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Implementation of Data Mining to predict sales of Bogo helmets using the Naïve Bayes algorithm

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Abstract: Consumer needs for safety and comfort in driving are very important, especially for two-wheeled or motorcycle riders. A good helmet is a helmet that is safe and comfortable when worn. Helmet qualifications that meet SNI standards are open helmets and closed helmets. Transactions are carried out online, because it was still in a pandemic situation when it was established. By carrying the tag line "Ride Safety With Your Own Style", trying to educate the younger generation to keep paying attention to safety when driving but also not neglecting fashion. For the type of sale of bogo and retro helmet brands, with a variety of colors and affordable prices. A common problem faced is how to predict or forecast future helmet sales based on pre-recorded data. This prediction is very influential on the decision to determine the number of helmets that must be provided, if you order helmets in sufficient quantities and it turns out that only a few helmet sales are sold and this will cause the stock of helmets to accumulate. The results of predictions for the sale of bogo helmets in Baris True Instances amounted to 16 data, which means Valid with 53% data accuracy. Meanwhile, there are 10 data classified as Instancely Classified Instance which means Invalid, with data accuracy of 46.67%. The amount of accuracy in the Weka application is the same as the amount of accuracy in Excel calculations. From the explanation above, the Naïve Bayes algorithm method is the best solution for predicting important things in a business need and others.

Keywords: Helmet, Bogo, Naïve Buyes , Sales

INTRODUCTION

Sales is an important element in a company in the field of marketing, hoping to get more profits in order to continue the business (Azis, 2021). Companies that are established for the purpose of producing goods and services for the needs of consumers, while at the same time reducing unemployment rates around the company's environment by providing jobs.

Consumer needs for safety and comfort in driving are very important, especially for two-wheeled or motorbike riders (Fatah, 2018). When driving, you must complete the existing regulations, especially wearing a standard helmet for the safety of the rider (Prasetyawan, 2021). Helmets are not only intended for protection or protection, but also for the aesthetics of the helmet wearer (Susanto, 2022). The standard helmet consists of a hard shell with a smooth surface, an impact-absorbing lining, and a chin strap. The shell is made of a hard material, the same thickness and homogeneous in its ability, does not blend with face and eye protection and must not have local reinforcement.(Rian Sacipto, 2019). The shock absorber consists of a shock absorber layer mounted on the inner surface of the shell. Helmet must be equipped with ear protection, neck cover, movable pet, shield or chin cover(Albert, 2020). Helmets that do not meet these specifications are not considered standard helmets. A good helmet is a helmet that is safe and comfortable to wear. Helmet qualifications that meet SNI standards are open and closed helmets. The open helmet has a part construction shape that can cover the head to the neck and cover the front of the ear, while the full face has a helmet shape that covers the top of the head. Some of them are the type of Bogo helmet which is widely offered in the broad market, both online and offline. The Bogo helmet is one of the most popular types of open helmets today, and it already has Indonesian National Standards (SNI).

A common problem faced by Flazo Stores is how to predict or forecast future helmet sales based on previously recorded data. This prediction is very influential on the decision of the Flazo Store to determine the

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number of helmets that must be provided by the Flazo Store, if you order a helmet in sufficient quantities and it turns out that only a few helmet sales have been sold and this will cause the stock of helmets to accumulate. Sales forecasting is a calculation to predict future conditions through testing past conditions. Forecasting future sales means determining the estimated amount of sales volume, even determining sales potential and market area controlled in the future.

Existing sales data will be processed or analyzed to determine the level of consumer tendencies in each product marketing destination on the factor of interest (Nelisa, 2018). From the data processing, a pattern of public consumption of the company's products will be obtained (Imam, 2019). The availability of quite a lot of data, the need for information to support decision making to create business solutions and infrastructure support in the field of information technology created the birth of a data mining technology, one of which is Naive Bayes.(Sari, 2022). Data mining is intended to provide real solutions for decision makers in the business world to grow their business (Triayudi, 2017).

Naive Bayes is one of the data mining methods used in classification problems based on the application of the Bayes theorem. Naive Bayes will calculate the posterior probability for each occurrence value of the target attribute in each data sample.(Mutiara, 2020). Furthermore, Naive Bayes will classify the sample data into the class that has the highest posterior probability value.

