Secret by collecting historical tweets with time period. Number of positive sentiment responses and negative responses between tweets taken using a glossary with keywords through data inputwhich will be processed with sources from tweets and mentions @deliveryfood @customersfood. From this data, some of it becomes training data and part of it becomes test data.

2. Processing Data

   Preprocessing is carried out to eliminate parts or text that are not needed so as to get quality data to be processed. There are several stages carried out on preprocessing:

   1) Cleansing

      This stage is the elimination of non-alphabetic characters to reduce noise. The characters that are removed punctuation marks.

   2) Tokenization

      In the tokenization process, spaces and punctuation marks are used to perform token splits on each document. The words are separated from the original text without seeing any duplication. In this process, terms of type integer and punctuation will be omitted.

   3) Stopwords Removal

      Stopword is in the form of words in general form, does not affect the grouping of texts and does not even have an effect in processing text. These words are considered less important to be used in text processing because they do not add information and do not show their relevance to the text.

3. SVM Method Modelling

   The SVM algorithm The model is used to determine the dividing line between positive and negative data groups using a hyperplane. The hyperplane is indicated by a margin with a maximum point. Margin in hyperlane is obtained from the distance between the closest data between two different classes, also called support vector. The basic method of SVM classification is described in the SVM concept of finding the best hyperlane among an unlimited number of functions. Characteristics of

Support Vector Machine (SVM):
  1) SVM is using linear classification.
  2) The pattern identification stage through the data transformation process, namely from the entry space to a higher dimensional space, then optimizing it in a new vector space. SVM always works on the SRM principle to ensure that there is a generalization stage.
  3) The working principle of the SVM method is basic in two classifications.

The positioning of the hyperplane is the main part of the SVM method. Linear SVM model shows a collection of points in an area consisting of two colors, then grouping them so that the points that have been separated. The results of the data obtained are then mapped in the same space and characterized in the upper category of the side gap where the data position is located. The SVM linear classification hyperplane:

$$f(x) = w, x + b = 0 \tag{1}$$

From the above equation, we get the class inequality +1 (negative):

$$w.x + b \leq +1 \tag{2}$$

Class -1 inequality:

$$w.x + b \geq -1 \tag{3}$$

w is normal plane, b is the position of the plane relative to center coordinates. By optimizing the value of the distance between the hyperplane and the next point, the largest margin can be found, i.e. $1 / \parallel w \parallel$.

1. Training Data - Testing Data
   Learning: model selection and model parameter determination, based on training data Testing: testing the method with testing data that are not the same as the training data, so that the estimated value for the generalization capability of the model is obtained. Supervised Learning. Training data with targets, namely $xi, ti, i = 1...n$. The purpose of learning is to build a model that can produce the correct output for an input data, for example for classification and regression.

2. Error Handling Structural Risk Minimization
   The boundary of the separation between the good margins is when the hyperplane shows the furthest distance to the training data points in each class, it is called the functional margin. the larger the margin obtained, the lower the generalization error of the sorter. Suppose there are m of data training is $(x1, y1)$, $(x2, y2)$,...,(xm, ym) is the sample data and $y1\ \epsilon -1, 1$ is the target or class of the sample data. Suppose also that the data for the two classes are separate, so we want to find a hyperplane $fx = xw + b$. weight parameter and b is the pattern parameter.
   1) Identify the patterns that are included in the class +1 (positive sample) can be formulated as a pattern that satisfies the inequality $xiw + b > 0 for xi = 1$.
      Identify the patterns that are included in the -1 (negative sample) can be formulated as a pattern that satisfies the inequality $xiw + b < 0 for xi = 1$.
   2) The problem of finding to optimal w and b parameters in order to obtain as optimal hyperplane is quadratic programming.

$$min_w b = \frac{1}{2} w^T + C \Sigma_{i=1}^{m} \mu_i \tag{4}$$

Solving the problem can be solved by using the Lagrange multiplier.

$$\Sigma_i^l a_i - \frac{1}{2} \Sigma_{i,j=1}^{i} \alpha_i \alpha_j y_i y_j \overline{x_l y_J} \tag{5}$$

a_i are lagrange multipliers, which are zero or positive $a_i \geq 0$ From the results of this calculation, most of them are positive. Data that correlates with the a_i positive is called SVM

3. Classification

   Grouping text words or sentences into predefined groups to identify information and predict more efficiently. Real systems show:

   1) Recommend actions or repair work needed based on text describing malfunctions or faults using a predictive model built with historical data..

