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Application of Neural Network Method to Determine Public Satisfaction Level on Pertalite Fuel

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Abstract: This research aims to analyze public interest in Pertalite fuel using the Data Mining method, specifically using the Neural Network method. The stages in this research include Data Analysis, Data Preprocessing, Designing Classification Models in Data Mining, Classification Results in Data Mining, Designing Evaluation Models in Data Mining, and Evaluation Results on Data Mining. The classification results show that of the total of 105 community data analyzed, 97 community data showed interest in Pertalite fuel, while only 8 community data showed no interest. The accuracy results obtained were 100%, indicating that the Neural Network method is very suitable and effective in classifying people's interest in Pertalite fuel. The Data Analysis process was carried out to understand and analyze the characteristics of data regarding public interest in Pertalite fuel. Data preprocessing is carried out to clean, transform and integrate data so that it is ready for the classification process. Next, the Designing Classification Models in Data Mining process is carried out to design a classification model using the Neural Network method. Classification Results in Data Mining produces information that the majority of people have an interest in Pertalite fuel. Designing Evaluation Models in Data Mining is carried out to design classification evaluation models, which then produce Evaluation Results on Data Mining which show an accuracy level of 100%. Thus, this research shows that the Neural Network method is very effective in classifying people's interest in Pertalite fuel.

Keywords : Box Plots; Classification; Confusion Matrix; Data Mining; Neural Network Method

INTRODUCTION

Fuel is a substance used to produce energy through the combustion process. Various types of fuel are used in everyday life, including fossil fuels such as petroleum, natural gas, and coal, as well as renewable fuels such as biofuel and hydrogen. Fossil fuels are formed from the remains of organisms that died millions of years ago and contain high levels of energy, but their use often causes air pollution and greenhouse gas emissions. Meanwhile, renewable fuels are obtained from renewable sources such as plants and algae, which are more environmentally friendly but still face challenges in terms of efficiency and production costs. The use of fuel has an important role in various sectors, from transportation, industry, to power generation. Motor vehicles, airplanes, and ships rely mostly on liquid fuels such as gasoline and diesel to operate. In the industrial sector, fuel is used in manufacturing processes and energy production. Power plants also use fuel to produce electricity needed by society. However, with increasing awareness of climate change and the need for cleaner energy sources, many

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countries are starting to switch to renewable energy and are looking for ways to increase the efficiency of fuel use to reduce environmental impact.

In Indonesia, fuels commonly used for motorbikes include Pertalite, Pertamax, and Pertamax Turbo. Pertalite is a type of gasoline with 90 octane which is cheaper than Pertamax and Pertamax Turbo, so it is widely used by motorbike users for their daily needs. Pertamax, with 92 octane, offers better engine performance and higher fuel efficiency, suitable for vehicles with more modern engine technology. Pertamax Turbo, with 98 octane, is a premium fuel designed for high-performance engines, providing more complete combustion and more optimal power. For cars, there are diesel fuels such as Diesel and Dexlite. Diesel is a standard diesel fuel that is widely used by commercial vehicles such as trucks and buses because it is more economical. Dexlite, on the other hand, is a higher quality diesel fuel that has a lower sulfur content and higher cetane number, resulting in more efficient combustion and cleaner emissions. Private and commercial vehicles that want better engine performance and lower environmental impact tend to choose Dexlite as an alternative fuel. The Indonesian government continues to encourage the use of more environmentally friendly and efficient fuels to support energy sustainability and reduce air pollution.

Many motor vehicle users in Indonesia choose Pertalite as their main fuel because the price is more affordable and economical. Pertalite, with an octane rating of 90, offers a balance between price and quality, making it a popular choice for owners of small to medium engine capacity motorbikes and cars. The cheaper price compared to Pertamax and Pertamax Turbo makes Pertalite a more practical choice for daily use, especially amidst fluctuating economic conditions. With this fuel, people can save operational costs without sacrificing their transportation needs. On the other hand, Pertamax, which has an octane rating of 92, is still less popular with most people because the price is relatively more expensive. Pertamax offers better engine performance and higher fuel efficiency, but the significant price difference makes many people prefer Pertalite. Vehicles that use Pertamax are usually cars with more sophisticated engine technology and whose owners prioritize engine performance and durability. However, awareness of the long-term benefits of using high-quality fuel such as Pertamax is slowly starting to increase, especially among vehicle owners who want to maintain optimal engine condition and reduce exhaust emissions.