LITERATURE REVIEW

In the literature review there are several related studies, which relate to the Naïve Buyes algorithm, including the following:

1. According to Sulastri et al, 2017. With the conclusion that in predicting the sales rating of this book, the Naïve Bayes method is applied to find the largest probability value in each of the existing variables. The variables used to predict book sales rating consist of book category, genre, price, cover, publisher, age category and rating. From this research, the accuracy rate is 74.60%, recall is 83.62% and precision is 80.61%.(Sulastri, 2017).
2. According to Moh. Deifa Satrio Damara et al, 2021. With the conclusion that the Naive Bayes method for predicting interest in jacket products is 90% while the precision is 100% and has a recall of 60%. After testing the system, then testing using rapidminer to compare the performance of naive bayes in the prediction system with naive bayes from rapidminer(Damara Satrio Deifa, 2021).
3. According to Rahayu Mayang Sari, 2022. With the conclusion that testing using the Naïve Bayes method uses the Sales dataset. The results obtained from this test get an accuracy of 72.00% with a precision value and recall for each class. The ROC curve is used to express the data, the horizontal line represents the false positive value and the vertical line represents the true positive value, it can be seen that the Area Under Curve (AUC) value of the nave Bayes algorithm model is 1,000, this shows that the nave Bayes algorithm achieves perfect classification.(Sari, 2022).

The process of finding a model that describes and distinguishes data classes or concepts that aims to be used to predict the class of objects whose class label is unknown. Classification algorithms that are widely used are Decision/classification trees, Bayesian classifiers/ Naïve Bayes classifiers, Neural networks, Statistical Analysis, Genetic Algorithms, Rough sets, k-nearest neighbors, Rule Based Methods, Memory based reasoning, and Support vector machines(Annur, 2018).

Naïve Bayes Algorithm

Naïve Bayes algorithm is an algorithm that studies the probability of an object with certain characteristics belonging to a certain group/class (Rizki, 2021), for classification problems. It is based on Bayes' probability theorem. In Bayes' Theorem, if there are two separate events (eg X and H), then Bayes' Theorem is formulated as follows(Retnowati, 2019):

$$P(H|X) = \frac{P(X|H)}{P(X)}.P(H) \qquad (1)$$

Information :
X = Data with unknown class
H = Hypothesis data X is a specific class
P(H|X) = Probability of hypothesis H based on condition x (posteriori prob)
P(H) = Hypothesis probability H (prior prob.)
P(X|H) = Probability X under these conditions
P(X) = Probability of X

The basic idea of Bayes' rule is that the outcome of the hypothesis (H) can be estimated based on some observed evidence (E). There are several important things from the Bayes rule, namely: (Prayoga, 2018) :
1. An initial/priori probability H or P(H) is the probability of a hypothesis before the evidence is observed.
2. A final probability H or P(H|E) is the probability of a hypothesis after the evidence is observed.

*name of corresponding author

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METHOD

The stages in this research include research steps. The framework in this research is described as follows:

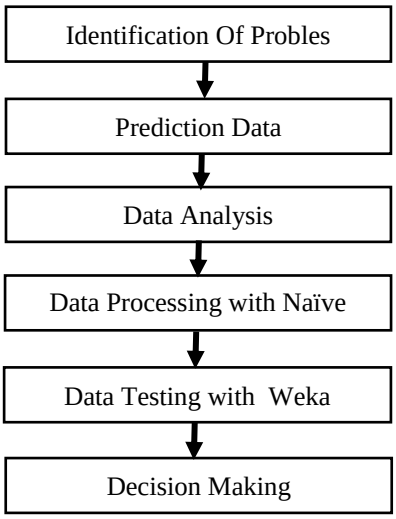

Figure 1: Research Framework

The data used in this study is the data used as training data.

