

# Implementation of the Naïve Bayes Method to determine the Level of Consumer Satisfaction

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**Abstract:** Satisfaction is a feeling of pleasure at something you like, you get it from goods and services. Satisfaction becomes an important assessment when someone sells goods or services. This is because satisfaction will be an assessment of the goods purchased by consumers or services that will be received by consumers. Therefore the authors make research about the level of consumer satisfaction in shopping. This research was made using the Naïve Bayes method and used consumer data as sample data which used 49 consumer data. By using the Naïve Bayes method, this study aims to see the level of consumer shopping satisfaction, it is made to see the results of a consumer's satisfaction, sometimes there are some consumers who are dissatisfied with the reason the product is not good and some are satisfied with the reason the product is still new and good. Therefore this research was made. This research was conducted using the naïve Bayes method with the first stage being data analysis, then data preprocessing, then naïve Bayes algorithm and finally system testing. After system testing is carried out, classification results will be obtained using the naïve Bayes method. Classification results stated that as many as 47 consumers were satisfied shopping and as many as 2 consumers were not satisfied shopping. The conclusion is that a lot of consumers are satisfied with shopping, meaning that the place is very good and liked by many consumers.

**Keywords:** Classification, Confusion Matrix, Data Mining, Naïve Bayes, Satisfaction

## INTRODUCTION

Shopping is one of the main things that is often done by the community, especially shopping is often done by mothers. Goods purchased by the community are household staples that are used to meet their daily needs. When shopping, each community has their own schedule, some shop every day, buy for 1 day of use, some shop weekly and some monthly. To do shopping, in Labuhanbatu there is a supermarket that provides household staples, namely Brastagi. Brastagi is one of the supermarkets located on Jl. Gen. Ahmad Yani No.10, Bakaran Batu, Kec. Southern Rantau., Kab. Labuhanbatu. At the supermarket there are many staples that can be purchased, such as vegetables, meat, nuts. Brastagi is the target of many women, because the products sold at the supermarket are fresh (good). But there are still some people who don't want to shop at Brastagi, because the prices are quite expensive. They prefer shopping at the market or pokenan, because the prices are quite cheap. There are also some people who like to shop at the supermarket, because the ingredients are complete, still good, and the quality is maintained. In a shopping center such as the Brastagi Supermarket, many ingredients and products are sold, especially vegetables and fruits. In selling these products, there are lots of consumer evaluations. Please note that everyone's assessment is different, they have their own characteristics. So there are some consumers who say that the products sold at the Brastagi Supermarket are not very fresh and are quite wilted. There

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are also some consumers who say that the products they sell are fresh and very good, as if they had just been picked and harvested from the garden. From this assessment can affect the progress and development of the supermarket. That is because if many consumers do not like the products being sold, then the supermarket will no longer have consumers. Therefore, research was made on the level of customer satisfaction at the Brastagi Supermarket. The research will determine satisfied and dissatisfied consumers. If the results obtained show that many consumers are satisfied with the Brastagi Supermarket, it means that the products and supermarkets are liked and in demand by many consumers. But if the results obtained are that many consumers are dissatisfied with the supermarket, then the answers and ratings from these consumers can be used to become a parameter for changing the supermarket so that it is in great demand and liked by consumers. This means that satisfaction is one of the factors advancing and developing the supermarket.

Satisfaction is a person's pleasure towards something that is in accordance with their heart and thoughts. Satisfaction is also an expectation (which thought) according to what happened. Satisfaction will be realized if there is an action that occurs which responds between likes and dislikes, satisfaction and dissatisfaction. Everyone's satisfaction is different, because there are different tastes, both in terms of their assessment and response. Therefore, this research was made to see the level of customer satisfaction in the Brastagi Supermarket. To make this research, the author will first make indicators of this research, namely access to the location, product completeness, staff service, product price, location cleanliness, parking location. This indicator will be used as an attribute of the sample data. To determine the level of customer satisfaction, the author will carry out a data classification that will be processed in data mining.

Data mining is a data processing technique that has been widely applied to analyze large amount of existing data, extract information and knowledge that will be useful to support in the decision-making process (Patil & Tamane, 2018) (Uçar & Karahoca, 2021) (Yassir et al., 2020). Data mining is also a field of computer science for having extensification and availability that can transform large amounts of data into useful information and knowledge (Hussain, Dahan, Ba-Alwib, & Ribata, 2018). At the Tang center, data mining will be classified based on their respective groups, according to predetermined targets (Pour, Esmaili, & Romoozi, 2022).