Although Pertalite is popular among motorbike users in Indonesia, the public's primary interest in this fuel is still not fully understood. Several factors such as affordable price, wide availability, and adequate performance may be the reasons behind its popularity, but concrete data and in-depth analysis are needed to understand consumer preferences and behavior more comprehensively. For this reason, research that focuses on public interest in Pertalite as a motorbike fuel is very important to carry out. This research will explore various aspects that influence motorbike users' choice of Pertalite, such as perceived quality, fuel efficiency, and economic factors. By focusing research only on Pertalite fuel, the author aims to get a clear and specific picture of consumer preferences. Through surveys and interviews with motorbike users, this research is expected to provide in-depth insight into the motivations behind choosing Pertalite, as well as assist fuel providers and policy makers in formulating more effective strategies to meet consumer needs and preferences.

To conduct research on public interest in Pertalite fuel for motorbikes, the author will utilize data mining techniques using the Neural Network method. Neural Network is a classification method that is very effective in analyzing complex data and identifying patterns that are not easily visible with traditional analysis methods. As was done in research (Sari, Yanris, & Hasibuan, 2023) the neural network method can be used to carry out data classification and is almost the same as the research being carried out currently, only the research subject is different. This method is capable of processing large amounts of data and learning from the data to make accurate predictions or classifications, which is very suitable for this research which involves many variables and data from various sources. In research conducted by (Dharma, Sitorus, & Hatigoran, 2023) the neural network method can be used to carry out classification well, this is because the accuracy obtained was 99%. This research will begin with data collection covering various factors that influence motorbike users' fuel choices, such as user demographics, frequency of vehicle use, perceptions of the price and quality of Pertalite, as well as economic factors. This data will then be cleaned and processed to ensure its quality and relevance before being fed into the Neural Network model. A Neural Network will be trained using this data to identify

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patterns and relationships between variables that influence people's interest in Pertalite. After the model is trained, the author will use the model to classify new data and make predictions about motorbike users' preferences for Pertalite. The results of this analysis will be analyzed further to provide insight into the main factors influencing fuel choice. By using Neural Networks, this research is expected to produce more accurate and in-depth findings compared to traditional analysis methods, providing valuable guidance for fuel providers and policy makers in understanding and meeting consumer needs more effectively.

LITERATURE REVIEW

Data mining is the process of discovering patterns, relationships and valuable information from large amounts of data using statistical techniques, machine learning and artificial intelligence (Mawaddah, Dar, & Yanris, 2023). The aim is to convert raw data into useful knowledge for decision making (Indah, Sari, & Dar, 2023). This process involves several steps, including data collection, data pre-processing, application of data mining algorithms, and interpretation of results (Maizura, Sihombing, & Dar, 2023). Data mining is used in various fields such as business, health, social sciences, and technology to identify trends, make predictions, and optimize operational processes. By unearthing hidden information in data, data mining helps organizations and individuals understand complex phenomena and take more precise and effective action.

Classification models are techniques in machine learning that are used to categorize data into predetermined classes or categories (F. F. Hasibuan, Dar, & Yanris, 2023) (Ahsan, Kusrini, & Ariatmanto, 2023). In the context of research, classification models such as Neural Networks function by learning patterns and relationships in existing data to then be able to classify new data with high accuracy (Arifin & Mandala, 2023) (Violita, Yanris, & Hasibuan, 2023). This process involves training a model using a labeled dataset, where the model learns to recognize important features that differentiate one class from another (Sujadi, Sibaroni, & Ihsan, 2023). Once trained, a classification model can be used to make predictions or decisions based on new input data, making it a very useful tool in a variety of applications, from image recognition to consumer preference analysis (Maharani, Prasetiyowati, & Sibaroni, 2023) (Trihardianingsih, Sunyoto, & Hidayat, 2023).

