

# Analysis of Visitor Satisfaction Levels Using the K-Nearest Neighbor Method

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**Abstract:** Visitors are people who come to a place, entertainment, shopping, and tourism. Visitors are one of the important factors for the progress and development of a place. With visitors, an entertainment, tourism and shopping area can progress and develop. Therefore researchers will make a study of the level of visitor satisfaction. This research aims to improve the quality of an entertainment venue, shopping and increase the quantity of visitors. This research was conducted using the K-Nearest Neighbor method. The K-Nearest Neighbor method is a classification method based on training data (dataset). The data used by researchers is 45 visitor data. The classification carried out using the K-Nearest Neighbor method aims to classify data of satisfied visitors and dissatisfied visitors at an entertainment or tourism place. In using the K-Nearest Neighbor method, the first stage is selecting sample data, the data to be selected, then preprocessing, then designing the widget with the K-Nearest Neighbor method and finally testing data mining using the K-Nearest Neighbor method. The K-Nearest Neighbor Method. This visitor data was obtained by researchers through a questionnaire and the results of the questionnaire that 41 visitors were satisfied. After classifying visitor data using the K-Nearest Neighbor method, the classification results were 41 satisfied visitors. The conclusion is that many visitors are satisfied.

**Keywords:** Analysis, Classification, Confusion Matrix, Data Mining, K-Nearest Neighbor.

## INTRODUCTION

Suzuya Mall Rantauprapat is one of the shopping places in Labuhanbatu Regency. The place has become an entertainment center for the people of Labuhanbatu Raya. Inside there is a lot of entertainment, household shopping, tools for mechanics, snacks and many others. Therefore, many people like to visit. With so many visitors coming, researchers will make a study of the level of visitor satisfaction. Because sometimes there are many visitors to a place, they are not necessarily satisfied with the place, on the grounds that the place is not clean, the service is not good, the product is not complete. Therefore it is necessary to do research to see the level of visitor satisfaction. This research was conducted because there were still some people who became visitors who felt that the place was not good, incomplete. This means that the community is still dissatisfied with the place, but there are some people who consider that the place is complete, everything we need is there from entertainment, household staples, household appliances, with this reason meaning they are satisfied. But sometimes the perception of each person is different and the level of community satisfaction is not the same, they have their own evaluation characteristics. Therefore this research was made to see the level of satisfaction of the community (visitors).

Satisfaction is a person's feeling of pleasure in something, be it behavior, attitude or quality of an item. In everyday language satisfaction is an expectation that is in accordance with reality, so something

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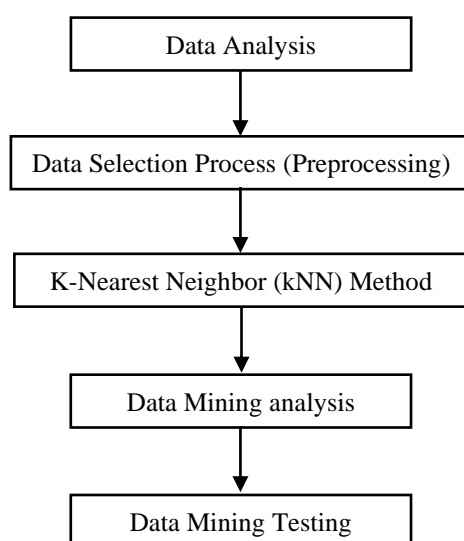


that someone thinks is in accordance with what exists and has happened. Satisfaction exists after an action is taken by someone. So researchers will look at the level of visitor satisfaction. To conduct this research, data is needed which will become the research parameter. The data will become a research parameter is a convenience access to locations, facilities and infrastructure, parking locations, officer services, and cleanliness. The data will be classified using the K-Nearest Neighbor method in data mining. So the data will be classified in data mining.

Data mining is a process of extracting and identifying useful information using statistical and mathematical techniques and models (Baharuddin, Azis, & Hasanuddin, 2019). Data mining will be used to find and determine patterns that are automatic or semi-automatic (Wijaya & Girsang, 2015)(Azahari, Yulindawati, Rosita, & Mallala, 2020). Data mining is also one way to determine the level of visitor satisfaction. Data mining is processed using an Algorithm that can find knowledge with statistical and mathematical techniques. Data mining functions to handle a large amount of data. This data mining process will be carried out by considering the amount of data to be processed. To carry out data mining, researchers will need a method to classify data on the level of visitor satisfaction. So the method that researchers will use is the K-Nearest Neighbor method to classify the data (Arowolo, Adebisi, Ariyo, & Okesola, 2021)(Firasari, Khultsum, Winnarto, & Risnandar, 2020). This method has often been used by researchers to classify data. Data classification is one of the learning models used in the data mining process (Saputra, Widiyaningtyas, & Wibawa, 2018)(Hussain, Dahan, Ba-Alwib, & Ribata, 2018).