## METHOD

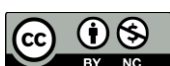
The naïve Bayes method is a classification method that will classify data or text in the closest category (Di & Duan, 2014). The naïve Bayes classification is also a classification that is often used for text classification and has good potential for such classification (Negara, Muhardi, & Putri, 2020). Naïve Bayes will be a probabilistic approach by dealing with training datasets and testing datasets (Santoso et al., 2020).

$$P(H|X) = \frac{P(X|H).P(H)}{P(X)} \quad (\text{Azzahra \& Wibowo, 2020})$$

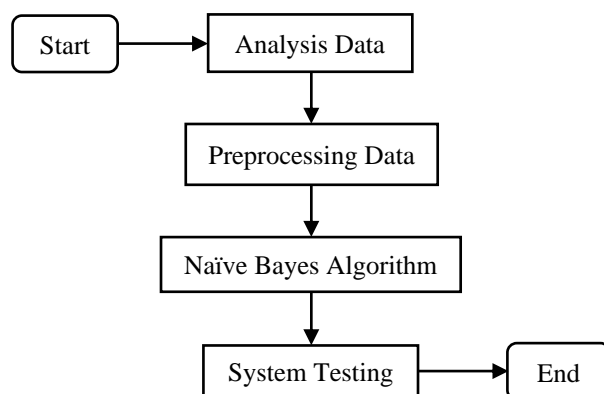
Information:

- X = Data with unknown class
- H = The data hypothesis X is a specific class
- P(H|X) = The probability of hypothesis H based on condition X (posterior probability)
- P(H) = The probability of the hypothesis H (prior probability)

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**Figure 1.** Naive Bayes Method Process Design

Figure 1 shows the stages of research that will be carried out by the author. The first stage is Data Analysis which is the process of selecting and determining the data to be used as a sample, then preprocessing the data which is the process of compiling the data that has been determined and the data is arranged into a file with the file.xlsx format. Furthermore, the Naive Bayes Algorithm, which is a design process for the Naive Bayes method, is the design used for classification of data to be processed in data mining. The last is System Testing which is the process of testing the method, design and Classification of sample data that has been tested previously.

**Confusion Matrix**

The confusion matrix is an easy and effective tool to use to show the performance of a Classification and is very easy to use to determine the results (Yun, 2021). The confusion matrix can be used to evaluate the work of a model and can be used to determine the results of a data mining using the K-Nearest Neighbor method (Waliyansyah & Fitriyah, 2019). The confusion matrix has several calculations, namely as follows.

Table 1  
Confusion Matrix

Confusion Matrix	True Class (Actual)	
	P	N
Y	True Positive (TP)	False Positive (FP)
N	False Negative (FN)	True Negative (TN)

To determine the calculation of the confusion matrix, researchers can do it by calculating accuracy, precision and recall.

$$\text{Accuracy} = \frac{TP+TN}{TP+TN+FP+FN} \times 100\% \quad (\text{Normawati \& Prayogi, 2021})$$

$$\text{Precision} = \frac{TP}{TP+FP} \times 100\% \quad (\text{Agustina, Adrian, \& Hermawati, 2021})$$

$$\text{Accuracy} = \frac{TP}{TP+FN} \times 100\% \quad (\text{Yun, 2021})$$

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## RESULT

### Data Analysis

On Table Below is Brastagi Supermarket consumer data obtained by distributing questionnaires to people who have shopped at Brastagi Supermarket. The data includes full name, gender, access to the location, product completeness, staff service, product price, cleanliness of the place, and finally the parking location. In the attributes there are 6 attributes that will become parameters in this study, namely access to the location, product completeness, staff service, product price, cleanliness of the place, and finally the parking location.