   2) Detect fraudulent reports using features extracted from text for cybersecurity or for asset selection using a prebuilt classification model.

   Output value to discrete value (class), aims to classify new data accurately.

4. Result

   The identification and sentiment value obtained through the analysis of the input data set in the form of text. The system show:

   1) Identify the difficulty level of sentiment scores from customer twit.
   2) Build the SVM model by selecting positive opinions using sentiment scores from tweet opinions.

5. Testing and Validation

   Confusion matrix useful for measuring the performance of a built model, especially on labeled groupings. Result of the Confusion matrix is to compare the results of the classification grouping of the model with the results of the actual classification category.

6. Accuracy

   Accuracy is needed to describe the accuracy of the model in producing an appropriate classification. The prediction ratio is said to be correct if it is positive and negative to the overall data processed if the level of the prediction value is close to the actual value.

3. RESULT AND ANALYSIS

Crawled data can be stored in various types of formats, one of which is CSV. Text analytics is the process of uncovering hidden patterns from raw human language to enable better decision-making and predictions. This section goes through four real-world applications of text analytics, topic modeling, classification, sentiment analysis and summarization. Accessing and processing previous text data with the stages of text analysis work. The stages of text analytic work consist of the following four steps.

3.1. Data Set

There are several techniques for collecting text-based data online that can be used. The collection of data is taken collectively from the system or social media and then with a range of time collected in a database or file for data cleaning. Searching for text data sets through online food, order analysis includes, food delivery service, delivery food, online food delivery Jakarta, grab food delivery, food delivery online, gojek food delivery.

3.2. Preprocessing Data

Coarse-grained sentiment analysis is a sentiment analysis that is carried out at the document level while Fine-grained sentiment analysis works at the sentence level. Preprocess data by eliminating extraneous information such as punctuation, common words, emotions, hastags, special character or stop words such as a and the.

Text format on twitter:

1) The total Twitter character is a maximum of 140 characters.
2) Through the API owned by Twitter, it can retrieve as much data as possible openly.
3) Twitter's comment language model has a higher error rate than comments on other social media.
4) The hashtags used by Twitter accounts are adapted to certain topics and apply globally.

The end result of stopwords is in the form of basic words which then will become keywords. The following is a comparison of positive and negative sentiment data for each tweet (before modeling) which is considered to represent the demographic profile, Table 1.

Table 1. Preprocesing Example Result

Preprocesing	Tweet
Cleansing	HARI RABU, #PASTI-ADAPROMO GOFOOD SIAP DISERBU! @gofoodindonesia
	"hari" "rabu" "pasti" "ada" "promo" "gofood" "siap" "diserbu"
Tokenizing	Selamat siang GO-JEKERS, bingung mencari menu makan siang hari ini ? di GO-FOOD in aja. GO-FOOD Jakarta Retweeted Gojek Indonesia @gojekindonesia
	"selamat" "sore" "gojekers" "bingung" "mencari" "menu" "makan" "siang" "hari" "ini" "di" "gofood"
Stopwords Removal	Have a Nice Lunch Gaes,.." #goodafternoon #lunch #lunchtime #cook #eat #delicious #food #deliciousfood #tradisionalfood #nasipadang #ayambakar #sambelijo #escampur #hobbymakan #makanenak #makasiang #culinary
	"have" "a" "nice" "lunch" "gaes"

