

# Analysis of the Neural Network Method to Determine Interest in Buying Pertamina Fuel

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**Abstract:** Fuel is one of the needs that is used by the community as a material to be used on motorcycles or cars. Fuel has become an important need for society, because when there is no fuel, a motorbike or car that is owned by someone cannot be used. Each vehicle has its own fuel, for motorbikes the fuel is pertainite, Pertamina, Pertamina Turbo and for cars the fuel is diesel and dexlite. For the fuel used in motorbikes, there are some people who are interested in Pertainite fuel and there are not many people who are interested in Pertamina fuel. So researchers will make a study of public interest in Pertamina fuel. This research will be made using the neural network method by classifying community data in data mining. This study aims to see the public's interest in purchasing Pertamina fuel. The research process was carried out with the initial stages of collecting and selecting data to be used, then preprocessing, then designing the neural network method and finally the testing process to obtain classification results using the neural network method. The results obtained from data classification using the neural network method state that there are 23 people who are interested in Pertamina fuel and 18 people who are not interested in Pertamina fuel. It turns out that many people are interested in Pertamina fuel.

**Keywords:** Classification, Confusion Matrix, Fuel, Neural Network, Roc Analysis.

## INTRODUCTION

Kotapinang District is one of the Districts in Labuhanbatu Regency. The majority of the people own motorbikes and some people drive cars. So it can be said that fuel is one of the important needs of the community in their daily needs, because of course people will need fuel so that their vehicles can be used. This happened because the distance between the location of the house and the work location was not close. So that means fuel is very important in everyday life. But not all fuels are in demand by the people of Kotapinang District. There are several fuels used such as pertainite, Pertamina, bio-diesel and dexlite. The fuel that people are most interested in are pertainite and bio-diesel. This is because the prices for pertainite and bio-diesel are cheaper than Pertamina and Dexlite. But in this study the researchers will only discuss motorcycle fuel, namely pertainite and Pertamina.

The people's choice of motorcycle fuel is pertainite, because of the low price. But not a few people choose Pertamina for reasons that it is cleaner and does not damage the vehicle, even though the price is expensive. But with only a few thousand price difference, we get clean fuel and don't damage the vehicle. These things became the impetus for researchers to analyze the interest of the Kotapinang District community regarding interest in buying Pertamina fuel. Researchers chose Pertamina, because they wanted to see how many people were interested in Pertamina fuel, even though it was expensive. We will classify community data by data mining.

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Data mining is the process of classifying data by grouping data according to their respective classes. The data mining process is carried out using statistical and mathematical techniques. To implement data mining, we need a method that can be used to classify data on interest in buying Pertamina fuel in Kotapinang District. The method that we will use to classify data on interest in buying Pertamina fuel is by using the Neural Network method. This method is a data classification method by grouping data according to their respective classes.

### METHOD

The neural network method is a computational mathematical model that contains a set of probabilities that are fully connected and arranged in two or more layers. (Khrisat & Alqadi, 2022)(Almasinejad et al., 2022) We will use the neural network method to classify data on people's buying interest in Pertamina fuel. (Cases et al., 2019) In our opinion, the neural network method can be superior for use as accuracy in data classification. (Chai, Wong, Goh, Wang, & Wang, 2019) Therefore we use the neural network method to make a prediction by classifying data on people's buying interest in Pertamina fuel. (Firdaus, Yunardi, Agustin, Putri, & Anggriawan, 2020) The data will be predicted by the neural network method using the orange application. (Priatna & Djamal, 2020) The neural network method is also the result of the development of the Multilayer Perceptron (MLP) (Rustam, Yuda, Alatas, & Aroef, 2020). To use this method, we will divide the dataset into training data as our reference for classifying and testing data as the data that we will classify. (Aguni, Chabaa, Ibnyaich, & Zeroual, 2021)(Baker, Mohammed, & Aldabagh, 2020)(Toradmalle, Muthukuru, & Sathyanarayana, 2019)

