HANIF
Journal of Information Systems
https://journal.ilmubersama.com/index.php/hanif

Classification Algorithm

Predicting The Risk of Online Sales Fraud with The Naïve Bayes Approach on Facebook Social Media

Leony Ayu Diah Pasha [1*], *Zainal Azis* [2]

[1] *Department of Information System, Faculty of Computer Science and Information Technology, Universitas Muhammadiyah Sumatera Utara, Medan, 20238, North Sumatera, Indonesia*
[2] *Department of Mathematics Education, Faculty of Teacher Training and Education, Universitas Muhammadiyah Sumatera Utara, Medan, 20238, North Sumatera, Indonesia*

ARTICLE INFORMATION

Received: February 10, 2025
Revised: February 17, 2025
Available Online: February 17, 2025

KEYWORDS

Naïve Bayes
Facebook
Fraud
Transactions

CORRESPONDENCE (*)

Phone: +62 853-6205-2393
E-mail: leonyayu1610@gmail.com

A B S T R A C T

The rapid development of digital shopping media is accompanied by increasing cases of online fraud, especially through social media platforms such as Facebook. This study aims to develop a prediction model for the risk of online sales fraud using the Naïve Bayes algorithm. The data used is the data of buying and selling transactions that occur through the Facebook marketplace. The data has been collected on the Kaggle platform so that it can be used directly. Data in the form of extracted features include seller characteristics, products sold, number of transactions, device usage and other fraud indicators. Important features that affect the potential for fraud are identified and used in the machine learning process. The results of the study show that the Naïve Bayes model is able to provide accurate predictions in identifying the risk of online sales fraud, with a satisfactory accuracy rate of 95%. The results of the study are expected to contribute to the development of a more effective fraud detection system and increase user confidence in making online transactions.

INTRODUCTION

In this digital era, online buying and selling through platforms such as social media is increasing rapidly throughout the world, including Indonesia. Online buying and selling is now increasingly popular because of easy and instant product access. This is an advantage for consumers and customers: consumers do not need to go anywhere to shop, and sellers do not need to sell their products anywhere so that they can be seen by others. Social media is another platform choice for online buying and selling besides shopping applications. Unlike regular e-commerce, in social commerce buyers and sellers can interact more freely, and can transact directly on social media without having to enter other digital sites or applications. The increasing number of social media users has become a separate target market for sellers to sell their goods to social media users, even some social media have also created special platforms for online buying and selling through social media such as Tik-Top Shop and Facebook Marketplace.

Based on a survey by the Indonesian E-Commerce Association (idEA), online transactions via social media such as Facebook and Instagram reached 66%. In the top position, Facebook took a market share of up to 43%. Only 16% of sellers and buyers use the marketplace platform and 7% choose to use their own website. This survey shows the phenomenon that buyers and sellers, most of whom are micro-entrepreneurs, use social media more as a place to transact e-commerce compared to the widely available marketplace platforms or through their own websites. This survey was conducted on around 2,000 MSMEs in 10 cities in Indonesia in 2017.

https://doi.org/10.56211/hanif.v2i2.41

According to a Populix survey, out of 1,020 Indonesian respondents, only 86% have shopped via social media. Of this group, the majority shopped via Tiktok Shop. Meanwhile, fewer respondents have shopped via WhatsApp, Facebook, Instagram, and other social media applications, as seen in the graph. Populix also found that the products most purchased by respondents via social media were clothing (61%), beauty products (43%), food and beverages (38%), and mobile phones and accessories (31%). This survey was conducted on July 28-August 9, 2022, against 1,020 respondents spread across urban areas in Indonesia, the majority from Jabodetabek (35%), Bandung (7%), and Surabaya (7%).

However, behind the ease and practicality of online shopping, there is also a growing problem of fraud in online sales. Online sales fraud is a serious threat, harming consumers and reducing public trust in e-commerce. Online sales through social media, especially Facebook, is a popular trend for both small businesses and large companies. With millions of active Facebook users, this platform has become one of the most popular places to sell online. However, this also poses a high risk of online sales fraud that can harm consumers.

