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Classification of Balinese Traditional Clothing Using Naïve Bayes

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Abstract

*Bali is an area rich in cultural products, one of the cultural products that attracts attention is traditional Balinese clothing. Balinese traditional clothing is an important cultural product for Balinese people themselves because it is used in religious activities or traditional activities in Bali. Classifying Balinese traditional clothing is very important based on its type so that both Balinese and people outside Bali can know the type of traditional Balinese clothing that suits its usefulness. By classifying Balinese traditional clothing by type, it can also overcome errors in the selection of the type of Balinese traditional clothing used in certain activities. Types of Balinese traditional clothing is traditional nista traditional clothing, madya traditional clothing, and agung traditional clothing. Dataset of Balinese traditional clothing obtained as many as 26 pieces by direct survey to several places of makeup as well as from the book "*Busana Adat Bali"*. Furthermore, the data will be classified using the Naive Bayes method. In two experiments, there was an equally large accuracy of 66.66% using the Naïve Bayes method.*

Keywords: *naïve bayes, classification, Balinese traditional clothing, culture, clothing.*

I. Introduction

Bali is an area are rich in cultural products, one of the cultural products that attracts attention is traditional Balinese clothing. For Balinese people themselves, Balinese traditional clothing is an important cultural product, this is because Balinese traditional clothing is used in religious activities or traditional activities in Bali. The flow of globalization also has the impact of a shift in traditional dress styles in Bali. It turns out that the younger generation of Bali also have a lack of understanding and also some who do not want to understand about the ethics in traditional dress. Many of them wear less suitable models. Basically, dressed will certainly be better if adjusted to the activities and activities that will be done [1].

Classifying Balinese traditional clothing is very important based on its type so that both Balinese and people outside Bali can know the type of traditional Balinese clothing that suits its usefulness. By classifying Balinese traditional clothing by type, it can also overcome errors in the selection of the type of Balinese traditional clothing used in certain activities. The type of traditional clothing in Bali is divided into three types based on its completeness and usefulness. Types of Balinese traditional clothing is traditional *nista* traditional clothing, *madya* traditional clothing, and *agung* traditional clothing. Classifying Balinese traditional clothing is very important based on its type so that both Balinese and people outside Bali can know the type of traditional Balinese clothing that suits its usefulness. By classifying Balinese traditional clothing by type, it can also overcome errors in the selection of the type of Balinese traditional clothing used in certain activities. The type of traditional clothing in Bali is divided into three types based on its completeness and usefulness. Types of Balinese traditional clothing are *nista* traditional clothing, *madya* traditional clothing, and *agung* traditional clothing.

In this study will use the Naïve Bayes method to classify the type of Balinese traditional clothing. This is because Naïve Bayes is an algorithm that can classify a particular variable using

probability and statistical methods. The advantage of using the Naïve Bayes method is its ability to classify documents with its simplicity and computational speed but high computing [2,3].

1.1 Balinese Traditional Clothing

Traditional clothing is a product of human culture that elevates local culture. Almost every region in the world has its own custom clothes, not least Bali. Traditional clothing in Bali is divided into three types based on its completeness, i.e *nista* traditional clothing, *madya* traditional clothing, and *agung* traditional clothing.

Nista traditional clothing (simple) used in marriage ceremonies with the level of nista ceremony. Sometimes, *nista* traditional clothing use *kebaya* with very simple decorations. Likewise, his menswear only uses a *hem* or a regular shirt. All of this depends on the customs of the village and the ability of each family.

Madya traditional clothing used for wedding ceremonies, haircuts, and *"ngeraja sewala"* ceremonies. The level of ceremony that uses this dress is the level of madya (intermediate) ceremony in Badung Regency and now it has been devoted to become makeup or Balinese wedding dress.

Agung traditional clothing is clothes that used by a person in a *"potong gigi"* ceremony, *metatah*, *ngeraja sewala*, and wedding ceremony. This dress is used in the *medudus agung* ceremony level (the main ceremony) [5].

1.2 Classification

Classification is one of the statistical methods of grouping a systematically compiled data. Classification can also be interpreted as a model formation technique of unclassified data, then the model is used to classify new data. Classification belongs to the type of supervised learning, which means that to perform the classification process it takes training data to build a classification model. To do the classification has a large selection of algorithms, some of the algorithms that are often used are naïve bayes algorithms, k-nearest neighbor, and decision tree [6].