## METHOD

The K-Nearest Neighbor method is a technique for classifying data based on cooperative learning with statistical and mathematical models (Al Dujaili, Ebrahimi-Moghadam, & Fatlawi, 2021)(Uçar & Karahoca, 2021) (Ni'mah, Sutojo, & Setiadi, 2018). The K-Nearest Neighbor method is a method that can be expressed as a simple algorithm, but can be used effectively (Nugroho, Nugraha, Rasyid, & Rahayu, 2021). To determine the level of visitor satisfaction, there are 5 column data attributes which are the research parameters. Among the five attribute data, if there are three positive attribute data, then the visitor is satisfied with Suzuya Mall Rantauprapat, but if there are only two positive attribute data, it means that the visitor is dissatisfied with the place. In the following, the researcher will describe the flow of the research conducted.



*Figure 1. Process Plan Data Mining*

Data analysis is a process of examining and cleaning data before entering the data selection process. Furthermore, the data selection process (preprocessing) which is the data selection process that will be

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used in data mining, then the K-Nearest Neighbor method is the method used for data classification in data mining. Data mining analysis is the process of determining patterns for the K-Nearest Neighbor method so that data classification can be carried out properly. Finally, data mining testing is a data mining process carried out using the K-Nearest Neighbor method to obtain data classification results.

### 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
Predicted class	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.

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

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

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

## RESULT

### Data analysis

In the picture below is a dataset of visitors to Suzuya Mall Rantauprapat which researchers obtained by distributing questionnaires to people who had been visitors at the place. The data will be used by researchers as a sample of this study.

Table 2. Visitor Data

Full Name	Gender	Easy Access to The Location	Infrastructure	Parking Lot	Official Service	Cleanliness	Category
Ade Finky Kartika	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Agil Chairul fadli	Man	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Aisyah Siregar	Woman	Difficult to access by vehicles	Less complete	Wide	Indifferent	Clean	Not Satisfied

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Alfanny Mariyuandra	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Aliyah Syafitri Harahap	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Arif Akbar	Man	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Avie Sienna	Man	Easily accessible by vehicles	Very Complete	Wide	Indifferent	Clean	Satisfied
Awaluddin	Man	Easily accessible by vehicles	Less complete	Narrow	Indifferent	Clean	Not Satisfied
Ayu Ramadhani	Woman	Difficult to access by vehicles	Less complete	Narrow	Proud	Clean	Not Satisfied
Bayu Saputra	Man	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Bela Apriliani	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Diah Nur Afiani	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Dzikri Abdullah	Man	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Elisa gustina	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Faridah Ritonga	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Fitri Febriyani Hasibuan	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
ghoji karowan	Man	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Heru eko prasetio	Man	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Irwansyah Rambe	Man	Difficult to access by vehicles	Very Complete	Narrow	Indifferent	Clean	Not Satisfied
Lianah	Woman	Easily accessible by vehicles	Less complete	Narrow	Indifferent	Clean	Satisfied

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Mayang Sari	Woman	Easily accessible by vehicles	Very Complete	Wide	Proud	Clean	Satisfied
Miranda Asina	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Muammar Siregar	Man	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Nia Putri Panjaitan	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Nilam Sari	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Novia ramadani	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Nur Addina	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Nurul Fatma	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Putri Violita	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Putri violita	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Risda Kesuma Lubis	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Rizka junita	Woman	Easily accessible by vehicles	Very Complete	Wide	Indifferent	Clean	Satisfied
Sandy Ritonga	Man	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Santi nur Cahyani	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Selvi Nurkholizah	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Sintya Lestari	Woman	Easily accessible by vehicles	Very Complete	Wide	Indifferent	Clean	Satisfied
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Wanda Pratama	Man	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Widia	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied

Table 2 shows visitor data that researchers obtained through questionnaires that researchers distributed to the public. The data used is the original data from the questionnaire. The data will be classified using the K-Nearest Neighbor method.

Table 3. Visitor data attributes

No	Attribute	Type	Descriptions
1	Full Name	Text	Visitor's full name
2	Gender	Category	Gender of visitor
3	Easy Access to The Location	Category	Conditions for access to the site
4	Infrastructure	Category	Condition of facilities and infrastructure
5	Parking Lot	Category	Parking condition
6	Security	Category	Place safety
7	Cleanliness	Category	Cleanliness of room and goods

The attribute table is a visitor dataset that is equipped with the attribute type and description of each attribute.