### 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) Confusion matrix can be used to evaluate the work results of a model and can be used to determine the results of a data mining. 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, we can do it by calculating accuracy, precision and recall

$$\text{Accuracy} = \frac{TP+TN}{TP+TN+FP+FN} \times 100\% \quad (\text{Sari, Prakoso, \& Baskara, 2020})$$

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

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

### RESULT

#### Data analysis

In the picture below is sample data that we get through a questionnaire. The data is data from Kotapinang sub-district community which we will classify using the neural network method. This data was obtained by distributing questionnaires to the people of Kotapinang District.

\*name of corresponding author



FULL NAME	STATUS	FUEL USED	FUEL PRICE	REASONS TO CHOOSE BBM	CATEGORY
Ahmad Isal Zai	Society	Pertamax	Expensive	Do not damage the vehicle	Interest
Ahmad Yani	Society	Pertalite	Low	The price is affordable	Not Interest
Alfadio Kurma Rifki	Student	Pertamax	Affordable	The quality is good	Interest
Anggi Claudia	Society	Pertamax	Expensive	The quality is good	Interest
Artiansyah Siregar	College Student	Pertalite	Affordable	The price is affordable	Not Interest
Bayu Ismail	Society	Pertamax	Expensive	The quality is good	Interest
Bayu Setiawan	Society	Pertamax	Expensive	The quality is good	Interest
Fadli	Society	Pertamax	Expensive	The quality is good	Interest
Faridah Ritonga	College Student	Pertalite	Affordable	The price is affordable	Not Interest
Fitriani Harahap	College Student	Pertamax	Low	The price is affordable	Interest
Irpan Romadhon	Student	Pertalite	Low	The price is affordable	Not Interest
Jainuddin	Society	Pertamax	Expensive	Do not damage the vehicle	Interest
Juhan Lubis	Society	Pertamax	Expensive	Do not damage the vehicle	Interest
Junaedi	Society	Pertamax	Affordable	Do not damage the vehicle	Interest
Khoirul anwar rambe	College Student	Pertamax	Expensive	Do not damage the vehicle	Interest
Latipa Hanum Pane	Society	Pertamax	Affordable	The price is affordable	Interest
M. Al Fahrizal	Society	Pertalite	Low	The price is affordable	Not Interest
Mardiana Rambe	College Student	Pertamax	Expensive	Do not damage the vehicle	Interest
Mariman	Society	Pertamax	Expensive	The quality is good	Interest
Metty lia monalisa	College Student	Pertalite	Affordable	The price is affordable	Not Interest
Muhammad Siregar	College Student	Pertalite	Expensive	The price is affordable	Not Interest
Mulyadi	Society	Pertamax	Affordable	The price is affordable	Interest
Nanda Fahrezi Munazhif	College Student	Pertamax	Expensive	Do not damage the vehicle	Interest
Nina Wati	Student	Pertalite	Affordable	The price is affordable	Not Interest
Putra Marpaung	Student	Pertalite	Low	The price is affordable	Not Interest
Putri Setiani	Society	Pertalite	Low	The price is affordable	Not Interest
Rahmad Lase	Society	Pertalite	Low	The price is affordable	Not Interest
Rahmaita Pane	Society	Pertamax	Expensive	Do not damage the vehicle	Interest
Rahman	Society	Pertamax	Affordable	The quality is good	Interest
Rizky Abadi Harahap	Society	Pertalite	Low	The price is affordable	Not Interest
Ronaklo	Society	Pertamax	Affordable	The price is affordable	Not Interest
Samini	Society	Pertamax	Expensive	The quality is good	Interest
Samaeli	Society	Pertalite	Low	The price is affordable	Not Interest
Sandi Nur Muhammad	Society	Pertalite	Expensive	The quality is good	Not Interest
Sandy Ritonga	College Student	Pertamax	Expensive	The quality is good	Interest
Sariah	Society	Pertamax	Expensive	The quality is good	Interest
Siti Fatimah	Society	Pertalite	Low	The price is affordable	Not Interest
Sri Maulana Adha	Student	Pertamax	Affordable	The price is affordable	Not Interest
Sri Wulan Sari	Society	Pertalite	Low	The price is affordable	Not Interest
Tri Putri	Society	Pertamax	Expensive	The quality is good	Interest
Tri Sutrisno	Society	Pertamax	Expensive	Do not damage the vehicle	Interest