1.3 Naïve bayes

Naïve Bayes is an algorithm that can classify a particular variable using probability and statistical methods. This Naïve Bayes algorithm is used because it is a technique for predicting things on a simple probalitistic basis that has the basis of applying bayes theorems assuming independence or arguably having a strong independence [2,3].

II. Research Methods

2.1. Data Collection

The data in this study is data obtained from the book *"Busana Adat Bali"* and from makeup services. The data used in this study are 26 datasets. The data collected in the form of attributes and uses of Balinese traditional clothing types will be used as datasets in this study. The example of data is the completeness used by men on the headdress for the *madya* traditional clothing type is *udeng* and flowers placed on the left head and above the ears. The types of traditional Balinese clothing used in this study are *nista* traditional clothing, *madya* traditional clothing, and *agung* traditional clothing. Examples of datasets used are:

Table 1. Sample data set used

Feature1	Feature2	Feature3	Feature 4	Feature5	Feature6	Feature7	Feature8	Class
Women	*Pusung Tagel*	several kinds of flowers	*Tapih*	*Kamben Dodol*	*Stagen*	scraf	Jewel: *subeng cerorot, pelpelan*	*Nista*

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Women	*Seri nata* and *semi*	several kinds of flowers	*Tapih*	*Wastra : songket penuh*	*Stagen*	*Perada* scarf	Jewel: rings on the ring finger and dragon satru bracelet one pair	*Mady a*
Women	*Seri nata* and *semi, Petitis*	several kinds of flowers	*Sinjang perada*	*Wastra perada*	*Stagen*	*Perada* scarf	Jewel: one pair of kana bracelets, one-pair dragon bracelets, and ring	*Agung*

2.2. Naïve Bayes Classification

At this stage will be classified against the dataset that has been obtained from the data collection stage. The dataset will be divided into two parts, i.e. as much as 80% will be used as data training while as much as 20% will be used as data testing. Then the steps will run as follows: [7]

1. Read data training.

2. Calculate the value and probability.

a) If there is numeric data, it is necessary to find the mean value and standard deviation of each parameter that describes the number data. The formula used to calculate the average value – the mean can be seen in the formula below:

$$\mu = \sum_{i=1}^{n} x_i \quad (1)$$

Or

$$\mu = \frac{x_1+x_2+x_3+\ldots+x_n}{n} \quad (2)$$

Where:
μ : average value (mean)
xi : the value of -i sample
n : total sample

And the equation for calculating the default deviation value (standard deviation) can be seen in the following formula:

$$\sigma = \sqrt{\frac{\sum_{i=i}^{n}(x_i-\mu)^2}{n-1}} \quad (3)$$

Where:
σ : standard deviation
xi : value x on -i
μ : average value

n : total sample

b) If there is no numeric data, calculate the probability value of each same category, by way of the corresponding amount of data from the same category then divided by the amount of data in that category to find the probabilistic value.

3. Probability value of each feature.
To find out the probability value of each feature in a class we have to calculate the corresponding amount of data from the same category and then divided by the amount of data in that category.

4. Gaussian Distribution Value
The next step is to calculate the probability value for the Data Testing feature which has numeric/numeric data. Equations in search of gaussian distribution values can be seen in the formula below.

$$P = \left(X_i = x_i \vee Y = y_j\right) = \frac{2}{\sqrt{2\pi\sigma ij}} \times e - \frac{(x_i - \mu ij)^2}{2\sigma^2 ij}$$

(4)

5. Final Probability of Each Class
Calculating the final probability for each class means entering all existing gaussian distribution value data into the same class. Calculations can be done in the following ways.
P(X| Class)=P(V1| Class)×P(V2| Class)×P(V3| Class)×P(V4| Class)×P(V5| Class)×P (V6| Class)×P(V7| Class)×P(V8| Class)
(5)

6. Final Probability
The final probability is obtained through the calculation of the final probability value of the class into the Naïve Bayes Classifier formula. The final probability calculation is as follows.
P (Class| X) = P(Class) * P(X)
(6)

7. Normalization
Normalization can be done by sharing the probability value of one category with the number of values of all categories.
P(Class)= P (Class| X) / (P (X| Class) + P (X| Class))
(7)

III. Results And Discussions

This research on traditional Balinese clothing uses 26 pieces of dataset with 80% division for training data and 20% for test data. The data will be inputted into Microsoft excel to be used as input into the classification program. Programs are created using the python programming language.