The Neural Network method is a machine learning technique that imitates the way the human brain works in processing information to recognize patterns and make decisions (Sari et al., 2023) (Saputra, Hindarto, & Haryono, 2023) (Suherman, Hindarto, Makmur, & Santoso, 2023). This network consists of layers of interconnected artificial neurons, where each neuron receives input, processes it, and sends output to the next neuron (Karo Karo, Kiswanto, Panggabean, & Perdana, 2023) (Lestari, Mawengkang, & Situmorang, 2023). Through a training process that involves adjusting connection weights based on training data, a Neural Network can learn from the data and improve its ability to perform tasks such as classification, regression, and pattern recognition. This method is very effective in handling complex and unstructured data, such as images, sounds, and text, so it is widely used in applications such as facial recognition, natural language processing, and predictive analysis (Anwar, Jalinus, & Abdullah, 2023).

METHOD

In this research, the Neural Network method will be used to analyze public interest in Pertalite fuel by classifying data that includes various variables such as demographics, frequency of vehicle use, perceptions of the price and quality of Pertalite, as well as economic factors. Research conducted in (Sari et al., 2023) shows that the neural network method can be used to classify data. Neural Networks, with their ability to handle complex data and identify patterns invisible to traditional methods, will be trained using existing datasets. This model will learn from this data to recognize important features that influence motorbike user preferences. Once trained, this Neural Network model will be used to make accurate predictions about public interest in Pertalite, providing deeper insights for fuel providers and policy makers in understanding and meeting consumer needs. To be able to carry out this research, the author did it in several stages, namely as follows.

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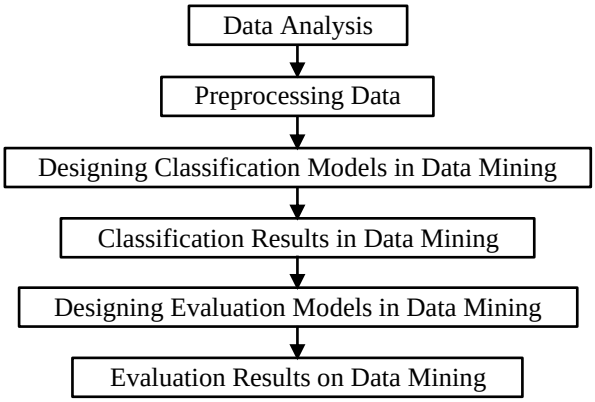

Fig 1. Flow of stages in data mining

The stages above are the steps that will be carried out to help this research process be carried out smoothly. To better understand the stages above, the author will provide an explanation of each stage, the explanation is as follows.

Data Analysis : Data analysis is a stage for collecting data that will be used in this research. For the data that will be used later we will use 2 data sets. For the first data set, namely training data as training data and the second, namely testing data as test data or as research sample data.

Preprocessing Data : The data preprocessing stage is a process carried out to clean the data set that will be used. At this stage the data will also be selected based on data that is suitable for use, then the data will be arranged based on a format that is appropriate to the research being carried out.

Designing Classification Models in Data Mining : At this stage is the design of the research model that will be used in this research.

Classification Results in Data Mining : At this stage, the results of the classification are carried out using the previous design model.

Designing Evaluation Models in Data Mining :At this stage is the process of designing a model to evaluate the method used.

Evaluation Results on Data Mining : This stage is the result of evaluating the method used

Confusion Matrix

Confusion Matrix is an evaluation tool used to measure the performance of a classification model by comparing the predicted values with the actual values of the data. So this Confusion Matrix will later be used to help with the evaluation process of the methods used in this research. For the Confusion Matrix, there is a table which is the result of the evaluation and there are also calculations to determine the accuracy of the method used.

Table 1. Confusion Matrix

		Prediction Class	
	Class	**True**	**False**
Attribute Class	True	True Positive (TP)	False Positive (FP)
	False	False Negative (FN)	True Negative (TN)

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From the table above for the explanation below.