Tweet data from mentions are categorized as positive and negative opinions. Categorization is based on the number of positive and negative words in each tweet can be seen in the following picture, Figure 2.
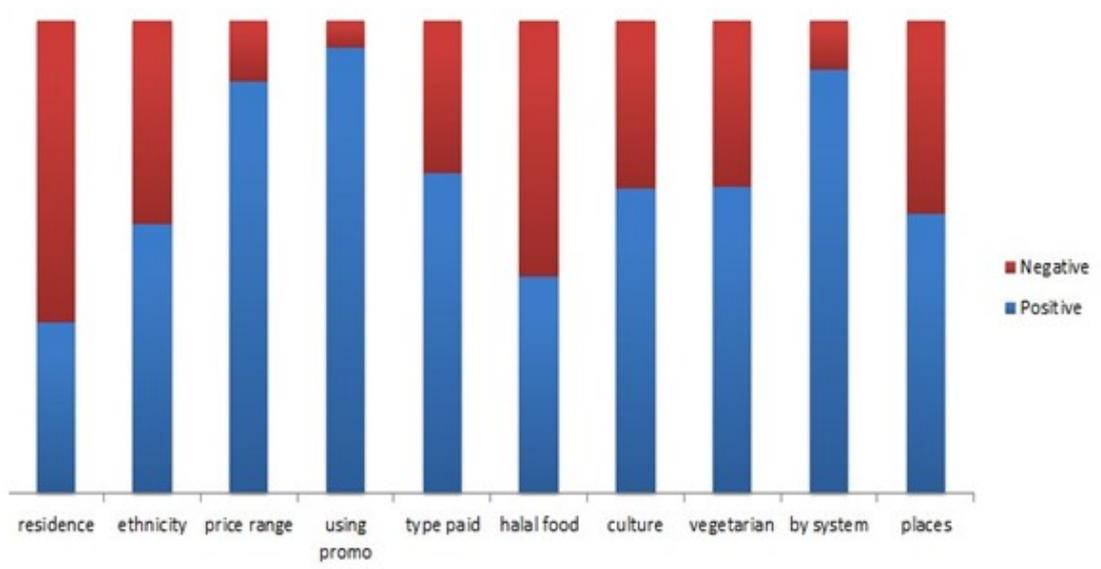

Figure 2. Positive Negative Tweet Chart

3.3. Build predictive models using SVM Linier

Each data is labeled according to the tweet variable identification. In this research, the data used is tweet data with the search keywords residence, ethnicity, price range, using promo, type paid. From 14971 tweets January 2020 January 2021 as se data obtained tweet residence shows the area of residence seen from the order delivery address, tweett ethnicity shows ethnicity, can be seen from the type of food ordered, tweet price range shows the price limit for food, tweet using promo shows customers who ordered based on promos, paid tweets indicate the type of payment. If the word or term has a value >0 then it is included in a negative comment if the word $= 0$ then it is considered a normal or undefined comment, and if a comment >0 is considered positive, Table 2.

Table 2. Variable Data Sentiment

Variable	Variable of Name	Scale
y	sentiment 0 = positive sentiment nominal 1 = negative sentiment	Nominal
xk	the keyword weight of each tweets obtained from result ratio TF-IDF	Ratio

The weighting is represented in vector form and TF-IDF. The use of the TF-IDF method in the weighting process can produce a vector with many terms so that each word that is counted as a feature can be recognized. Determination of the weight of each term and word in a document in the dataset using augmented TF based on:

$$tf = 0.5 + 0.5 \frac{tf}{max(tf)} \tag{6}$$

tf = the number of words that appear in a document $max(tf)$ the word length of the document itself. Inverse Document Frequency (IDF) This process is the number of documents containing the term sought in the document dataset:

$$idf = In\frac{N}{df} + 1 \tag{7}$$

In : Logarima Natural.

N : Total of all documents.
df : Number of terms/words in the document.

TF IDF The way to calculate it is by multiplying TF and IDF. TF-IDF works by looking for two main values, namely TF (How often a value comes out) and IDF (weighted value seen from how often a word comes out, inverse because the more often it comes out, the smaller the weighting value). Formation of term document matrix, show in the table 3.