In the classification process, for men who use *udeng* and use several kinds of flowers to decorate his head. Then use *kamben endek*, *saput umpal* and bali shirt to decorate his body. For complementary accessories use *keris*. Thus, a man who wears Balinese traditional clothing with the attributes as mentioned above will be classified into the *nista* class.

For the next classification process, for women who use *seri nata* and *semi* and use several kinds of flowers to decorate her head. Then use *Sinjang perada*, *wastra* with full *songket*, *stagen*, and perada scarf to decorate his body. For her complementary accessories use jewel rings on the ring finger and dragon satru bracelet one pair. Thus, a woman who wears Balinese traditional clothing with attributes as mentioned above will be classified into the *madya* class.

For the next classification process, for a man who uses a *gelungan agung* and uses several kinds of flowers to decorate his head. Then use the *kampuh perada*, *wastra perada*, *umpal perada*, and belt to decorate his body. For complementary accessories use jewelry and *keris*.

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Thus, a man who wears Balinese traditional clothing with attributes as mentioned above will be classified into the *agung* class.

Table 2. Classification example with *Nista*, *Madya*, and *Agung* class

Feature1	Feature2	Feature3	Feature 4	Feature5	Feature6	Feature7	Feature8	Class
Men	*Udeng*	several kinds of flowers	*Kamben endek*	*Saput*	*Umpal*	Bali shirt	*Keris*	*Nista*
Women	*Seri nata* and *semi*	several kinds of flowers	*Sinjang perada*	*Wastra : songket penuh*	*Stagen*	Perada scarf	Jewel: rings on the ring finger and dragon satru bracelet one pair	*Madya*
Men	*Gelungan agung*	several kinds of flowers	*Kampuh perada*	*Wastra perada*	*Umpal perada*	Belt	jewelry and *keris*	*Agung*

In the program the first step input is the criteria in feature 1, for example in this example will be selected number 1.

```
Fitur 1 :
1. Wanita
2. Pria
inputan :1
```

Figure 1. Feautre 1 input

The next step is to specify feature 2, for example in this example will be selected number 5.

```
Fitur 2 :
1. Pusung Tagel
2. Udeng
5. Seri Nata dan Semi
10. Udeng Songket
14. Udeng Perada
16. Seri Nata dan Semi + Petitis
inputan :5
```

Figure 2. Feautre 2 input

The next step is to specify feature 3, for example in this example will be selected number 1.

```
Fitur 3 :
1. Bunga - Bunga (Wanita)
2. Bunga - Bunga (Pria)
inputan :1
```

Figure 3. Feautre 3 input

The next step is to specify feature 4, for example in this example will be selected number 9.

```
Fitur 4 :
1. Tapih
2. Kamben Endek
3. Kamben Kotak2
9. Sinjang Perada
11. Kamben Songket
19. Kampuh Perada
inputan :9
```

Figure 4. Feautre 4 input

The next step is to specify feature 5, for example in this example will be selected number 6.

```
Fitur 5 :
1. Kamben Dodol
2. Saput
4. Songket Pinggiran
6. Wastra Songket
12. Saput (Madya)
15. Wastra Perada
20. Wastra Perada : Motif Lelancing
inputan : 6
```

Figure 5. Feautre 5 input

The next step is to specify feature 6, for example in this example will be selected number 1.

```
Fitur 6 :
1. Stagen
2. Umpal
21. Umpal Perada
17. Long Torso
inputan: 1
```

Figure 6. Feautre 6 input

The next step is to specify feature 7, for example in this example will be selected number 1.

```
Fitur 7 :
1. Selendang
2. Kemeja Bali
7. Selendang Perada
13. Stagen untuk menahan Keris
22. Ikat Pinggang
inputan : 7
```

Figure 7. Feautre 7 input

The next step is to specify feature 8, for example in this example will be selected number 8.

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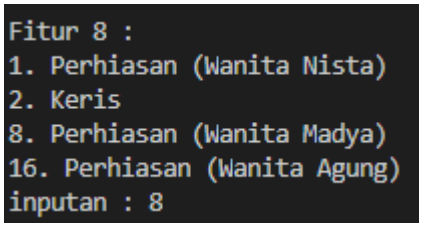

Figure 8. Feautre 8 input

After that there will be a probability value for each feature.