Online fraud on Facebook social media has become a serious threat to consumers. In the form of fake accounts, fraudsters offer products at low prices, but do not send the goods after payment is made. Fraud also occurs through fake investments and the lure of partnerships with large rewards that are not realized. To avoid fraud, it is important to verify sellers, use secure payment methods, and be wary of offers that are too tempting. Facebook Data collected from online sales activities on social media, ranging from comments, reviews, and interactions between sellers and buyers, provides valuable information when analyzing fraud risks.

Early prediction of fraud risk is very important to reduce losses that may be experienced by consumers and merchants when transacting online. In conducting predictive modeling, of course, the existing data must support so that the model created will produce maximum results. Therefore, to predict the risk of fraud in online sales transactions, data sourced from Kaggle is used. The data is in the form of online fraud cases on the Facebook marketplace. In this case, the fraud in online buying and selling in question is the transaction part. The data taken from the Kaggle site has parameters in the form of columns that support analysis and prediction, by using the right approach and building a good model, it is hoped that maximum prediction results will be obtained.

The Naïve Bayes approach, which is one of the classification methods in machine learning, has been proven effective in predicting risk or data classification in various fields, including sentiment analysis and fraud detection. By applying the Naïve Bayes approach to online sales data on Facebook social media, it is expected to provide accurate predictions related to the possibility of research fraud by [1,2,3]. For profiling victims of online fraud in Indonesia, the accuracy value of the Naïve Bayes algorithm was 75.28%.

METHOD

Machine Learning

Machine learning (ML) technology is a system developed to be able to learn by itself by reading data as a reference to be able to produce output without direction from its users. Machine learning is developed based on other disciplines such as statistics, mathematics and data mining so that machines can learn by analyzing data without the need to be reprogrammed or ordered. In this case, machine learning has the ability to learn existing data so that it can perform certain tasks. The tasks that can be performed by Machine Learning are also very diverse, depending on what it learns [4,5,6].

Data Mining

Data mining is the process of obtaining useful information from large databases and needs to be extracted to become new information and can help in decision making [7,8]. Data mining is a field of science that is used to handle the problem of retrieving information from large databases by combining techniques from statistics, machine learning, data visualization, pattern recognition, and databases. The goal of data mining is to extract information with intelligent methods from data sets and then transform the information into a structure that can be understood for further use.

Data Mining Stages

As a series of data mining processes often referred to as KDD (Knowledge Discovery Data), this process is a large amount of data that is extracted through the stages of excavation and analysis to obtain useful information and knowledge.

[9,10,11]. To obtain information discovery in data analysis and business using data mining, the data mining stages can be described as follows:

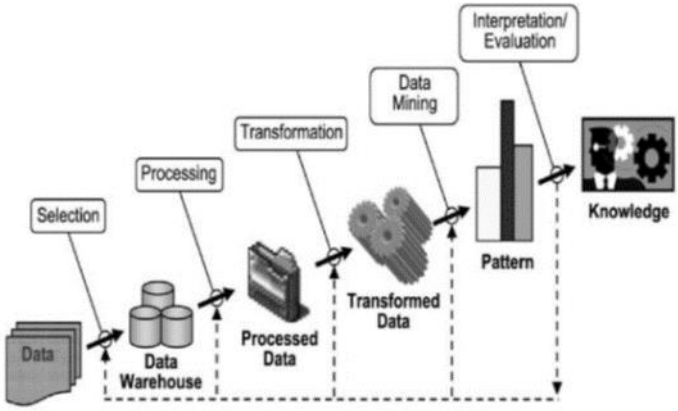

Figure 1. KDD Process

RESULTS AND DISCUSSION

Kaggle Data

The data that will be processed is taken from the Kagle website. The dataset used is called Fraudulent E-Commerce Transactions. The data set comes from the Kaggle website. The dataset is a collection of transaction data on the Facebook marketplace that is collected as material for the development of machine learning to predict fraudulent e-commerce transactions. The dataset is divided into 2 parts, the first dataset contains 1,472,952 data and the second dataset contains 23,634 data. The second dataset is used in this study. The data is transaction data on the Facebook marketplace designed to simulate transaction data from e-commerce platforms with a focus on fraud detection. It contains various features that are commonly found in transaction data, with 16 additional attributes specifically designed to support the development and testing of fraud detection algorithms.