\*name of corresponding author



**Training Data**

Training data is data used as a research sample. The data will be arranged in file.xlsx format. In this study, the data that researchers used were data compiled in the Microsoft Excel application.

Table 4. Data Training

Full Name	Gender	Easy Access to The Location	Infrastructure	Parking Lot	Official Service	Cleanliness	Category
Ade Finky Kartika	Woman	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
Agil Chairul fadli	Man	Easily accessible by vehicles	Very Complete	Wide	Friendly	Clean	Satisfied
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Table 4 contains visitor data for Suzuya Mall Rantauprapat, which is the research sample for researchers. The data will be classified based on the category of visitor satisfaction level.

\*name of corresponding author



Table 5. Data Training

No	Attribute	Type	Role	Values
1	Nama	Text	Meta	
2	Gender	Categorical	Feature	Man, Woman
3	Easy to The Location	Categorical	Feature	Difficult to access by vehicles, Easily accessible by vehicles
4	Infrastructure	Categorical	Feature	Less complete, Very complete
5	Parking Lot	Categorical	Feature	Narrow, Wide
6	Official Service	Categorical	Feature	Friendly, Indifferent, Proud
7	Cleanliness	Categorical	Feature	Clean
8	<b>Category</b>	<b>Categorical</b>	<b>Target</b>	<b>Satisfied, Not Satisfied</b>

Table 5 contains attribute data that the researcher will use in the process of classifying data on the satisfaction level of Suzuya Mall Rantauprapat visitors using the K-Nearest Neighbor method.

**Data Selection Process (Preprocessing)**

The data selection process is a process of determining the data to be used in this study. This data will later be entered into data mining to carry out a data classification using the K-Nearest Neighbor method. So before a data enters the data mining process, the data will be selected first in the data preprocessing.

**Data Mining Process**

The data mining process is the widget design process required by the K-Nearest Neighbor method in data mining.

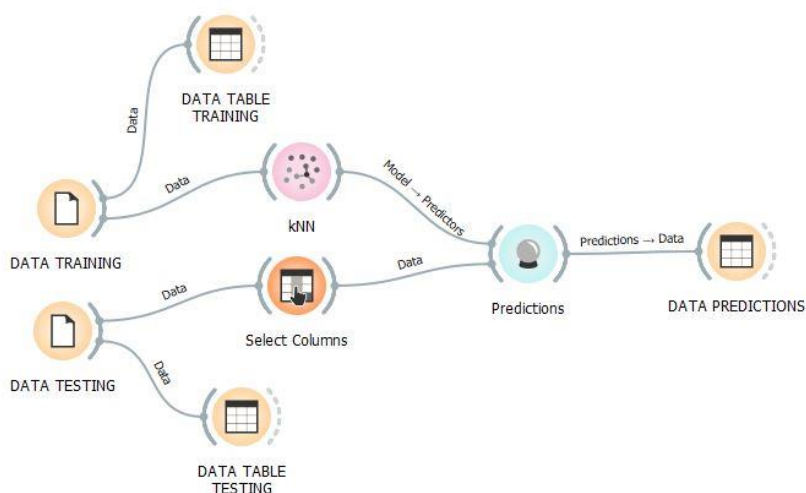


Figure 2. Data Mining Process

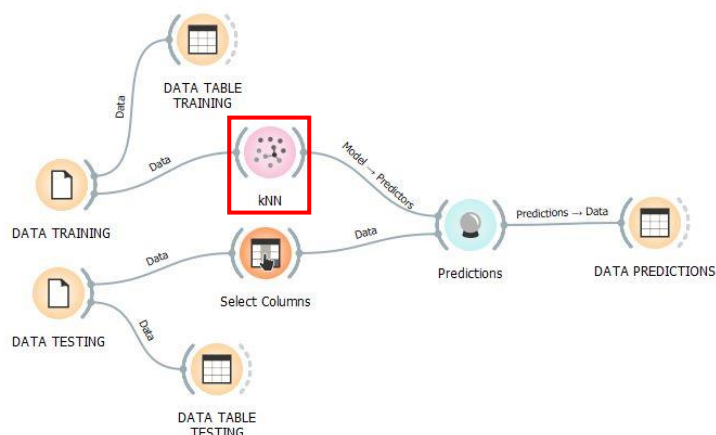
Figure 2 is a widget required by the K-Nearest Neighbor method and has been compiled to be used in the data classification process.

\*name of corresponding author



### Model Classification Testing Process

In the testing process, the model classification is the process of testing the K-Nearest Neighbor method using two data, namely training data and testing data. For the data classification process, both data must be in the classification process.