1. TP (True Positive), namely the amount of positive data that has a true value.
2. TN (True Negative), namely the amount of negative data that has a true value.
3. FN (False Negative), namely the amount of negative data but which has the wrong value.
4. FP (False Positive), namely the amount of data that is positive but has the wrong value.

$$\boldsymbol{Acuracy} = \frac{\boldsymbol{TP+TN}}{\boldsymbol{TP+TN+FN+FP}} \times \mathbf{100\%}$$ (Pratama, Yanris, Nirmala, & Hasibuan, 2023)

$$\boldsymbol{Presisi} = \frac{\boldsymbol{TP}}{\boldsymbol{TP+FP}} \times \mathbf{100\%}$$ (Triani, Dar, & Yanris, 2023)

$$\boldsymbol{Recall} = \frac{\boldsymbol{TP}}{\boldsymbol{TP+FN}} \times \mathbf{100\%}$$ (S. A. Hasibuan, Sihombing, & Nasution, 2023)

RESULT

Data Analysis

Data analysis is the process that will be carried out to determine the data set that will be used in this research. There are 2 data sets that will be used in this research which are very important and must be present in every data mining research. The data sets that will be used are training data and testing data.

Data Training

Training data is training data that is used to assist the data processing process. For this research, data processing will be classified based on predetermined classes. So later the training data will be used to help the data classification process.

Table 2. Data Training

Name	Gender	Fuel Type	Selling price	Fuel Quality	Fuel Efficiency	Category
Ahmad Fauzan	Man	Pertalite	Cheap	Not Good	Economical	Interest
Budi Santoso	Man	Pertalite	Cheap	Good	Economical	Interest
Diah Permata Sari	Man	Pertalite	Expensive	Good	Economical	Interest
Eka Putra	Woman	Pertalite	Cheap	Good	Economical	Interest
Fitriani Nur Aini	Man	Pertalite	Cheap	Good	Wasteful	Interest
Gita Pramudita	Woman	Pertalite	Cheap	Good	Economical	Interest
Hendra Wijaya	Man	Pertalite	Expensive	Not Good	Wasteful	Not Interested
Indah Kusuma Dewi	Man	Pertalite	Cheap	Good	Economical	Interest
Joko Susilo	Man	Pertalite	Cheap	Good	Economical	Interest
Kartika Sari	Man	Pertalite	Cheap	Good	Economical	Interest
Lestari Puspitasari	Man	Pertalite	Cheap	Not Good	Wasteful	Not Interested
Muhammad Rizky	Man	Pertalite	Cheap	Good	Economical	Interest
Nanda Septian	Man	Pertalite	Expensive	Not Good	Economical	Not Interested

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Oki Setiawan	Woman	Pertalite	Cheap	Not Good	Wasteful	Not Interested
Putri Amelia	Man	Pertalite	Expensive	Not Good	Wasteful	Not Interested
Rini Yuliani	Woman	Pertalite	Cheap	Good	Economical	Interest
Sari Wijayanti	Man	Pertalite	Cheap	Good	Economical	Interest
Taufik Hidayat	Man	Pertalite	Expensive	Good	Wasteful	Not Interested
Umi Kalsum	Woman	Pertalite	Cheap	Good	Economical	Interest
Zahra Inayah	Woman	Pertalite	Cheap	Good	Economical	Interest

In the table above is the training data that will be used to help the data classification process. The training data that will be used is 20 training data.

Data Testing

Testing data is the data that will be tested in this research. This testing data is research sample data that will be used. This data will later be classified.

Table 3. Data Testing

Name	Gender	Fuel Type	Selling price	Fuel Quality	Fuel Efficiency
Aaron Siregar	Man	Pertalite	Cheap	Good	Economical
Ade Nasution	Man	Pertalite	Cheap	Good	Economical
Aditya Bayu	Man	Pertalite	Cheap	Good	Economical
Aisyah Pangaribuan	Woman	Pertalite	Cheap	Good	Economical
Aldiansyah	Man	Pertalite	Cheap	Good	Economical
Aliya Lubis	Woman	Pertalite	Cheap	Good	Economical
Ananda	Man	Pertalite	Expensive	Not Good	Wasteful
Andre Sipahutar	Man	Pertalite	Cheap	Good	Economical
Angel	Man	Pertalite	Cheap	Good	Economical
Ardiansyah	Man	Pertalite	Cheap	Good	Economical
Arsyad	Man	Pertalite	Cheap	Good	Economical
Arya Dimas	Man	Pertalite	Cheap	Good	Economical
Aryan	Man	Pertalite	Cheap	Good	Economical
Ayu Siregar	Woman	Pertalite	Cheap	Good	Economical
Bagas	Man	Pertalite	Expensive	Not Good	Wasteful
Good Sinaga	Woman	Pertalite	Cheap	Good	Economical
Bahagia Nainggolan	Man	Pertalite	Cheap	Good	Economical
Bayu Syahputra	Man	Pertalite	Cheap	Good	Economical
Bella Hasibuan	Woman	Pertalite	Cheap	Good	Economical
Betty Br Siahaan	Woman	Pertalite	Cheap	Good	Economical

In the table above is the data that will be used to classify the data. The testing data that will be used is 105 testing data. However, for the data in the table above, the author only entered 20 test data. The test data above will later be processed using a data design model and will be processed using the neural network method.