Table 2  
Consumer Data at the Brastagi Supermarket

Full Name	Gender	Access to Location	Product Completeness	Officer Service	Product Price	Place Cleanliness	Parking Location	Cate
Agus Triatma	Man	Easy	Incomplete	Friendly	Cheap	Clean	Enough	Satis
Ahmad Fikri	Man	Easy	Complete	Friendly	Cheap	Clean	Enough	Satis
Andika Pratama	Woman	Easy	Complete	Not Care	Cheap	Clean	Wide	Satis
Anggiat Rizky	Man	Easy	Complete	Friendly	Cheap	Clean	Wide	Satis
Anhar Rizky	Man	Easy	Incomplete	Indifferent	Expensive	Clean	Enough	N Satis
Arsyad Tholib Pohan	Man	Easy	Complete	Friendly	Cheap	Clean	Enough	Satis
Bambang Widiyanto	Man	Easy	Complete	Friendly	Cheap	Clean	Wide	Satis
Dian Syahfitri	Woman	Easy	Complete	Arrogant	Cheap	Clean	Enough	Satis
Dikki Syahputra	Man	Easy	Complete	Friendly	Cheap	Clean	Wide	Satis
Dimas Putra	Man	Easy	Complete	Friendly	Cheap	Clean	Wide	Satis
Dinda Cahaya	Woman	Easy	Incomplete	Arrogant	Expensive	Clean	Wide	Satis
Dita Syahfitri	Woman	Easy	Complete	Friendly	Cheap	Clean	Enough	Satis
Elizabeth Siska	Woman	Easy	Complete	Not Care	Cheap	Clean	Enough	Satis
Esfelaranza Larosa	Woman	Easy	Complete	Indifferent	Cheap	Clean	Wide	Satis
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Gracia Br Mnurung	Woman	Easy	Complete	Friendly	Cheap	Clean	Wide	Satis
Indra Syahputra	Man	Easy	Complete	Friendly	Cheap	Clean	Enough	Satis
Inka Nasution	Woman	Easy	Incomplete	Arrogant	Expensive	Clean	Narrow	N Satis
Intan Permatasari	Woman	Easy	Complete	Indifferent	Cheap	Clean	Enough	Satis
Irwansyah Putra Yahya	Man	Easy	Complete	Friendly	Cheap	Clean	Enough	Satis
Irwansyahputra	Man	Easy	Complete	Friendly	Cheap	Clean	Enough	Satis
Ismal Arifin	Man	Easy	Complete	Friendly	Cheap	Clean	Enough	Satis
Joko Azhari	Man	Easy	Complete	Friendly	Cheap	Clean	Enough	Satis
Lianah	Woman	Easy	Complete	Friendly	Cheap	Clean	Enough	Satis
May Syarah	Woman	Easy	Complete	Indifferent	Cheap	Clean	Enough	Satis
Miranda Simatupang	Woman	Easy	Complete	Arrogant	Cheap	Clean	Enough	Satis
Muhammad Anwar	Man	Easy	Complete	Friendly	Cheap	Clean	Wide	Satis

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Muhammad Ridwan	Man	Easy	Complete	Friendly	Cheap	Clean	Wide	Satis
Nanda Munazhif	Man	Easy	Complete	Friendly	Cheap	Clean	Wide	Satis
Nia Syafitri	Woman	Easy	Complete	Indifferent	Cheap	Clean	Wide	Satis
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Rama Ade Pratama	Man	Difficult	Complete	Indifferent	Cheap	Clean	Wide	Satis
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Siti Harahap	Woman	Easy	Complete	Indifferent	Cheap	Clean	Enough	Satis
Sophia Caroline	Woman	Easy	Complete	Friendly	Cheap	Clean	Enough	Satis
Sri Kurnia Harahap	Woman	Easy	Complete	Indifferent	Cheap	Clean	Enough	Satis
Suci Ramadhani	Woman	Easy	Complete	Not Care	Cheap	Clean	Wide	Satis
Ucok Simatupang	Man	Easy	Complete	Friendly	Cheap	Clean	Enough	Satis
Wulandari	Woman	Easy	Complete	Indifferent	Cheap	Clean	Enough	Satis
Yusuf Ardiansyah	Woman	Easy	Complete	Friendly	Cheap	Clean	Enough	Satis
Zakia Husna	Woman	Easy	Complete	Indifferent	Cheap	Clean	Enough	Satis
Zaskia Dwi Sabina	Woman	Easy	Complete	Not Care	Cheap	Clean	Enough	Satis

In table 2, which is the consumer data of the Brastagi Supermarket, there are 49 consumer data. This data will be used as research sample data using the Naïve Bayes method. The data will be classified based on predictions using the Naïve Bayes method.

Table 3  
Consumer Data Attributes

No	Attribute	Text	Description
1	Full Name	Text	Consumer's full name
2	Gender	Categorical	Consumer Gender
3	Access to Location	Categorical	Consumer access to Locations
4	Product Completeness	Categorical	Completeness of products sold
5	Officer Service	Categorical	Brastagi officer service
6	Product Price	Categorical	Price of products sold
7	Place Cleanliness	Categorical	Cleanliness of the place
8	Parking Location	Categorical	Parking location provided

In table 3 above is the consumer attribute data along with an explanation of each attribute. Each attribute has been given a description, so it's easy to understand each existing attribute.