Figure 1. People Data

In Figure 1, the table data above is data from the Kotapinang District community obtained from a questionnaire. The data obtained has the following attributes, namely full name, status, fuel type, price and reason.

Table 2  
Community Data Attributes

No	Atribut	Type	Deskripsi
1	Nama Lengkap	Teks	Nama lengkap Masyarakat
2	Status	Kategori	Status Masyarakat
3	Jenis Bahan Bakar	Kategori	Jenis bahan bakar yang digunakan
4	Harga	Kategori	Penilaian tetang harga bahan bakar
5	Alasan	Kategori	Alasan memilih bahan bakar tersebut

In the attribute table. Research attributes are data that we obtained from questionnaires distributed to each community. The attribute data is equipped with the type and description of each attribute.

### Training Data

The training data is data that we will use as a sample in the research that we will conduct, we obtain this data by distributing questionnaires to the community in Kotapinang District. Initially this data was compiled on Google Spreadsheet, then we downloaded it in file.xlsx format. Then we arrange the data so that it can become an attribute to determine people's interests Kotapinang on the purchase of fuel Pertamina in kotapinang sub-district.

\*name of corresponding author



FULL NAME	STATUS	FUEL USED	FUEL PRICE	REASONS TO CHOOSE BBM	CATEGORY
Ahmad Isal Zai	Society	Pertamax	Expensive	Do not damage the vehicle	Interest
Ahmad Yani	Society	Pertalite	Low	The price is affordable	Not Interest
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Bayu Setiawan	Society	Pertamax	Expensive	The quality is good	Interest
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Fitriani Harahap	College Student	Pertamax	Low	The price is affordable	Interest
Irpan Romadhon	Student	Pertalite	Low	The price is affordable	Not Interest
Jaimuddin	Society	Pertamax	Expensive	Do not damage the vehicle	Interest
Juhan Lubis	Society	Pertamax	Expensive	Do not damage the vehicle	Interest
Junaedi	Society	Pertamax	Affordable	Do not damage the vehicle	Interest
Khoirul anwar rambe	College Student	Pertamax	Expensive	Do not damage the vehicle	Interest
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Mulyadi	Society	Pertamax	Affordable	The price is affordable	Interest
Nanda Fahrezi Munazhif	College Student	Pertamax	Expensive	Do not damage the vehicle	Interest
Nina Wati	Student	Pertalite	Affordable	The price is affordable	Not Interest
Putra Marpaung	Student	Pertalite	Low	The price is affordable	Not Interest
Putri Setiani	Society	Pertalite	Low	The price is affordable	Not Interest
Rahmad Lase	Society	Pertalite	Low	The price is affordable	Not Interest
Rahmاتا Pane	Society	Pertamax	Expensive	Do not damage the vehicle	Interest
Rahman	Society	Pertamax	Affordable	The quality is good	Interest
Rizky Abadi Harahap	Society	Pertalite	Low	The price is affordable	Not Interest
Ronaklo	Society	Premium	Affordable	The price is affordable	Not Interest
Samini	Society	Pertamax	Expensive	The quality is good	Interest
Samaeli	Society	Pertalite	Low	The price is affordable	Not Interest
Sandi Nur Muhammad	Society	Pertalite	Expensive	The quality is good	Not Interest
Sandy Ritonga	College Student	Pertamax	Expensive	The quality is good	Interest
Sariah	Society	Pertamax	Expensive	The quality is good	Interest
Siti Fatimah	Society	Pertalite	Low	The price is affordable	Not Interest
Sri Maulana Adha	Student	Premium	Affordable	The price is affordable	Not Interest
Sri Wulan Sari	Society	Pertalite	Low	The price is affordable	Not Interest
Tri Putri	Society	Pertamax	Expensive	The quality is good	Interest
Tri Sutrisno	Society	Pertamax	Expensive	Do not damage the vehicle	Interest