Table 3. Positive Negative Variable Probability

Variable	Probability	
	Positive	Negative
residence	10.657	0.6532
ethnicity	0.0256	12.673
price range	10.654	0.0381
using promo	18.003	0.0096
type paid	10.064	0.0642
halal food	10.548	0.6873
culture	0.2147	10.093
vegetarian	0.1132	0.3218
by system	13.439	0.0034
places	14.310	0.2115

According to the TF-IDF algorithm, term weighting is carried out after the pre-processing process. some words are taken at random and then weighted, the weighting value of each tweet is obtained from the results of processing text data on the attributes then compared to each probability according to the TF-IDF weighting value. Sentiment analysis of text in the form of words or sentences assumes that each document represents one entity. Documents are analyzed whether they have a positive, negative, or neutral orientation.

Table 4. Demographic Profile Classification Result

Variable	Neutral Tweet	Sentiment		Grouping
		Positive	Negative	
residence	2%	11%	6%	Positive
ethnicity	2%	3%	15%	Negative
price range	5%	10%	4%	Positive
using promo	8%	15%	3%	Positive
type paid	8%	16%	2%	Positive
halal food	6%	13%	10%	Positive
culture	5%	10%	28%	Negative
vegetarian	3%	7%	10%	Negative
by system	6%	12%	2%	Positive
places	5%	10%	13%	Negative

The final result of the classification of sentiment analysis is to compare the percentage of each variable between positive, neutral, negative. a larger percentage of tweets will represent the analysis of each variable, then grouping is carried out. for percentages above 10%, the sentiment group is concluded, show in Figure 3.
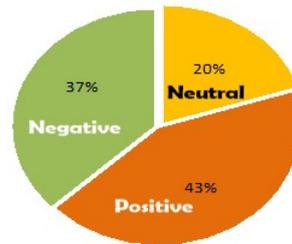

Figure 3. Sentiment Analysis Classification Result

In this study, tweets that have been preprocessed are grouped into 10 variables, each variable contains a value of 0 and a value of 1. The test results of 500 tweets show positive sentiments including residence 11%, price range 10%, using promo 15%, type paid 16%, halal food 13%, by system 12%. Negative sentiments include ethnicity 15%, culture 28%, vegetarian 10%, places 13%.

Clasificiation Learner

In addition, to obtain satisfactory predictive accuracy, can use various SVM kernel functions, and must tune the parameters of the kernel functions, Figure 4.

	1 residence	2 ethnicity	3 pricerange	4 usingpromo	5 typepaid	6 TrainedClassifier
211	1	1	1	1	0	0.4310
212	1	1	1	0	1	0.0177
213	1	1	1	1	0	0.4310
214	1	0	1	0	1	0.4668
215	1	1	1	0	1	0.0177
216	0	1	1	1	0	0.4319
217	1	1	1	0	1	0.0177
218	1	0	1	0	1	0.4668
219	1	1	1	1	0	0.4310
220	0	0	1	0	1	0.4659
221	1	1	1	1	0	0.4310
222	1	1	1	1	0	0.4310
223	1	0	1	0	1	0.4668
224	0	1	1	1	0	0.4319
225	1	0	1	0	1	0.4668
226	1	1	1	1	0	0.4310
227	1	1	1	0	1	0.0177
228	1	1	1	1	0	0.4310
229	1	0	1	0	1	0.4668
230	1	1	1	0	1	0.0177
231	0	1	1	1	0	0.4319

Figure 4. Training Classifier

Classification has two processes, namely building a classification model from a set of existing data classes through training data sets using a test data classification model and measuring the accuracy of the model.

Using the classification learner from MatLab, a linear SVM Kernel model with Cross Validation Partitions data into k randomly chosen subsets (or folds) of roughly equal size. One subset is used to validate the model trained using the remaining subsets. This process is repeated k times, such that each subset is used exactly once for validation performance indicator, k-fold = 10 was made, data training was carried out, resulting in:

1. Linier SVM
   Overall Accuracy = 87.1%
   Overal Error = 12.9%
2. SVM KernelFungtion = Gaussian
   Overall Accuracy = 85.6%
   Overal Error = 14.4%
3. SVM KernelFungtion = Quadtratic
   Overall Accuracy = 84.4%
   Overal Error = 15.6%
4. SVM KernelFungtion = Cubic
   Overall Accuracy = 85.2%
   Overal Error = 14.8%

Testing and Validation

Performance measurement using confusion matrix represents the results of the classification process TP: True Positive (Number of correct predictions in positive class) FP: False Positive (Number of incorrect predictions in positive class). FN: False Negative (Number of wrong predictions in negative class) TN: True Negative (Number of correct predictions in negative class) of the four classifications, the values of accuracy, precision, and recall will be obtained. the training stage was taken 500 tweets, to calculate the accuracy of the classification used confusion matrix, obtained accuracy 92.55%, Table 5.