\*name of corresponding author



**Data Training**

The training data is the data that will be used to determine the prediction results using the Naïve Bayes method. the training data obtained from the results of the questionnaire and then arranged in the form of file.xlsx format so that it can be used and processed in data mining.

Tabel 4  
Data Training

Full Name	Gender	Access to Location	Product Completeness	Officer Service	Product Price	Place Cleanliness	Parking Location	Category
Agus Triatma	Man	Easy	Incomplete	Friendly	Cheap	Clean	Enough	Satisfied
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Zakia Husna	Woman	Easy	Complete	Indifferent	Cheap	Clean	Enough	Satisfied
Zaskia Dwi Sabina	Woman	Easy	Complete	Not Care	Cheap	Clean	Enough	Satisfied

Table 4 contains the Brastagi Supermarket consumer data which will be used in the classification of data that will be processed in data mining using the Naïve Bayes method.

Table 5  
Consumer Column Data

No	Attribute	Type	Role	Values
1	Full Name	Text	Meta	
2	Gender	Categorical	Feature	Man, Woman
3	Access to Location	Categorical	Feature	Easy, Difficult
4	Product Completeness	Categorical	Feature	Complete, Incomplete
5	Officer Service	Categorical	Feature	Arrogant, Friendly, Indifferent, Not Care
6	Product Price	Categorical	Feature	Cheap, Expensive
7	Place Cleanliness	Categorical	Feature	Clean, Dirty
8	Parking Location	Categorical	Feature	Enough, Narrow, Wide
9	Category	Categorical	Target	Satisfied, Not Satisfied

In table 5 above is colonic data which is a research parameter to determine the level of customer satisfaction. The research was conducted using the Naïve Bayes method by classifying consumer data

\*name of corresponding author



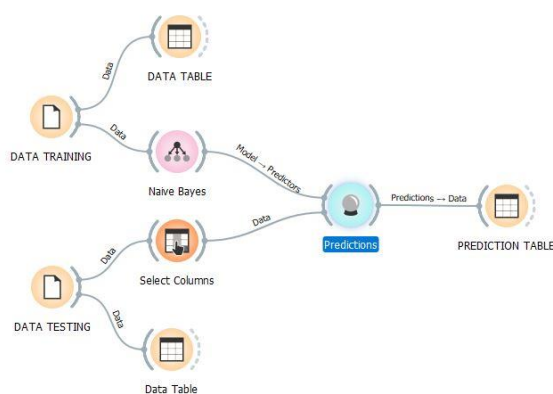
as satisfied and dissatisfied at the Brastagi Supermarket. By using the Naïve Bayes method, the rule on attributes category from feature is changed to target so Classification can be done and get results.

**Data Selection Process (Preprocessing)**

The data selection process is a process for determining data to be used as a research sample (Watratan, B, Moeis, Informasi, & Makassar, 2020). So in this process, data will be checked eligibility to be able to become sample data, the data will be compiled according to needs (Al-Rasheed, 2021). After determining the data, then the data will be processed and arranged properly so that it can be used. Data that has been compiled can already be used as sample data. Then the data will be entered into data mining using the naïve Bayes method.

**Data Mining Process**

The data development process will be carried out using the Classification Model using the Naïve Bayes method and will be processed using the Orange application.

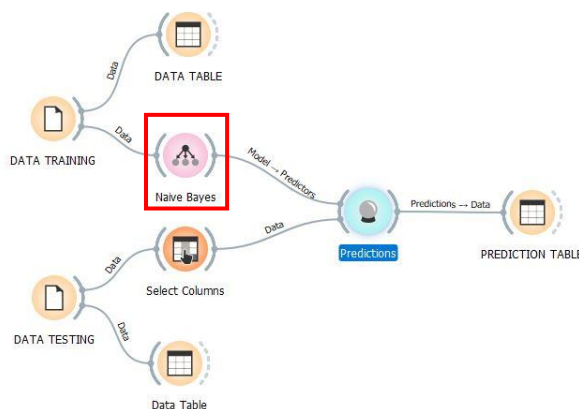


**Figure 2. Data Mining Process**

In figure 2 is the data mining process carried out in the orange application. This data mining process is a widget design process for the Naïve Bayes method which will be used for data classification in data mining which will be created and processed in the orange application. This process is carried out in order to get the target data that has been determined.