Figure 2. Data Training

Figure 2 contains data on the Kotapinang District community. This data is equipped with the required attributes and it is this data that will later be classified to determine the interest of the Kotapinang District community in purchasing Pertamina fuel in Kotapinang District.

Tabel 3, People Data Columns

No	Attribute	Type	Role	Values
1	Nama	Text	Meta	
2	Status	Categorical	Feature	College Student, Society, Student
3	Fuel Used	Categorical	Feature	Pertalite, Pertamina, Premium
4	Fuel Price	Categorical	Feature	Affordable, Expensive
5	Reason to Choose BBM	Categorical	Feature	Do Not Damage the Vehicle, The Price is Affordable, The Quality is Good
6	Category	Categorical	Target	Interest, Not Interest

The table above contains the data needed to carry out a classification using the neural network method. The neural network method will classify data on people who are interested and not interested in Pertamina fuel. By using the neural network method and changing the type of the category attribute which was originally a feature to become a target in order to get the appropriate results.

**Data Selection Process (Preprocessing)**

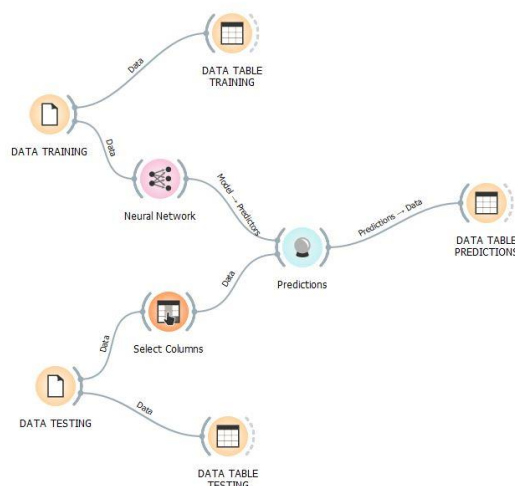
The column selection process is a process carried out to complete the attribute data needed to determine public interest in purchasing Pertamina fuel. This method is a very important method in data classification, because in this process data will be selected to suit the needs of the attributes to be used. (Hassan, Ariffin, Syed Yusof, Ghazali, & Kanona, 2021)

\*name of corresponding author



**Data Mining Process**

The data mining process is carried out using a data classification model using the orange application. In this data classification model, we will use the neural network method to determine people's interest in purchasing Pertamina fuel.

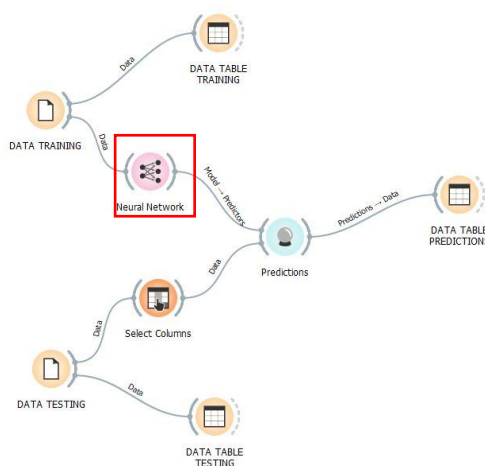


**Figure 3. Data Mining Process**

In Figure 3 is a widget that is used to classify data using the neural network method which will determine and classify data on people who are interested and not interested in purchasing Pertamina fuel.