Table 5. Confusion Matrix SVM

Actual Class	TRUE Positive	TRUE Negative	Precission
Prediction Positive	396	19	92.03%
Prediction Negative	53	31	73.57%
Class Recall	93.7%	63.1%	

The accuracy value obtained shows the accuracy of the method used in grouping all data correctly. The precision value indicates the number of data belonging to the positive category that is classified correctly divided by the total data classified as positive category. The recall value shows how percent of the positive category data are classified correctly. The confusion matrix contains the classification result information which is predicted correctly using SVM. Positive negative class predictions are indicated by label 0 and label 1. This number shows the proportion of correctly predicted labels from the total predictions, Figure 5.
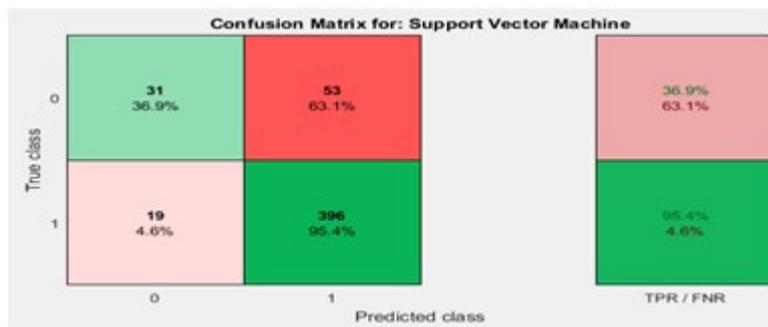

Figure 5. Confusion Matrix SVM

The confusion matrix from SVM modeling shows:
True Class Positive:
True Positive Rates (TPR) = 36.9% FNR False Negative Rates (FNR) = 63.1%
True Class Negative:
True Positive Rates (TPR) = 95.4% FNR False Negative Rates (FNR) = 4.6%

The ROC (Receiver Operating Characteristic) curve evaluates the classification accuracy visually. The ROC graph consists of a two-dimensional plot of the proportion of false positives on the X axis and true positives on the Y axis. Display on the ROC curve using the SVM Vector Machine algorithm, Figure 6.
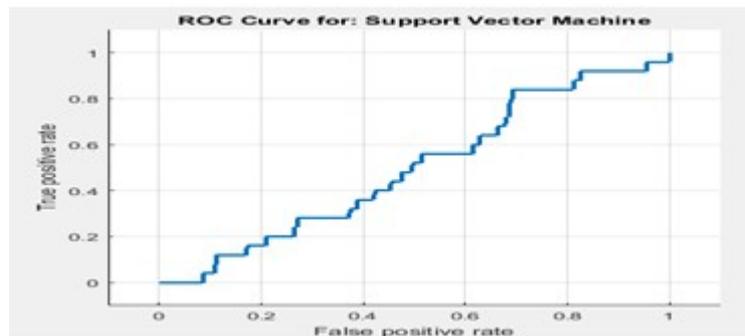

Figure 6. ROC Vector Machine algorithm Curve

One point on the ROC curve is better than another if the line direction is from bottom left to top right on the graph. The ROC graph consists of tweets as positive class with the area under the curve showing 0.496371.