**Classification Model Testing Process**

In this testing process will be carried out using the naïve Bayes method. The data to be used in this process are training data and testing data. The test data is sample data in this study.



**Figure 3. Classification Model Widget Design Dataset Level of Consumer Satisfaction**

In Figure 3 is the process of predicting the Classification model, in this process is the widget design that will be used for Classifying the level of customer satisfaction at the Brastagi Supermarket. In the

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widget section that is located inside the red box is the naïve Bayes method used to classify the level of consumer satisfaction at the Brastagi Supermarket.

**Classification Model Predictions Process**

This process is the result of a classification model prediction in data mining using the Naïve Bayes method. This prediction process determines the level of consumer satisfaction in the Brastagi Supermarket.

Table 6  
Classification Model Prediction Results

Full Name	Gender	Access to Location	Product Completeness	Officer Service	Product Price	Place Cleanliness	Parking Location	Category
Agus Triatma	Man	Easy	Incomplete	Friendly	Cheap	Clean	Enough	Satisfied
Ahmad Fikri	Man	Easy	Complete	Friendly	Cheap	Clean	Enough	Satisfied
Andika Pratama	Woman	Easy	Complete	Not Care	Cheap	Clean	Wide	Satisfied
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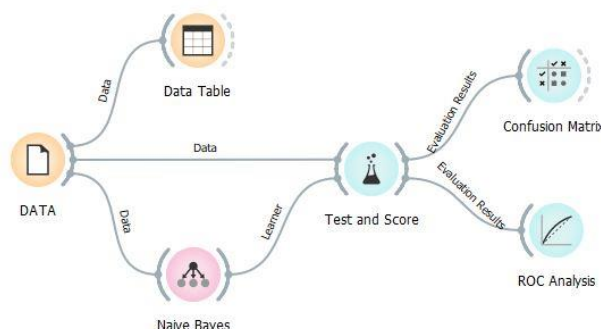
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Zaskia Dwi Sabina	Woman	Easy	Complete	Not Care	Cheap	Clean	Enough	Satisfied

Table 6 is the prediction result obtained from the classification of consumer satisfaction levels in the Brastagi Supermarket with as many as 49 consumer data. The prediction results were made using the naïve Bayes method that 47 consumers were satisfied at the Brastagi Supermarket (representation of 95.91%) and 2 consumers were dissatisfied with the Brastagi Supermarket (representation of 4.08%).

\*name of corresponding author



**Classification Model Evaluation Results**



**Figure 4. Design Widget Evaluation Process**

Figure 4 is a classification evaluation to determine test results and scores. After that, the results for the confusion matrix and ROC analysis will also be determined. To get these results, the author will use as much as two data, namely training data and testing data which will be used as 1 dataset with an attribute as a target, 1 attribute as text, namely full name and 6 attributes as a category, namely access to location, product completeness, officer service, product prices, cleanliness of the place, and finally the parking location.

**Table 7  
Result of Test and Score**

Model	AUC	CA	F1	Precision	Recall
Naïve Bayes	0.922	0.917	0.917	0.917	0.917

After the authors carried out an evaluation with the Classification model using the Naïve Bayes method, the results for the test and score were obtained. The results obtained were AUC 0.979, CA results 0.980, F1 results 0.982, Precision results 0.986 and Recall results 0.980.

**Evaluation Result with Confusion Matrix**

The confusion matrix is a widget that is used as a measuring tool for classification techniques by calculating the correct power that has been classified using the Naïve Bayes method.

**Table 8  
Results of the Confusion Matrix**

		Predicted		
		Satisfied	Not Satisfied	Σ
Actual	Satisfied	46	1	47
	Not Satisfied	0	2	2
Σ		46	3	49

Table 8 is the result of the confusion matrix obtained from the evaluation of the Classification model. The results of the confusion matrix are True Positive (TP) is 30. True Negative (TN) is 25, False Positive (FP) is 2 and False Negative (FN) is 3. Then the values for accuracy, precision and recall are as follows:

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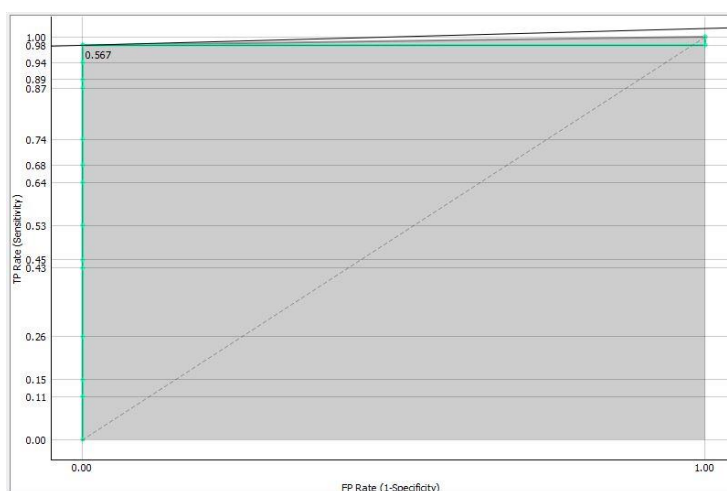
$$Accuracy = \frac{46+2}{46+2+0+1} + 100\% \quad \text{Then the Accuracy value} = 97,9\%$$

$$Presisi = \frac{46+2}{46+2+0} + 100\% \quad \text{Then the Precision value} = 100\%$$

$$Recall = \frac{46+2}{46+2+1} + 100\% \quad \text{Then the Recall value} = 97,95\%$$

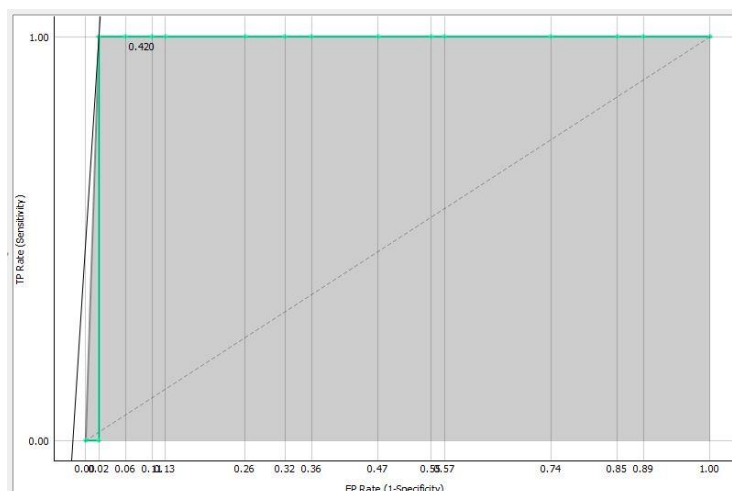
**Evaluation Result with ROC Curve**

Roc Analysis is obtained from the evaluation results of the Classification model with the addition of the ROC Analysis widget. The ROC Analysis results will be displayed in the form of graphic images obtained from data mining processing. The results can be seen in Figures 5 and 6.



**Figure 5. ROC Analysis with Satisfied Consumer Target**

Figure 5 is the result of ROC Analysis satisfied consumers at Brastagi Supermarket using the naïve Bayes method. The results obtained were 0.567.



**Figure 6. ROC Analysis Targeting Dissatisfied Consumers**

Figure 6 is the result of ROC Analysis dissatisfied consumers at Brastagi Supermarket using the naïve Bayes method. The results obtained were 0.420.

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## DISCUSSIONS

Consumers are people who come to get goods or services. Consumers can also be referred to as buyers. In this study, consumers are people who come and shop at the Brastagi Supermarket. This research was made to see the level of customer satisfaction at the Brastagi Supermarket. This research was made using the Naïve Bayes method and processed in data mining using the Orange application. The accuracy results obtained from the evaluation of the classification model with the widget test and score were 0.922 (for a representation result of 92.9%) and the accuracy results obtained from the evaluation of the classification model with a widget for representation were 97.9%. Comparison of the two results shows that the results of the confusion matrix are superior to the test and score by 5%.

of the two results, even though there is a difference of several percent, these results have given the best results, because these results are more than 90% and the method used is also the best method, because this method can give good results.

## CONCLUSION

Classification carried out using the Naïve Bayes method gives the best results, because the results are more than 90%, these results have given good results. That way it can be stated that many consumers are satisfied with the Brastagi Supermarket in Rantauprapat. Classification results obtained using the naïve Bayes method show that 47 consumers are satisfied with the Brastagi Supermarket and 2 consumers are dissatisfied with the Brastagi Supermarket. These results were obtained from 49 consumer data obtained from a questionnaire. From the results that have been obtained, the Brastagi Supermarket is one of the supermarkets that consumers like and are interested in going to the Brastagi Supermarket, because the results of the predictions that have been made state that many consumers are satisfied with the Brastagi Supermarket.

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