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Preprocessing Data

At the data preprocessing stage, the data that has been obtained will be arranged in a form and format that suits research needs. But before that the data will be selected and selected for data that is suitable for use.

Designing Classification Models in Data Mining

This stage is the stage carried out to design the model that will be used to classify data in data mining. For the design model that will be carried out using the Orange application.

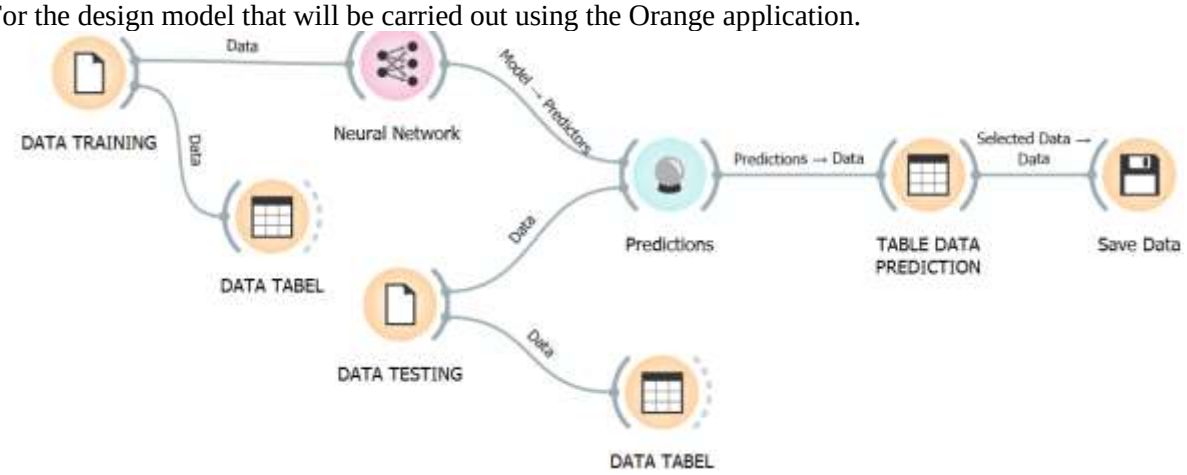

Fig 2. Model Design in Data Mining

In the image above is the design model that will be used to classify data in data mining. The method used can be seen in the Neural Network widget. This widget is a neural network method that will be used to classify data in data mining.

Classification Results in Data Mining

At this stage, the results of the classification are carried out using a model that has been designed in the Orange application. The results obtained are a classification carried out using the neural network method.

Table 4. Classification Results in Data Mining

Name	Gender	Fuel Type	Selling price	Fuel Quality	Fuel Efficiency	Category
Aaron Siregar	Man	Pertalite	Cheap	Good	Economical	Interest
Ade Nasution	Man	Pertalite	Cheap	Good	Economical	Interest
Aditya Bayu	Man	Pertalite	Cheap	Good	Economical	Interest
Aisyah Pangaribuan	Woman	Pertalite	Cheap	Good	Economical	Interest
Aldiansyah	Man	Pertalite	Cheap	Good	Economical	Interest
Aliya Lubis	Woman	Pertalite	Cheap	Good	Economical	Interest
Ananda	Man	Pertalite	Expensive	Not Good	Wasteful	Not Interested
Andre Sipahutar	Man	Pertalite	Cheap	Good	Economical	Interest
Angel	Man	Pertalite	Cheap	Good	Economical	Interest
Ardiansyah	Man	Pertalite	Cheap	Good	Economical	Interest
Arsyad	Man	Pertalite	Cheap	Good	Economical	Interest
Arya Dimas	Man	Pertalite	Cheap	Good	Economical	Interest
Aryan	Man	Pertalite	Cheap	Good	Economical	Interest
Ayu Siregar	Woman	Pertalite	Cheap	Good	Economical	Interest
Bagas	Man	Pertalite	Expensive	Not Good	Wasteful	Not Interested

