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Optimization of Bali Tourism Recommendations Based on Personal Motivation of Tourists Using the Naive Bayes Algorithm

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Abstract

In the recovery of the tourism sector in Bali due to COVID-19, a solution is needed with the aim of making tourists more interested in having a vacation in Bali. One of the solutions that can be offered is optimizing the tourist recommendations on the island of Bali, because so far tourists only get travel recommendations from travel agents and guides who usually recommend favorite tourist destinations, and sometimes guides recommend tourist attractions according to their personal wishes or goals. making tourists less optimal in enjoying tourist attractions in Bali. Optimization of Bali Tourism Recommendations Based on Tourist Personal Motivation Using the Naive Bayes Algorithm, is one solution to optimize tourism recommendations in Bali, where tourist recommendations are taken based on tourist characteristics using the Naïve Bayes Algorithm. In this study the authors used 180 training data, and the results of this study indicate that the personal motivation of tourists who are processed using the Naïve Bayes algorithm is feasible to use for tourism recommendations in Bali.

Keywords: Recommendation Optimization, Personal Motivation, Naïve Bayes.

1. Introduction

During the COVID-19 pandemic, many industries have suffered losses, especially the tourism sector, according to the Bali Tourism Industry Association (GIPI) Data, the potential losses of the tourism sector in Bali from leisure and mice reach USD 9 billion or around IDR 140 trillion exchange rate of IDR 15,639). According to the provincial government of Bali, the spread of the COVID-19 issue has resulted in a decrease in the number of tourists to Bali, especially Chinese tourists [1]. Thus, a solution is needed to restore the tourism sector in Bali, considering that Bali is one of the best tourist destinations in Indonesia. However, improving the economy in Indonesia as a whole certainly takes time, especially considering that the COVID-19 pandemic has yet to be confirmed.

Based on these problems, given the possibility of economic recovery due to the COVID-19 pandemic, a solution that can be supported by the government is urgently needed, with the aim of making tourists more interested in having a vacation in Bali. One of the solutions that can be offered

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is optimizing the Tourism Recommendations on the island of Bali, because so far tourists only get travel recommendations from guides or travel agents, where the travel recommendations are only based on favorite tourist attractions, sometimes even guides recommend tourist attractions according to their wishes, or personal goals, even though with the choice of unfounded tourist recommendations, it is likely that tourists are less than optimal in enjoying tourist attractions in Bali, this can be proven in the Market Analysis book and the 2019 Archipelago Tourist Satisfaction Index, the impression of tourist attractiveness by domestic tourists visiting Bali (35.3%) is very good, (62.6%) is good, (1.3%) is quite good, (0.8%) is very poor, while the level of satisfaction of domestic tourists visiting Bali (27.5 %) very satisfied, (68.4%) satisfied, (3.4%) quite satisfied, (0.6%) less satisfied, (0.1%) very dissatisfied [2], thus it can be concluded that a solution is needed. i to optimize the impression and satisfaction of tourists on tourist attractions in Bali.

Therefore, the authors propose an idea, namely Optimization of Bali Tourism Recommendations Based on Personal Motivation of Tourists Using the Naive Bayes Algorithm. With the concept of optimized Bali tourism recommendations, which is how to optimize it based on the personal motivation of tourists such as tourist characteristics to provide a set of recommendations to related tourists, as well as how to process tourist characteristics data using the Naïve Bayes algorithm to produce tourist recommendations. The personal motivation of tourists that I use comes from the attributes of age, origin, gender, interest. The data that will be used comes from the 2019 National Tourist Characteristics Survey in Bali Province. With these attributes it can certainly produce tourism recommendations that are in accordance with the character of tourists, so that tourists travel more optimally in Bali, besides that it is hoped that tourist visits in Bali will be more evenly distributed.

2. Reseach Methods

Optimization of Bali Tourism Recommendations based on Tourist Personal Motivation was developed using several designs, methods and algorithms. The following is a discussion of the Bali Tourism Recommendation Optimization method, algorithm. The Naive Bayes algorithm is used to classify tourist data, with the aim of providing the greatest possibility, the suitability of tourist attractions based on the characteristics of the related tourists, whose simple concept is to compare tourist characteristics data related to tourist characteristics data that have previously determined tourist attractions, so recommendations are given from the classification results.