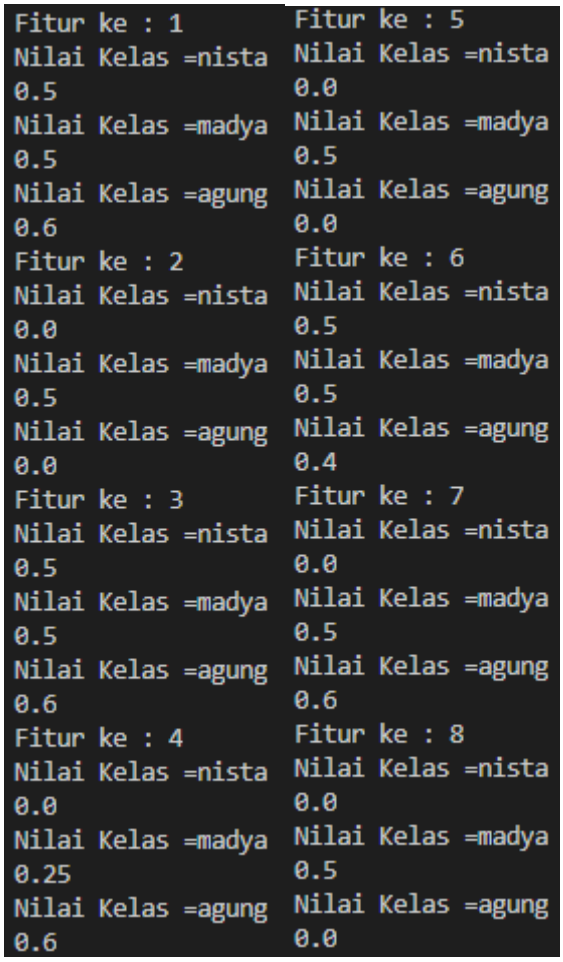

Figure 9. Probability value for each feature

Once found the probability value of each feature, it will then be displayed a class faithful probability value.

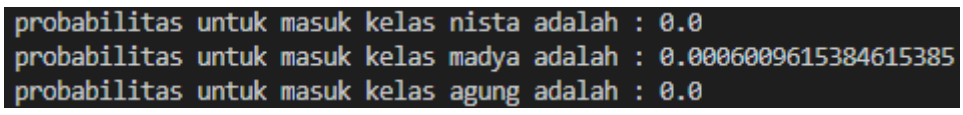

Figure 10. Probability value for each class

Then there will be a comparison of the probability values of each class to find the largest probability value. As in the image above then we can see that the probability value of the madya class is the largest. Then it can be known that Balinese traditional clothing with those that use attributes such as those input will enter into the Madya class.

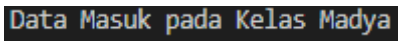

Figure 11. Classification Results

The results of the evaluation of the system obtained using the naïve bayes method obtained from the large classified data are correctly shared with all test data.

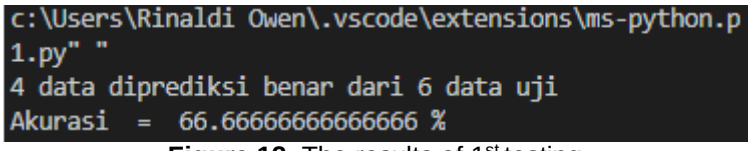

Figure 12. The results of 1st testing

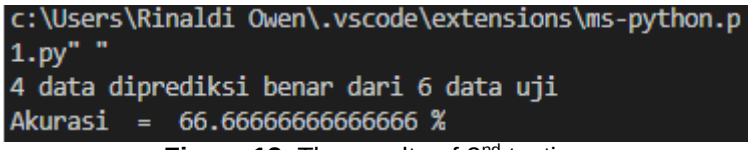

Figure 13. The results of 2nd testing

In figure 1 and 2 above, we tested twice to make sure the accuracy generated by the program was appropriate. From the results of both tests, 66.66% accuracy was obtained using the naïve bayes method.

IV. Conclusion

From the results of the research that has been done seen that the Method Naïve Bayes produces quite good accuracy. With an accuracy percentage of 66.66% of the 6 test data can be said to be good. Furthermore it is possible to improvise for a higher degree of accuracy by performing classifications with different methods with the same topic. This is because the programs created will be very helpful to preserve the culture in Indonesia.

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