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Good Sinaga	Woman	Pertalite	Cheap	Good	Economical	Interest
Bahagia Nainggolan	Man	Pertalite	Cheap	Good	Economical	Interest
Bayu Syahputra	Man	Pertalite	Cheap	Good	Economical	Interest
Bella Hasibuan	Woman	Pertalite	Cheap	Good	Economical	Interest
Betty Br Siahaan	Woman	Pertalite	Cheap	Good	Economical	Interest

In the table above are the results of data classification that has been carried out using a model that has been previously designed with the Orange application and classified using the neural network method. The results obtained were that of the 105 data used, there were 97 community sample data that were interested in Pertalite fuel and 8 community sample data were not interested in Pertalite fuel.

Designing Evaluation Models in Data Mining

This stage is the model design stage for evaluating the neural network method. The purpose of the evaluation is to test the performance and effectiveness of the method used.

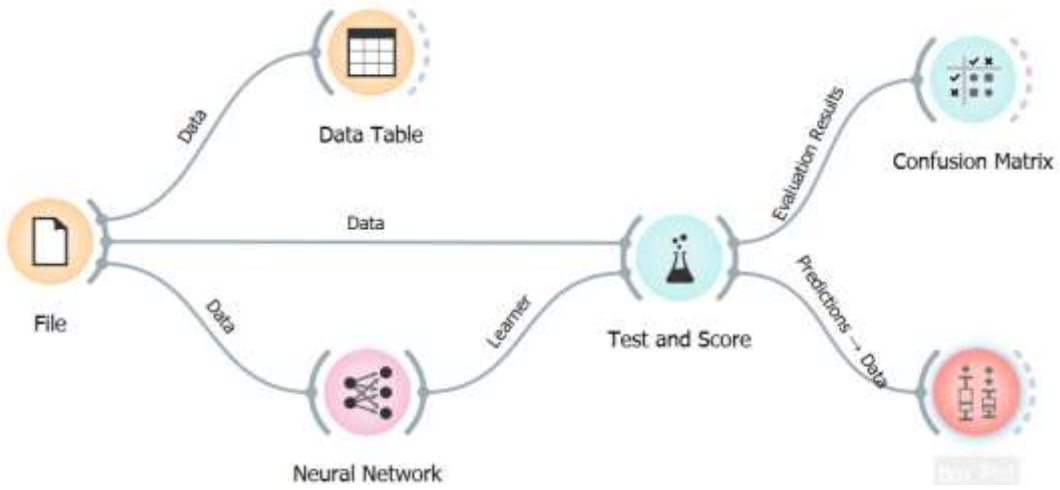

Fig 3. Design of Evaluation Model Design in Data Mining

In the image above is a design model that will be used to evaluate the neural network method that has been used to classify data in data mining. With the model in the image above, the author can provide accuracy, precision and recall of the method used. The widgets used are the blue ones, the test and score widget and the confusion matrix widget.

Evaluation Results on Data Mining

Test and Score

Table 5. Result of Test and Score

Model	AUC	CA	F1	Precision	Recall	MCC
Neural Network	1.000	1.000	1.000	1.000	1.000	1.000

In the table above are the evaluation results of the Test and Score widget using the Neural Network method. The results obtained show that the AUC, CA, F1, Precision, Recall, and MCC values all reach 1,000. This indicates excellent model performance with an error rate close to zero, indicating that the neural network model is able to classify the data perfectly without errors. With an accuracy of 100%, these results confirm that the neural network method is very suitable for use in this research, namely for classifying people's interest in Pertalite fuel. The perfect accuracy reflects that the model can effectively identify patterns and trends in the data, making it an invaluable tool for analysis and decision making in this field.

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Confusion Matrix

The confusion matrix results were obtained to provide evaluation results for the Neural Network method and the results are as follows.