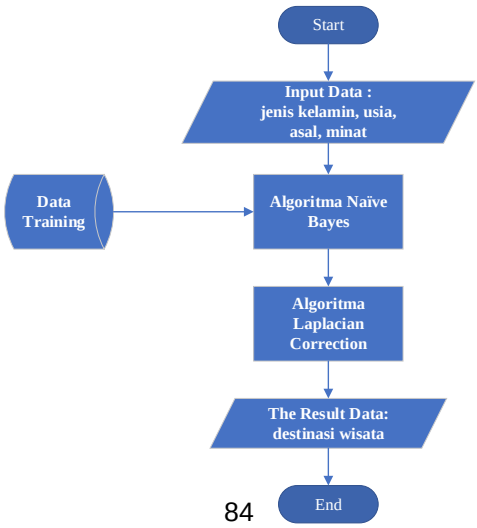

Figure 1, System Flow

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2.1. Optimization

Optimization is a process to achieve ideal results or optimization (the effective value that can be achieved). Optimization can be interpreted as a form of optimizing something that already exists, or designing and making something optimally [3].

2.2. Tourism

The definition of tourism is a trip that is carried out individually or in groups to a certain place which is carried out repeatedly or going around, either in a planned or unplanned manner which can produce a total experience for the perpetrator [4].

There are several factors that influence tourists in traveling to a place, according to the journal [5]. There are 24 factors that are taken into consideration by tourists visiting a tourist spot, namely: personal motivation, availability of attractive tourist objects and products, advice and recommendations from travel agents, information obtained about tourist destinations from tourism and travel organizations agents, recommendations from friends, friends or relatives (words of mouth), political conditions, security and technology of tourism destinations, environmental hygienic conditions of tourist destinations, special promotions from tourism organizations, climate and weather of tourist destinations, attitudes, opinions and perceptions of tourist destinations, lifestyle of these tourism consumers, current knowledge of tourist destinations, hobbies and interests as well as past experiences of tourism consumers who have visited a particular tourist destination, commitment to family, income levels, consumer personalities, transportation and road access, and supporting infrastructure for accommodation facilities i, hotel food and beverage and others. Middleton, Fyall & Morgan (2009) provide a model for the decision-making process for tourism consumers, there are 3 models, namely, Process, Stimulation and Response.

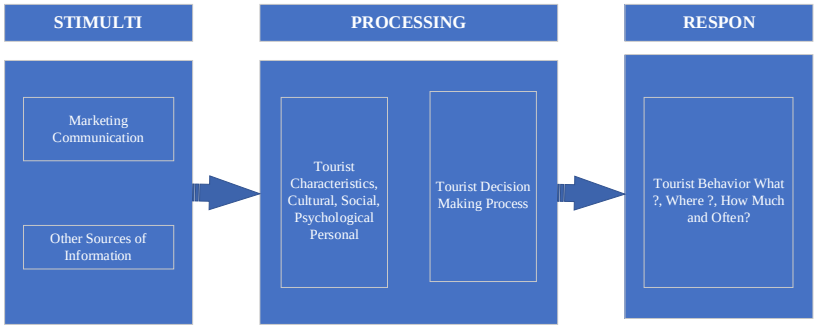

Figure 2, Tourism decision model, STIMULI, PROCESSING, RESPONSE

In Figure 2 above, you can see a model that influences tourists' decisions in traveling to a place, starting from STIMULI which contains marketing communications, and other sources of information about the destination tourist attractions. Then proceed to PROCESSING which involves the characteristics of tourists both culturally, socially, personally, and psychologically in receiving and posting information, so that a tourist decision-making process occurs. So that tourists can provide RESPONSE regarding the tourist information received, in the form of questions about tourist attractions that tourists want to know more about.