**Figure 3.** The classification model of the widget design dataset is the level of visitor satisfaction

Figure 3 shows the classification process carried out using the K-Nearest Neighbor method. The method that will classify data on visitor satisfaction levels at Suzuya Mall Rantauprapat.

### Classification Model Prediction Process

In the process of predicting the Classification model is the prediction result of data Classification using the K-Nearest Neighbor method.

Table 6. Data Training

Full Name	Gender	Easy Access to The Location	Infrastructure	Parking Lot	Official Service	Cleanliness	Category
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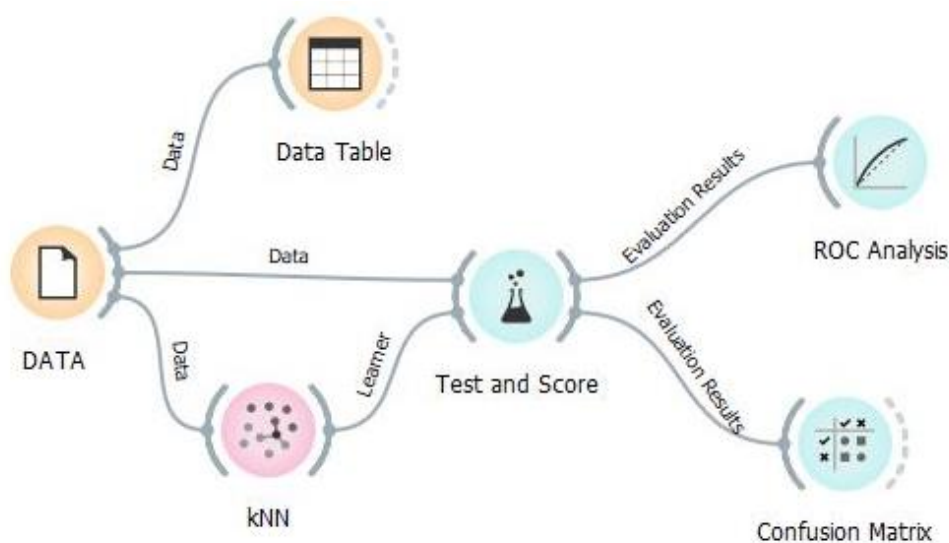
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Table 6 contains the predicted results from the Classification process for the level of visitor satisfaction at Suzuya Mall Rantauprapat. The prediction results obtained from the classification of 45 visitor data are that there are 41 satisfied visitors at Suzuya Mall Rantauprapat (for a representation of 91.11%) and found 4 dissatisfied visitors at Suzuya Mall Rantauprapat (for a representation of 8.88). %).

**Classification Model Evaluation Results**



**Figure 4. Classification Evaluation Widget**

In Figure 4 is the arrangement and shape of the widgets used to view tests and scores from the Classification results using the K-Nearest Neighbor method.

**Table 7, Test and Score Results**

Model	AUC	CA	F1	Precision	Recall
kNN	0.866	0.956	0.949	0.958	0.956

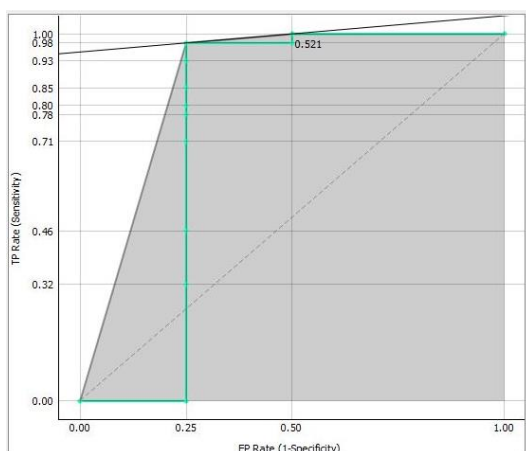
Figure 7 shows the test results and scores from the Suzuya Mall Rantauprapat visitor data. Then the result of the AUC is 0.866, the result of CA is 0.956, the result of F1 is 0.949, the result of Precision is 0.958, the result of Recall is 0.956. These results were obtained using the K-Nearest Neighbor (kNN) method.