**Model Classification Testing Process**

In the data testing process, the neural network method will be used to classify community data. To carry out this classification we will need training data and testing data which are sample data, these data are data from the people of Kotapinang District.



**Figure 4. Classification of the widget design model of the Pertamina buying interest dataset**

Figure 4 shows the widget pattern needed when performing a classification using the neural network method. The widget in the red box is the neural network method that we use for data classification by grouping data that is interested and not interested in purchasing Pertamina fuel in Kotapinang District.

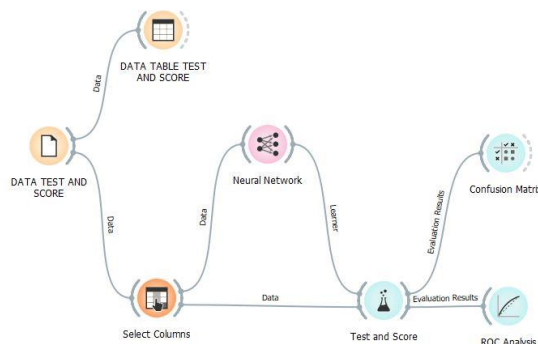
\*name of corresponding author



**Classification Model Prediction Process**

In this process is a process to make a data prediction by classifying data using the neural network method. To realize the neural network method, classification will be carried out using the neural network method in data mining. The results obtained from data mining from 41 community data obtained 23 people who were interested in buying Pertamina fuel (representation of 56.10%) and obtained as many as 18 people who were not interested in buying Pertamina fuel (representation of 43.90%). The results of this data classification show that in fact many are interested in buying Pertamina fuel.

**Classification Model Evaluation Results**



**Figure 5. Classification Evaluation Widget**

Figure 5 contains a widget for us to use as an evaluation of the data classification that we have done before. To evaluate the data, we will determine the Confusion matrix and ROC analysis. To determine the results of both we will also use the neural network method. The sample that we use is sample data (test data) which we have classified between training data and test data. The data has 1 text attribute, namely full name and 4 category attributes, namely status, fuel type, fuel price and finally the reason for choosing that fuel.

**Table 4, Result of Test and Score**

Model	AUC	CA	F1	Precision	Recall
Neural Network	0.993	0.951	0.951	0.951	0.951

The table above shows the results of the tests and scores that we got from the 41 Kotapinang sub-district community data that we have classified using the neural network method. The test results and scores obtained are as follows, the results for AUC are 0.993, the results for CA are 0.951, the results for F1 are 0.951, the results for Precision are 0.951, the results for Recall are 0.951.

**Evaluation Results with Confusion Matrix**

Confusion Matrix is a measuring tool to make a prediction by calculating the truth of a data using the neural network method.

**Table 5, Result of Confusion Matrix**

		Predicted		Σ
		Interest	Not Interest	
Actual	Interest	22	1	23
	Not Interest	1	17	18
Σ		23	18	41

\*name of corresponding author



The table above shows the True Positive (TP) result is 22. True Negative (TN) is 17, False Positive (FP) is 1 and False Negative (FN) is 1. Then the values for accuracy, precision and recall are as follows:

$$\text{Accuracy} = \frac{22+17}{22+17+1+1} \times 100\% \quad \text{Then the Accuracy value} = 95\%$$

$$\text{Presisi} = \frac{22}{22+1} \times 100\% \quad \text{Then the Precision value} = 95\%$$

$$\text{Recall} = \frac{22}{22+1} \times 100\% \quad \text{Then the Recall value} = 95\%$$

### Evaluation Results with ROC Curve

The Roc Curve is obtained from the true signal (sensitivity) and (1 specificity) over the entire cut off point range to obtain the ROC curve visualized from the Confusion Matrix. The results of the ROC chart can be seen in Figure 6.