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Based on the journal, it is concluded that 15 main factors from the 24 factors tested, in the influence of decision making on tourists in choosing tourist attractions, namely:

Faktor	Tidak	Ya	Ranking
Motivasi Personal	83	317	1
Sikap, Opini & Persepsi	86	314	2
Ketersediaan Obyek & Produk Wisata	87	313	3
Kepribadian	87	313	3
Transportasi & Akses Jalan	91	309	5
Kondisi Kebersihan & Lingkungan	93	307	6
Words of Mouth	94	306	7
Pengetahuan ttg Destinasi Wisata	96	304	8
Fasilitas Utama & Pendukung	98	302	9
Tingkat Pendapatan	99	301	10
Kesehatan Personal	100	300	11
Event & Hiburan	101	299	12
Cuaca & Iklim	103	297	13
Hobi & Ketertarikan	103	297	13
Kondisi Politik & Keamanan	112	288	15

Sumber: Data diolah, Februari 2015

Figure 3, Main Factors

2.3. Personal Motivation

Personal motivation, according to Swarbrooke & Horner (2007) consists of physical (relaxation, health, comfort, etc.), social (visiting friends and family, meeting work partners, doing things that bring prestige, etc.), the desire to know the culture, customs, traditions and other regional arts, self-actualization, and security. From the explanation regarding tourist factors in making decisions about tourist attractions you want to visit above. The author uses the factors of age, gender, origin, and interest as attributes in the classification process to provide recommendations for tourists to choose tourist attractions. The influence of the factors of age, gender, and origin is the environment that tourists have so that it affects the personal motivation of tourists in making decisions about choosing tourist attractions. In addition, there is an attribute of interest which is one of the main factors for tourists in choosing tourist attractions, namely those related to hobbies and interests.

2.4. Algoritma Naive Bayes

The Naïve Bayes Classifier is a classification method rooted in the Bayes theorem. The classification method uses probability and statistical methods proposed by the British scientist Thomas Bayes, which predicts future opportunities based on previous experience, so it is known as Bayes' Theorem. The main characteristic of this Naïve Bayes Classifier is a very strong assumption (naive) of the independence of each condition / event. The Naive Bayes Classifier performs very well in comparison to other classifier models. This is evidenced in the journal "Naïve Bayes vs. Decision Trees vs. Neural Networks in the Classification of Training Web Pages "says that" Naïve Bayes Classifier has a better level of accuracy than other classifier models "[6]. The advantage of using this method is that this method only requires a small amount of training data to determine the parameter

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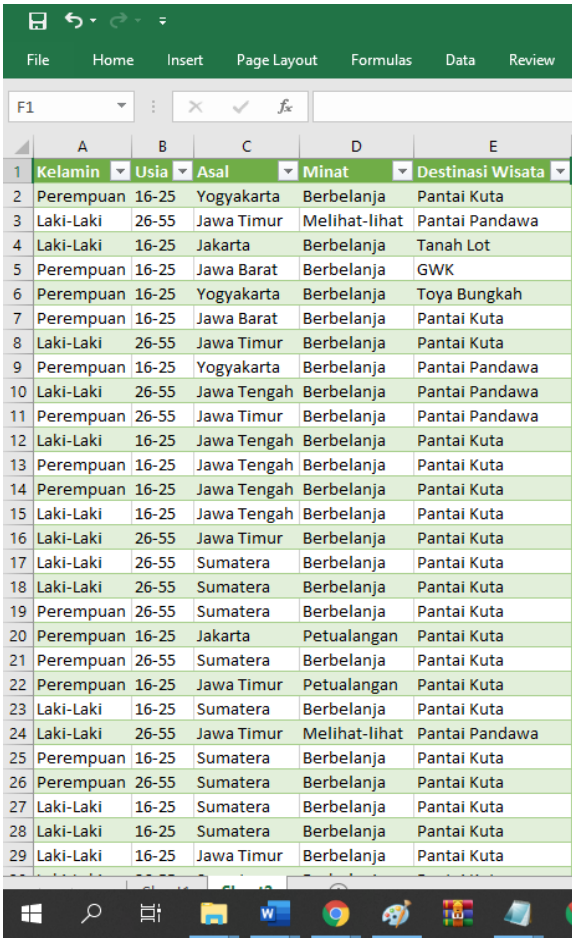
estimates required in the classification process. Since it is assumed to be an independent variable, only the variance of a variable in a class is needed to determine the classification.