Comparison and Result analysis using SVM with K-Nearest Neighbor
KNN includes an algorithm for classifying objects into one of the classes that already exist in the sample data that has been previously defined. then testing the classification of tweets through modeling using the KNN method. Comparison of the built model, data testing is carried out with KNN, the test results are shown in the Confusion Matrix Accuracy Calculation. k-fold = 5 was made, data training was carried out, resulting Overal Accuracy = 85.5% Overal Error = 14.5%. Confusion Matrix tweets using KNN can be seen at Figure 7.
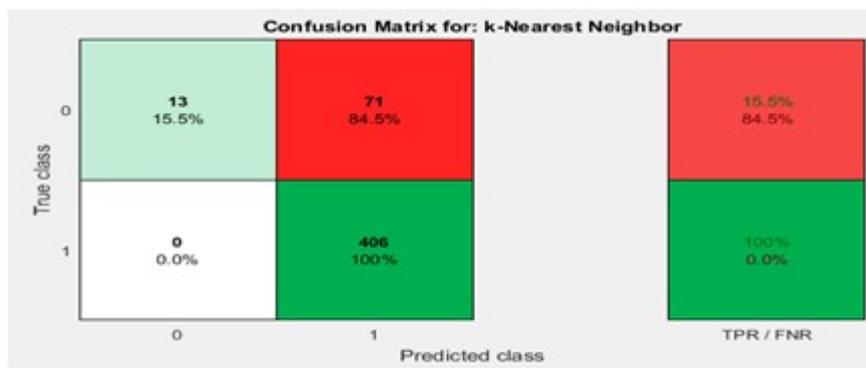

Figure 7. Scattler Diagram Simulated Tweet

3.4.   Predictive models in visualization
In supervised learning model, early stage train a SVM, use trained machine to build model, show in scattler diagram, Positive = 1 Negative = 0, Figure 8.
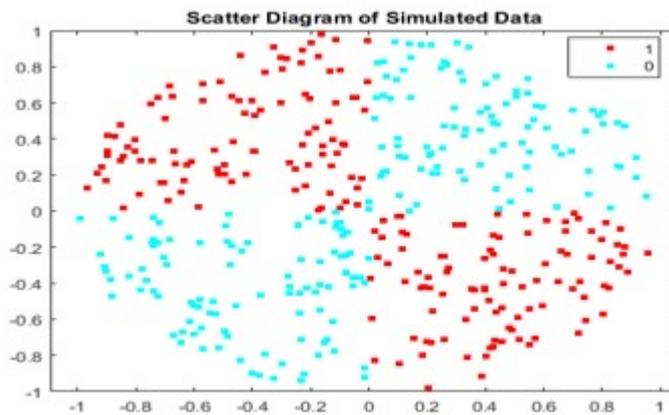
Figure 8. Scattler Diagram Simulated Tweet

4. CONCLUSION

Sentiment analysis using the SVM algorithm produces significant accuracy with shorter computations than other classification methods through train and data testing. The classification obtained is tested again through the confusion matrix. The data set consists of 14971 tweets, through preprocessing the data, the data is ready to be trained using the Linear SVM model, each data is assigned a value of 1 indicating a positive value, 0 indicating a negative value. Neutral tweets are not processed because in linear SVM positive and negative sentiments are generated. In this study, tweets that have been preprocessed are grouped into 10 variables, each variable contains a value of 0 and a value of 1. The test results of tweets show Positive Sentiments = 64% including residence, price range, using promo, type paid, halal food, by system and Negative Sentiments = 36% include ethnicity, culture, vegetarian, places. Linear SVM model produces accuracy 87.1% K-NN model produces accuracy 85.5%. The classification results of sentiment analysis inform what tweets are personal regarding demographic profile data that can affect online food ordering marketing. The limitation in this study is to classify tweets into positive and negative categories from each variable that contains positive and negative according to classification validation. Input for future research so that we can try other SVM algorithms according to the needs of the problems that arise.

REFERENCES

[1] F. D. Ananda and Y. Pristyanto, "Analisis Sentimen Pengguna Twitter Terhadap Layanan Internet Provider Menggunakan Algoritma Support Vector Machine," *MATRIK : Jurnal Manajemen, Teknik Informatika dan Rekayasa Komputer*, vol. 20, no. 2, pp. 407–416, 2021.

[2] W. Bourequat and H. Mourad, "Sentiment Analysis Approach for Analyzing Iphone Release Using Support Vector Machine," *International Journal of Advances in Data and Information Systems*, vol. 2, no. 1, pp. 36–44, 2021.