Table 1. Training Data

No.	Buyer	Income	Helmet Bogo	Helmet Color	Sale
1	Teenager	Low	Classic	Tosca	Lots
2	Mature	Tall	Classic	Tosca	Currently
3	Mature	Currently	Classic	Yellow	Lots
4	Teenager	Currently	Classic	Yellow	A little
5	Teenager	Tall	Retro	Brown	Lots
6	Mature	Tall	Retro	Brown	Lots
7	Mature	Currently	Classic	Brown	A little
8	Teenager	Low	Classic	Baby Pink	Currently
9	Teenager	Currently	Retro	Yellow	Currently
10	Teenager	Tall	Classic	Baby Pink	Lots
11	Mature	Low	Retro	Brown	A little
12	Mature	Currently	Retro	Cream	Currently
13	Teenager	Low	Classic	Purple	A little
14	Mature	Currently	Classic	Baby Pink	Currently
15	Mature	Tall	Classic	Baby Pink	Lots
16	Teenager	Tall	Retro	Cream	A little
17	Mature	Tall	Retro	Brown	Currently
18	Mature	Low	Classic	Baby Pink	Lots
19	Teenager	Low	Classic	Cream	A little
20	Teenager	Currently	Classic	Purple	Lots
21	Mature	Currently	Retro	Cream	Lots

*name of corresponding author

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22	Teenager	Currently	Retro	Brown	Lots
23	Mature	Currently	Retro	Tosca	A little
24	Mature	Low	Classic	Purple	Currently
25	Mature	Tall	Retro	Cream	Currently
26	Teenager	Tall	Classic	Tosca	Currently
27	Mature	Low	Retro	Baby Pink	A little
28	Teenager	Low	Retro	Brown	A little
29	Teenager	Currently	Classic	Tosca	Lots
30	Mature	Tall	Retro	Yellow	A little

In Table 1. The data used for the dataset is transaction detail data on the sale of Boco helmets, some detail data on 30 transactions obtained from the Flaze shop.

Determination of Data Variables This stage is carried out to determine the need for data that will later assist research, based on IAS 1, the determination and data conversion stages will be carried out as follows:

a. Buyer

For the Buyer variable, it has been determined that teenage buyers and adult buyers have been determined. So no data conversion is performed.

b. Income

For the income variable, an income category is created.

Table 2. Income Categories

Income	Income Range
Initial income < 1,000,000	Low
1,000,001 <= Initial Income <= 2,5000.00	Currently
Initial Income >= 2,500,000	Tall

Based on Table 2 above. For income categories with a low, medium and high range.

c. Helmet Bogo

For bogo helmet variables, classic helmets and retro helmets have been determined. So no data conversion is performed.

d. Helmet Color

For the helmet color variable, the color has been determined including tosca, yellow, baby pink, brown, cream and purple, so no data conversion is carried out.

e. Sale

For the sales variable, a sales category is created.

Table 3. Sales Category

Income Qty	Income Qty Range
Sales Qty< 10	A little
10<= Sales Qty <= 10	Currently
Sales Qty >= 10	Tall

Based on Table 3 above. For the sales category with a small, medium and high range.

From the results of research and data conversion used in the study as follows:

Table 4. Variables used in the study

Variable	Variable Name
Buyer	X1

*name of corresponding author

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Income	X2
Helmet Bogo	X3
Helmet color	X4
Sale	Y

Based on Table 4 above, the determination and conversion of data, then the composition of the variables Buyer(X1), Income(2), Helmet Bogo(X3), Helmet Color(X4) and variable Y(Sales).

RESULT

Implementation of calculations with Naïve buys, Conditional Probabilities calculation process on the probability of each input value to the sales class value.

Tabel 5. Class Probabilities

Sale			Probability		
Lots	Currently	A little	Lots	Currently	A little
11	9	10	0.3667	0.3000	0.3333

Based on Table 5 above, in the Y (Sales) variable, the probability numbers are for many (0.3667), Medium (0.3000) and little (0.333)..
Numerical Data Calculation for numerical data is carried out by calculating the number and probability.

Table 6. Probability of Buyer Criteria

Sale	The amount of goods	Buyer		Probability	
		Teenager	Mature	Teenager	Mature
Lots	11	6	5	0.5455	0.4545
Currently	9	3	6	0.3333	0.6667
A little	10	5	5	0.5000	0.5000

Based on Table 6 above, in the variable X1 (Buyers) the probability numbers are obtained for many with the category of teenagers (0.5455) and adults (0.4545), for the moderate probability number with the category of teenagers (0.3333) and adults (0.6667), for the number of a little probability with the category of teenagers(0,5000) and adults(0,5000).