3. Result and Discussion

The following is the data that the authors use as training data in this study, where this training data comes from the results of a survey of the characteristics of domestic tourists in the province of Bali in 2019, which has been carried out by the Bali Provincial Tourism Office, in collaboration with the University's Culture and Tourism Research Center. Udayana.



	A	B	C	D	E
1	Kelamin	Usia	Asal	Minat	Destinasi Wisata
2	Perempuan	16-25	Yogyakarta	Berbelanja	Pantai Kuta
3	Laki-Laki	26-55	Jawa Timur	Melihat-lihat	Pantai Pandawa
4	Laki-Laki	16-25	Jakarta	Berbelanja	Tanah Lot
5	Perempuan	16-25	Jawa Barat	Berbelanja	GWK
6	Perempuan	16-25	Yogyakarta	Berbelanja	Toya Bungkah
7	Perempuan	16-25	Jawa Barat	Berbelanja	Pantai Kuta
8	Laki-Laki	26-55	Jawa Timur	Berbelanja	Pantai Kuta
9	Perempuan	16-25	Yogyakarta	Berbelanja	Pantai Pandawa
10	Laki-Laki	26-55	Jawa Tengah	Berbelanja	Pantai Pandawa
11	Perempuan	26-55	Jawa Timur	Berbelanja	Pantai Pandawa
12	Laki-Laki	16-25	Jawa Tengah	Berbelanja	Pantai Kuta
13	Perempuan	16-25	Jawa Tengah	Berbelanja	Pantai Kuta
14	Perempuan	16-25	Jawa Tengah	Berbelanja	Pantai Kuta
15	Laki-Laki	16-25	Jawa Tengah	Berbelanja	Pantai Kuta
16	Laki-Laki	26-55	Jawa Timur	Berbelanja	Pantai Kuta
17	Laki-Laki	26-55	Sumatera	Berbelanja	Pantai Kuta
18	Laki-Laki	26-55	Sumatera	Berbelanja	Pantai Kuta
19	Perempuan	26-55	Sumatera	Berbelanja	Pantai Kuta
20	Perempuan	16-25	Jakarta	Petualangan	Pantai Kuta
21	Perempuan	26-55	Sumatera	Berbelanja	Pantai Kuta
22	Perempuan	16-25	Jawa Timur	Petualangan	Pantai Kuta
23	Laki-Laki	16-25	Sumatera	Berbelanja	Pantai Kuta
24	Laki-Laki	26-55	Jawa Timur	Melihat-lihat	Pantai Pandawa
25	Perempuan	16-25	Sumatera	Berbelanja	Pantai Kuta
26	Perempuan	26-55	Sumatera	Berbelanja	Pantai Kuta
27	Laki-Laki	16-25	Sumatera	Berbelanja	Pantai Kuta
28	Laki-Laki	16-25	Sumatera	Berbelanja	Pantai Kuta
29	Laki-Laki	16-25	Jawa Timur	Berbelanja	Pantai Kuta

Figure 4, Training Data

In this case, currently the author only uses 180 training data, to apply the Naïve Bayes algorithm in the Optimization of Tourism Recommendations, there are 4 attributes & 1 label that the author uses, each value in the attribute consists of :

-Sex (Male, Female)

-Age (<= 15,16-25,26-55)

-Asal (Jakarta, West Java, Central Java, East Java, Sumatra, Yogyakarta)

- Interests (Shopping, Sightseeing, Adventure)

Whereas the label contains the values:

-Tourism Destinations (GWK, Kuta Beach, Pandawa Beach, Tanah Lot, Toya Bungkah)

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Which is where the author only uses data from domestic tourists, and from 1190 authors use 180 random data.

Here is the calculation of Naïve Bayes:

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

For example:

Table 1, Example Cases

Kelamin	Usia	Asal	Minat	Destinasi Wisata
Laki-Laki	16-25	Jawa Tengah	Melihat-lihat	????????