Table 6. Confusion Matrix Results in the Neural Network Method

		Predicted		
		Interest	Not Interested	∑
Actual	Interest	97	0	97
	Not Interested	0	8	8
	∑	97	8	105

In the table above are the results of the evaluation carried out on the Neural Network method using the Confusion Matrix widget. The results show that there are 97 data included in the True Positive (TP) category, 8 data in the True Negative (TN) category, 0 data in the False Positive (FP) category, and 0 data in the False Negative (FN) category. Even though these results look very good, to measure the accuracy value precisely, the data must be calculated first using the formula in the confusion matrix, which is as follows.

$$\boldsymbol{Accuracy} = \frac{\mathbf{97+8}}{\mathbf{97+8+0+0}} \mathbf{+ 100\%}$$ Then the Accuracy value = 100%

$$\boldsymbol{Presisi} = \frac{\mathbf{97}}{\mathbf{97+0}} \mathbf{+ 100\%}$$ Then the Precision value = 100%

$$\boldsymbol{Recall} = \frac{\mathbf{97}}{\mathbf{97+0}} \mathbf{+ 100\%}$$ Then the Recall value = 100%

From the calculation results above, the accuracy of the confusion matrix widget for the neural network method is obtained, which shows very good results, with an accuracy level of 100%. These results indicate that the neural network method is very suitable for use in this research for classifying public interest in Pertalite fuel. This perfect accuracy indicates that the neural network model succeeded in classifying the data very precisely, so it could become a reliable method for similar analyzes in the future.

Box Plot Results

Box plots in data mining are visualization tools used to display data distribution, identify outliers, and understand variability and central tendencies in datasets. In this context, the author will provide an image of the evaluation results of the Neural Network method using the Box Plot widget. This box plot will make it easier to analyze model performance by looking at the distribution of predicted values, identifying deviant data, and ensuring the accuracy and consistency of the model used in classifying public interest in Pertalite fuel.

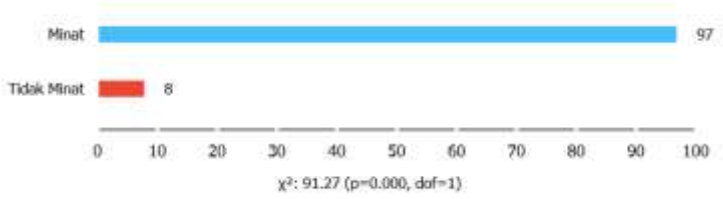

Fig 4. Box Plot Results

*name of corresponding author

The results of the evaluation carried out using the Box Plot widget show that more people are interested in Pertalite fuel than those who are not interested. In the image above, the blue line represents people who are interested in Pertalite fuel, with a total of 97 people's data. Meanwhile, the red line represents people who are not interested in Pertalite fuel, with a total of 8 people's data. This indicates that the majority of people prefer Pertalite fuel, which can be important information for making decisions regarding the distribution and marketing of this fuel.

DISCUSSIONS

Research on public interest in Pertalite fuel shows that the majority of people have a high interest in this fuel. The research results show that the majority of people have a preference for using Pertalite fuel compared to other fuel options. However, there are a small number of people who are not interested or have no interest in Pertalite fuel. This shows that even though the majority of people choose Pertalite fuel, there is potential to expand the market or increase the interest of people who are not yet interested.

In evaluating using the Neural Network method, researchers used the Test and Score widget and the Confusion Matrix Widget. The accuracy results obtained from both widgets show the same results, namely 100%. A comparison of the two accuracy results shows perfect agreement (1:1), which shows that the Neural Network method is very suitable and effective in classifying people's interest in Pertalite fuel. With these very high accuracy results, it can be concluded that the Neural Network method can be relied on for further analysis and can be a reference in making decisions regarding Pertalite fuel marketing strategies.

CONCLUSION

Research on public interest in Pertalite fuel shows that the majority of people have significant interest in this type of fuel. The data obtained showed that 97 people showed interest in Pertalite fuel, while only 8 people showed no interest. This confirms that public interest in Pertalite fuel is quite high, with only a small portion of the public not being interested in this type of fuel. Apart from that, the evaluation results obtained from this research are also very positive. The evaluation methods used, such as the use of the Test and Score widget and Confusion Matrix, show very good accuracy results, reaching 100%. This indicates that the model used in this research is able to classify people's interest in Pertalite fuel very accurately. With these very good evaluation results, it can be concluded that the model used in this research is very effective and reliable for further analysis related to public interest in Pertalite fuel.

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