Table 7 : Probability of Income Criteria

Sale	The amount of goods	Income			Probability		
		Low	Currently	Tall	Low	Currentl y	Tinggi
Lots	11	2	5	4	0.1818	0.4545	0.3636
Currently	9	2	3	4	0.2222	0.3333	0.4444
A little	10	5	3	2	0.5000	0.3000	0.2000

Based on Table 7 above, in the X2 (income) variable, the probability numbers are obtained for many with low (0.1818), medium (0.4455) and high (03.636) categories. For Medium probability numbers with low (0.2222), medium (0.3333) and high (0.4444) categories. For Slight probability numbers with low(0,5000), medium(0,3000) and high(0,2000) categories.

Table 8 : Probability of the Bogo Helmet Criteria

Sale	The amount of goods	Types of Helmet Bogo		Probability	
		Classic	Retro	Classic	Retro
Lots	11	7	4	0.6364	0.3636
Currently	9	5	4	0.5556	0.4444

*name of corresponding author

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A little	10	4	6	0.4000	0.6000

Based on Table 8 above, in the X3 (Bogo Helmet) variable, the probability numbers for many are obtained in the classic (0.6364) category, retro (0.3636). For Medium probability numbers with classic(0.556), retro(0.4444) categories. For a little probability number with the classic(0.4000), retro(0.6000) category.

Table 9. Probability of Helmet Color Criteria

Sale	The amount of goods	Helmet Color						Probability					
		BP	B	C	P	T	Y	BP	B	C	P	T	Y
Lots	11	3	3	1	1	2	1	0.2727	0.2727	0.0909	0.0909	0.1818	0.0909
Currently	9	2	1	2	1	2	1	0.2222	0.1111	0.2222	0.1111	0.2222	0.1111
A little	10	1	3	2	1	1	2	0.1000	0.3000	0.2000	0.1000	0.1000	0.2000

Based on Table 9 above, for the helmet color BP(Baby Pink), B(Brown), C(Cream), P(Purple), T(Tosca) and Y(Yellow), the variable X4(Helmet Color) obtained the probability number for many with color categories BP(0,2727),B(0.2727), C(0.0909),P(0.0909),T(0.1818) and Y(0.0909). For medium probability numbers with color categories BP(0.2222), B(0.1111), C(0.2222), P(0.1111), T(0.2222) and Y(0.1111). For a few probability numbers with color categories BP(0.1000), B(0.3000), C(0.2000), P(0.1000), T(0.1000) and Y(0.2000).

From the probability value above, 30 data will be tested, and the results of the sales classification of the Bogo Helmet will be tested as shown in Table 10 below.

Table 10. Classification Results of Bogo Helmet Sales

Number	**Category Input**				Probability			**Prediction**
	(X1)	**(X2)**	**(X3)**	**(X4)**	**Lots**	**Currently**	**A little**	
1	Teenager	Low	Classic	Tosca	0.0042	0.0027	0.0033	Lots
2	Mature	Tall	Classic	Tosca	0.0070	0.0110	0.0013	Currently
3	Mature	Currently	Classic	Yellow	0.0044	0.0041	0.0040	Lots
4	Teenager	Currently	Classic	Yellow	0.0053	0.0021	0.0040	Lots
5	Teenager	Tall	Retro	Brown	0.0072	0.0022	0.0060	Lots
6	Mature	Tall	Retro	Brown	0.0060	0.0044	0.0060	Lots
7	Mature	Currently	Classic	Brown	0.0131	0.0041	0.0060	Lots
8	Teenager	Low	Classic	Baby Pink	0.0063	0.0027	0.0033	Lots
9	Teenager	Currently	Retro	Yellow	0.0030	0.0016	0.0060	A little
10	Teenager	Tall	Classic	Baby Pink	0.0126	0.0055	0.0013	Lots
11	Mature	Low	Retro	Brown	0.0030	0.0022	0.0150	A little
12	Mature	Currently	Retro	Cream	0.0025	0.0066	0.0060	Currently
13	Teenager	Low	Classic	Purple	0.0021	0.0014	0.0033	A little
14	Mature	Currently	Classic	Baby Pink	0.0131	0.0082	0.0020	Lots
15	Mature	Tall	Classic	Baby Pink	0.0105	0.0110	0.0013	Currently
16	Teenager	Tall	Retro	Cream	0.0024	0.0044	0.0040	Currently
17	Mature	Tall	Retro	Brown	0.0060	0.0044	0.0060	Lots
18	Mature	Low	Classic	Baby Pink	0.0053	0.0055	0.0033	Currently
19	Teenager	Low	Classic	Cream	0.0021	0.0027	0.0067	A little
20	Teenager	Currently	Classic	Purple	0.0053	0.0021	0.0020	Lots
21	Mature	Currently	Retro	Cream	0.0025	0.0066	0.0060	Currently
22	Teenager	Currently	Retro	Brown	0.0090	0.0016	0.0090	Lots
23	Mature	Currently	Retro	Tosca	0.0050	0.0066	0.0030	Currently
24	Mature	Low	Classic	Purple	0.0018	0.0027	0.0033	A little
25	Mature	Tall	Retro	Cream	0.0020	0.0088	0.0040	Currently
26	Teenager	Tall	Classic	Tosca	0.0084	0.0055	0.0013	Lots
27	Mature	Low	Retro	Baby	0.0030	0.0044	0.0050	A little