Table 2, Examples of the Naïve Bayes Classification Process

Perhitungan Naive Bayes	Hasil	Label
16/38 * 16/38 * 4/38 * 19/38 * 38/180	0.00196984	GWK
32/68 * 41/68 * 10/68 * 35/68 * 68/180	0.0081134	Pantai Kuta
10/19 * 7/19 * 4/19 * 11/19 * 19/180	0.00249469	Pandawa
20/45 * 31/45 * 0/45 * 24/45 * 45/180	0	Tanah Lot
2/10 * 6/10 * 0/10 * 5/10 * 10/180	0	Toya Bungkah

To eliminate the 0 in naïve Bayes calculations we need the Laplacian Correction algorithm, along with the calculations:

$$\rho_i = \frac{m_i+1}{n+k}$$

Table 3, Example of a Laplacian Correction Process

Perhitungan Naive Bayes + Laplacian Correction	Hasil	Label
17/76 * 17/76 * 5/76 * 20/76 * 38/180	0.000182875	GWK
33/136 * 42/136 * 11/136 * 36/136 * 68/180	0.000606093	Pantai Kuta
11/38 * 8/38 * 5/38 * 12/38 * 19/180	0.000267289	Pandawa
21/90 * 32/90 * 1/90 * 25/90 * 45/180	0.000064014	Tanah Lot
3/20 * 7/20 * 1/20 * 6/20 * 10/180	0.00004375	Toya Bungkah

Based on the calculations from table 2 to table 3, a tourism recommendation can be given, namely Kuta Beach. The results of the analysis using the python language program are:

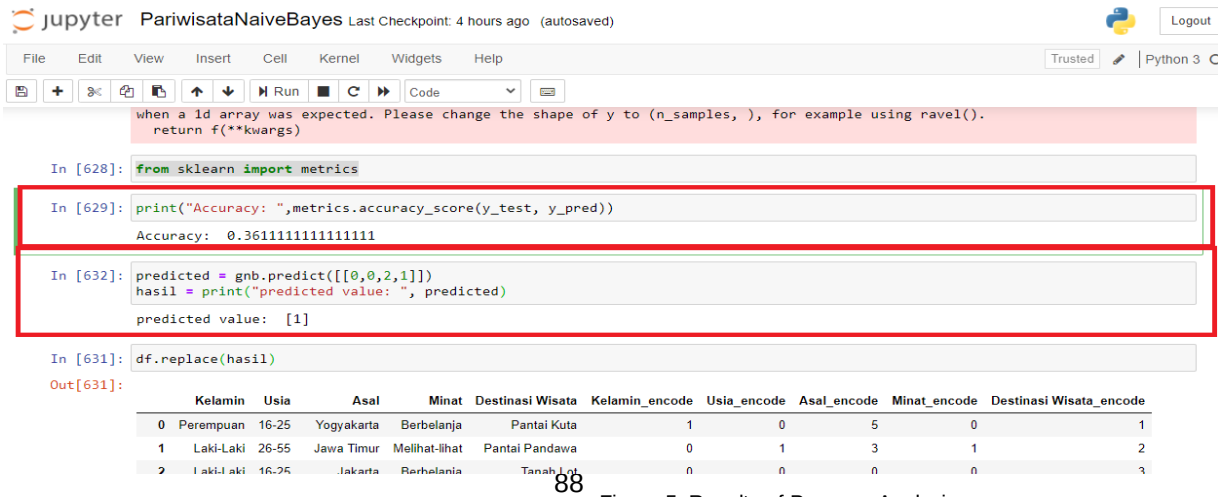

Figure 5, Results of Program Analysis

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In python the author uses the GaussianNB () library to calculate the Naïve Bayes algorithm. In this program, each value and label is simplified into numeric variables, then it can be read :

Table 4, Translation of Program Results

Kelamin	Usia	Asal	Minat	Destinasi Wisata
Laki-Laki	16-25	Jawa Tengah	Melihat-lihat	????????
0	0	2	1	????????

In accordance with Figure 5 the result is: variable 1 which means Kuta Beach Based on the python program analysis in Figure 5, it is concluded that the resulting accuracy is between 80% of training data and 20% of testing data, with an accuracy of 0.3611111111, or it can be concluded that 36%.

4. Conclusion

Based on this research, it can be concluded that, the Naïve Bayes Algorithm can be used to maximize travel recommendations based on the Personal Motivation of Tourists, and based on the results of this study, the Application of Travel Recommendations using the Naïve Bayes Algorithm based on the Personal Motivation of Tourists has the potential to be done, and in the future it will be very beneficial for the tourism industry.

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