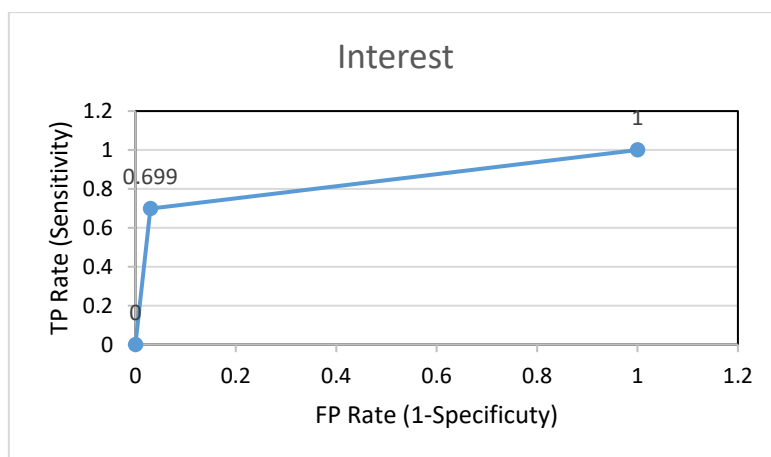


Figure 6. ROC Analysis of people interested in buying Pertamina fuel

Figure 6 states that the results of the ROC analysis of people who are interested in purchasing Pertamina fuel using the neural network method, the result is 0.699.

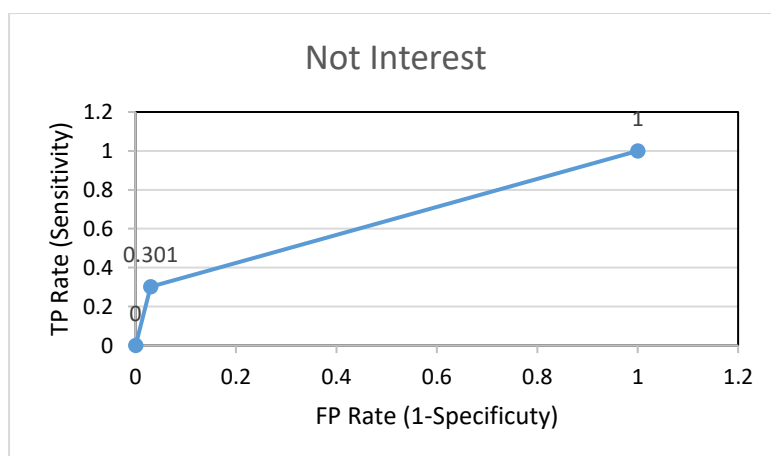


Figure 7. ROC Analysis of people who are not interested in buying Pertamina fuel

Figure 7 states that the results of the ROC analysis of people who are not interested in purchasing Pertamina fuel using the neural network method, the result is 0.301.

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## DISCUSSIONS

This research was conducted to determine the interest in buying Pertamina fuel for the people of Kotapinang District. research conducted using the neural network method, data that has passed preprocessing, will enter the data mining process. The results obtained from data mining testing using the neural network method, the result of the test and score accuracy is 0.993 (representation of 99.3%) and the results of the accuracy of the confusion matrix are 95%. Both results were obtained using the neural network method. The comparison of these results between the test and score results and the results of the confusion matrix is only a 4% difference.

The results of the two accuracy states that the neural network method is one method that is suitable for use as a classification method with good results, namely above 90%. These results are very good, because it has a high yield/value.

## CONCLUSION

This research was made to classify people's buying interest in Pertamina fuel. In Kotapinang District, there are lots of people who use motorbikes, of course they need fuel. From the results of the classification that we have done, we get the result that there are still many people who are interested in Pertamina fuel, on the grounds that Pertamina fuel does not damage vehicles. So this decision tree method is very suitable for us to use to carry out a data classification. In data mining, there are many Classification methods that we can use, but we want to use the decision tree method. Each method has its own function, so whatever method we use, make sure that the method meets the needs of our research.

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