[3] S. Dey, S. Wasif, D. S. Tonmoy, S. Sultana, J. Sarkar, and M. Dey, "A Comparative Study of Support Vector Machine and Naive Bayes Classifier for Sentiment Analysis on Amazon Product Reviews," *2020 International Conference on Contemporary Computing and Applications, IC3A 2020*, no. May, pp. 217–220, 2020.

[4] A. N. Rosyad, R. Syarief, and M. F. Syuaib, "Business Model Development Strategy for Frozen Food Micro-Business in The New Normal Era (Case Study : CV XYZ) ," vol. 8, no. 1, pp. 93–103, 2022.

[5] C. Villavicencio, J. J. Macrohon, X. A. Inbaraj, J. H. Jeng, and J. G. Hsieh, "Twitter Sentiment Analysis Towards Covid-19 Vaccines in The Philippines Using Naïve Bayes," *Information (Switzerland)*, vol. 12, no. 5, 2021.

[6] M. Boukabous and M. Azizi, "Crime Prediction using A Hybrid Sentiment Analysis Approach Based on The Bidirectional Encoder Representations From Transformers," *Indonesian Journal of Electrical Engineering and Computer Science*, vol. 25, no. 2, pp. 1131–1139, 2022.

[7] E. M. Sari Rochman, I. Oktavia Suzanti, Imamah, M. Ali Syakur, D. R. Anamisa, A. Khozaimi, and A. Rachmad, "Classification of Thesis Topics Based on Informatics Science Using SVM," *IOP Conference Series: Materials Science and Engineering*, vol. 1125, no. 1, p. 012033, 2021.

[8] R. Amalia, M. A. Bijaksana, and D. Darmantoro, "Negation Handling in Sentiment Classification Using Rule-Based Adapted From Indonesian Language Syntactic for Indonesian Text in Twitter," *Journal of Physics: Conference Series*, vol. 971, no. 1, 2018.

[9] A. Faesal, A. Muslim, A. H. Ruger, and K. Kusrini, "Sentimen Analisis Terhadap Komentar Konsumen Terhadap Produk Penjualan Toko Online Menggunakan Metode K-Means," *MATRIK : Jurnal Manajemen, Teknik Informatika dan Rekayasa Komputer*, vol. 19, no. 2, pp. 207–213, 2020.

[10] M. Tika Adilah, H. Supendar, R. Ningsih, S. Muryani, and K. Solecha, "Sentiment Analysis of Online Transportation Service Using The Naïve Bayes Methods," *Journal of Physics: Conference Series*, vol. 1641, no. 1, 2020.

[11] S. Wadhwa, "Performance Comparison of Classifiers on Twitter Sentimental Analysis," pp. 50–61, 2022.

[12] S. P. Kristanto and L. Hakim, "Ekstraksi Informasi Destinasi Wisata Populer Jawa Timur Menggunakan Depth-First Crawling," *MATRIK : Jurnal Manajemen, Teknik Informatika dan Rekayasa Komputer*, vol. 21, no. 1, pp. 229–236, 2021.

[13] B. J. Gogoi, "Changing Consumer Preferences: Factors Influencing Choice of Fast Food Outlet," *Academy of Marketing Studies Journal*, vol. 24, no. 1, pp. 1–17, 2020.

[14] M. Schmitt, S. Steinheber, K. Schreiber, and B. Roth, "Joint Aspect and Polarity Classification for Aspect-Based Sentiment Analysis with End-to-End Neural Networks," *Proceedings of the 2018 Conference on Empirical Methods in Natural Language Processing, EMNLP 2018*, pp. 1109–1114, 2020.

[15] D. E. Kurniawati and R. Z. Khoirina, "Online-Based Transportation Business Competition Model of Gojek and Grab," *Advances in Social Science, Education and Humanities Research*, vol. 436, pp. 1054–1057, 2020.

[16] F. R. Azmi, H. Musa, S. H. M. Zailani, and S. F. Fam, "Analysis of Mitigation Strategy for Operational Supply Risk: An Empirical Study of Halal Food Manufacturers in Malaysia," *Uncertain Supply Chain Management*, vol. 9, no. 4, pp. 797–810, 2021.