\*name of corresponding author



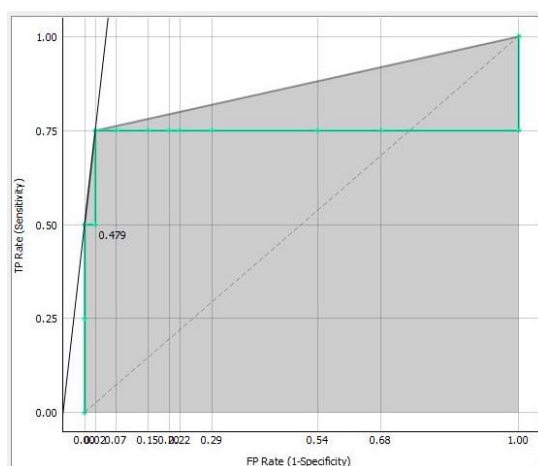
**Evaluation Results with ROC Curve**

The Roc Curve is a curve diagram that shows the results of data classification in the form of a curve that researchers get from the classification results using the K-Nearest Neighbor (kNN) method.



**Figure 52.** ROC Analysis level of visitor satisfaction

Figure 5 states that the results of the ROC Analysis of visitors who are satisfied when they come and shop at Suzuya Mall Rantauprapat using the K-Nearest Neighbor method with a result of 0.521.



**Figure 6.** ROC Analysis the level of visitor dissatisfaction

Figure 6 states that the results of the ROC Analysis of visitors who are dissatisfied when they come and shop at Suzuya Mall Rantauprapat using the K-Nearest Neighbor method with a result of 0.479.

**Evaluation Results with Confusion Matrix**

Confusion Matrix is a measurement tool that is used as a predictive tool to classify data based on certain categories using the K-Nearest Neighbor method.

Tabel 8, Result of Confusion Matrix

		Predicted		Σ
		Satisfied	Not Satisfied	
Actual	Satisfied	41	0	41
	Not Satisfied	2	2	4
Σ		43	2	45

\*name of corresponding author



Figure 8 The True Positive (TP) result is 41, True Negative (TN) is 2, False Positive (FP) is 0 and False Negative (FN) is 2. Then the values for accuracy, precision and recall are as follows:

$$\text{Accuracy} = \frac{41+2}{41+2+2+0} \times 100\% \quad \text{Then the Accuracy value} = 95\%$$

$$\text{Presisi} = \frac{41}{41+2} \times 100\% \quad \text{Then the Precision value} = 95\%$$

$$\text{Recall} = \frac{41}{41+0} \times 100\% \quad \text{Then the Recall value} = 100\%$$

## DISCUSSIONS

The satisfaction of a visitor is very important for the development and progress of a place. This is because visitors are one of the important factors for the advancement of a place, so if a visitor is not satisfied, then the place may not be able to progress and develop because there are no visitors. This research discusses the level of visitor satisfaction at Suzuya Mall Rantauprapat with a total of 45 visitor data. Results obtained from questionnaire that from 45 visitor data, there are 41 visitors who are satisfied at Suzuya Mall Rantauprapat (for representation of 91.11%) and the results of Classification using the K-Nearest Neighbor method are 41 visitors who are satisfied at Suzuya Mall Rantauprapat (for representation of 91.11%). For accuracy results obtained by using the test and score widget of 0.866 (representation of 86.6%) and the accuracy results obtained by using the confusion matrix widget is 95%. The comparison between the results obtained purely from the questionnaire and the predicted results is 1: 1, because the two results have the same amount. That way the K-Nearest Neighbor method is very good to use for data classification. Comparison for the results of the accuracy of the test and score with the confusion matrix, the results obtained have a large enough difference that is equal to 9%. The results obtained from the confusion matrix are greater than the results of the test and score.

However, the results of the comparison between the values from the questionnaire and the predictions show that the K-Nearest Neighbor method is the best method when used to classify data. The accuracy comparison results obtained are also very good Good, because it can give a fairly large value, although there is a fairly large difference.

## CONCLUSION

Satisfaction is a person's feeling of pleasure at something, such as a beautiful place, clean place and good quality of an item. Visitor satisfaction is one of the factors that is important for the development of a place, because with a sense of satisfaction it will continue to bring in visitors, because they are satisfied with the place. If someone is dissatisfied, chances are that someone will not come again. Therefore a study was made to see the level of visitor satisfaction at Suzuya Mall Rantauprapat. This research was conducted with a classification process using the K-Nearest Neighbor method which will be processed in data mining. After a Classification was carried out using the K-Nearest Neighbor method, the result was that there were 41 satisfied visitors at Suzuya Mall Rantauprapat and the results obtained from Classification using the K-Nearest Neighbor method were 41 visitors. These results indicate that many visitors are satisfied with Suzuya Mall Rantauprapat. This means that Suzuya Mall Rantauprapat can provide satisfaction to visitors, from an easily accessible location, complete facilities and infrastructure, a large parking area, friendly staff service and a clean, clean place. These parameters have positive results from visitors.

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