The dataset contains 23,634 data which is a collection of transaction data on buying and selling on the Facebook marketplace. Download the data in the form of a csv file and name it “Data.csv”. Furthermore, to process the data, the data is imported into the Google Colab application for further processing and analysis. Importing data uses the python programming language with the help of the pandas library.

Preparation Data

Data preparation is the process of preparing data before carrying out the analysis process. The initial stage of data preparation is to check for missing values or empty data in the data set. By using the pandas function "df.isnull().sum()".

There are no missing values in the data, which means the data is complete. The next step is to check the data for duplicate data in the data set using the function "df.duplicated().sum()" and there is no duplicate data in the data set. To see the data distribution value in the form of a visualization graph, this method provides a visual depiction of the data range, including the minimum value, first quartile (Q1), median, third quartile (Q3), and maximum value. A box plot is used because it is a method that is easy to understand and widely used.

At this stage, the variables that are viewed are quantitative variables that have the possibility of wild data distribution. It was found that the variable "Customer age" contains data that is outside the normal distribution. The minimum value of Q1 or the lower limit of the data is 10, but there are some data that are below it. The value of Q2 or the middle value is 10 to 60 and the value of Q3 or the upper limit is 60 but there is still data that is greater than that. Data that is included outside of Q1 and Q3 is data that is not normally distributed or is called outlier data to overcome this by deleting data. The presence of data that is not normally distributed can result in the performance of the model to be built being less than optimal.

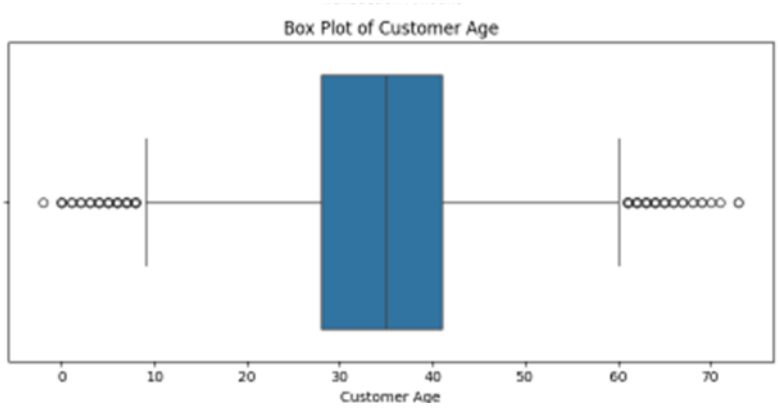

Figure 2. Box Plot Outlier Customer Age Data

Data deletion using the loc() function with data parameters in the "Customer age" column whose value is less than 10 and whose value is greater than 60. After deletion, it can be seen that the data in the "Customer age" column with the lowest value is 10 and the highest is 60, so the outlier data has been removed and the data has been normally distributed.

In the database there are Shipping Address and Billing Address columns that function to record address details related to each transaction. For the purposes of security analysis and detection of potential fraud, a comparison is made between the two columns to produce a match of addresses that will be entered into the Address Match column. The column will contain a parameter number of 1 for matching shipping and billing addresses and 0 for the opposite. This address match column is used as one of the indicators in identifying potentially suspicious or fraudulent transactions. If there is a significant mismatch between the shipping address and billing address, this can be one of the parameters for detecting transactions that are categorized as risky or fraudulent.

For analysis purposes, not all columns will be used, so it would be better to delete unused columns for ease of further analysis. The unused columns are: "Transaction ID", "Customer ID", "Customer Location", "Transaction Date", "IP Address", "Shipping Address", "Billing Address". Deleting columns will not reduce the quality of data and analysis results because these columns do not have a significant influence for analysis purposes.

```
df = df.drop(["Transaction ID","Customer ID","Customer Location","Transaction Date","IP Address","Shipping Address","Billing Address"], axis=1)
df.head()
```

	Transaction Amount	Payment Method	Product Category	Quantity	Customer Age	Device Used	Is Fraudulent	Account Age Days	Transaction Hour	Address Match	Transaction Day
0	42.32	PayPal	electronics	1	40.0	desktop	0	282	23	1	Sunday
1	301.34	credit card	electronics	3	35.0	tablet	0	223	0	1	Monday
2	340.32	debit card	toys & games	5	29.0	desktop	0	360	8	0	Monday
3	95.77	credit card	electronics	5	45.0	mobile	0	325	20	1	Tuesday
4	77.45	credit card	clothing	5	42.0	desktop	0	116	15	1	Tuesday