*name of corresponding author

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				Pink				
28	Teenager	Low	Retro	Brown	0.0036	0.0011	0.0150	A little
29	Teenager	Currently	Classic	Tosca	0.0105	0.0041	0.0020	Lots
30	Mature	Tall	Retro	Yellow	0.0020	0.0044	0.0040	Currently

Based on Table 10. It can be seen that the percentage for Correctly Classified Instances is 53% of the data on the number of buyers as many as 16 and can be classified, so the data is VALID. Meanwhile, the Incorrectly Classified Instance in Table 10 is 46.67% of the data on the number of buyers, 14 data have not been successfully classified, so the data is not correct (Invalid)..

Naïve Buyes On Weka

Based on the Classifier output display as follows::

Table 11. Summary

Correctly Classifield Instances	16	53.3333%
Incorrectly Classified Instances	14	46.6667%
Kappa statistic	0.2953	
Mean absolute error	0.3972	
Root mean squared error	0.4363	
Relative absolute error	89.6338%	
Root relative squared error	92.7049%	
Total Number of Instances	30	

Based Table 11, it is seen for Correctly Classified Instances, totaling 16 data, which means Valid with data accuracy of 53.3333%. While the amount of data that is Incorrectly Classified Instance is 10 data, which means Invalid, with data accuracy of 46.6667%.

Based on the results of the Instance info as follows:

Table 12. Invalid data

Process Order	Prediction Marjin
4	-0.1622318
7	-0.2482933
11	0.4578075
13	0.1070696
16	0.0028375
19	0.2465807
23	0.0925770
28	0.4447706
30	-0.0562325

Based on Table 12 above, it can be seen that the number of data errors in the Weka application are on buyers number 4,7,11,13,16,19,23,27,28,30. There are 10 Invalid data.

DISCUSSIONS

Based on the results of the study predicting the sale of Bogo helmets with a total of 30 transactions data, for Correctly Classified Instances, there are 16 data, which means Valid with 53% data accuracy. While the amount of data that is Incorrectly Classified Instance is 10 data, which means Invalid, with 46.67% data accuracy. This is in accordance with the reference research from Sulastri et al, 2017, from Moch. Deifa Satrio Damara et al, 2021 and Rahayu Mayang Sari, 2022 that based on previous research for data sales predictions, accuracy is valid above > 50% and corrected data is invalid <50%. For the results of the prediction of the sale of the Bogo Helmet, according to the hypothesis, the final probability of H or P (H | E) by observing the evidence of sales becomes a future sales strategy.

CONCLUSION

The conclusion of the research on the prediction of bogo helmet sales for Correctly Classified Instances, totals 16 data, which means that it is valid with 53% data accuracy. Meanwhile, there are 10 data that are

*name of corresponding author

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Incorrectly Classified Instance, which means Invalid, with data accuracy of 46.67%. The amount of accuracy in the Weka application is the same as the amount of accuracy in Excel calculations. From the explanation above, the Naïve Bayes algorithm method is the best solution for predicting important things in a business need and others, the calculation is also quite easy because it utilizes probability calculations.

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