Figure 3. Removing Unnecessary Columns

Model Evaluation

After the modeling process is complete, the next stage is model evaluation to assess the performance of the model that has been built. Evaluation is carried out using three main metrics, namely accuracy score, confusion matrix, and classification report. In model evaluation there are several terms that describe the results of the data itself, here is the explanation:

Table 1. Model Evaluation Terms

Term	Explanation
TP (True Positive)	Prediction results that are classified as correct based on actual data for the value of not fraud (Not Fraud)
FP (Falese Negatif)	Prediction results that are classified as correct based on actual data for the value of fraud (Fraud)
TN (True Negatif)	Prediction results that are classified as wrong based on actual data for the value of not fraud (Not Fraud)
FN (False Negatif)	Prediction results that are classified as wrong based on actual data for the value of fraud (Fraud)

1. Accuracy Score: The accuracy score metric measures the proportion of correct predictions compared to the total predictions made by the model. Accuracy is calculated using the formula:

   Acuracy= (true positive+true negative) / (total data)

   High accuracy values indicate that the model has good ability in classifying data. In this study, the evaluated model obtained an accuracy score of X%, which indicates that the model can classify data well.

2. Confusion Matrix: Confusion matrix is a visual representation of the performance of a classification model that shows the number of correct and incorrect predictions for each class. This matrix consists of four components: true positives (TP), true negatives (TN), false positives (FP), and false negatives (FN). From the confusion matrix, we can calculate other metrics such as precision, recall, and F1-score. In this study, the confusion matrix produced is as follows:

   Table 2. Confusion Matrix

	Data Prediction	
Actual Data	**Positif**	**Negatif**
Positif	TP	FN
Negatif	FP	TN

3. Classification Report: The classification report provides a more complete picture of the model's performance by presenting evaluation metrics such as precision, recall, and F1-score for each class. Precision measures the accuracy of positive predictions, recall measures the model's ability to find all positive instances, and F1-score is the harmonic mean of precision and recall. In this study, the classification report includes precision, recall, and f1-score values.

Prediction Results

Prediction results Based on the Naïve Bayes model testing used in this study, an accuracy level of 95% was obtained. This value indicates that the model is able to predict fraud risk very well, with 95% of the tested data being predicted correctly by the model. From the analysis of the features used, it was found that the number of transactions feature has the greatest influence on the prediction objective, namely the occurrence of fraud. This feature plays an important role in identifying suspicious transaction patterns.

The model also shows that the larger the number of transactions or the more unusual the transactions, the greater the likelihood of fraud. In addition, balanced data distribution and proper feature selection also contribute to high model accuracy. The prediction results of each data are displayed in a new table "Prediction Results". By using the highest accuracy algorithm model, namely GausianNB. The column is the prediction result of the GusianNB model which contains the string values "Fraud" and "Not Fraud" which is obtained from GausianNB modeling with the target parameter of the "Is Fraudulent" column and features from other columns.

CONCLUSION

From this study, the conclusions that can be drawn are: The accuracy, precision, recall and f1-score values of the Naïve Bayes algorithm are classified as good in reading and predicting existing data because the average value of the three Naïve Bayes algorithms used shows a figure of 0.95 or 95%. This shows that Naïve Bayes is an effective method in

 https://doi.org/10.56211/hanif.v2i2.41

detecting fraud. The variable that has the most influence on the target variable, namely "Is Fraudulent" is the "Transaction Amount" variable measured by the correlation matrix method showing the highest positive number than other variables, namely 0.28. The transaction value has a strong correlation with the risk of fraud, indicating that the nominal amount of the transaction is important to consider in risk analysis. Naïve Bayes is a simple algorithm but still able to provide good performance. This model can be implemented with minimal computing resources, making it the right choice for efficient fraud detection. There are 12.5% of data from the total data that is classified as fraudulent transaction data. Buying and selling through the Facebook marketplace is considered not dangerous because of the existing data, not even half of it is fraudulent transaction data, so it can be concluded that buying and selling with the Facebook marketplace is considered safe.

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