Analysis of Community Satisfaction with the Service Systems in Civil Registry Service Office, South Buru Regency using the TAM (Technology Acceptance Model) Method

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Abstract-A good service system will satisfy the community, making that community's contentment the deciding factor or the key factor in determining how successful an organization is in providing the service. This research aims to analyze the service system that has been available in the Department of Population and Civil Registration of Buru South district through the public satisfaction survey as well as to understand the services system that should be improved to minimize public dissatisfaction with the procedures provided by using the machine learning model, namely Random Forest Classifier technique to obtain a prediction of the satisfaction of the public with the services provided and perform validity testing on the prediction results obtained from the Random forest classifier technique using the Technology Acceptance Model. (TAM). The results of the trials carried out there are 3 determining factors to be able to increase public dissatisfaction namely the complaint service, the service process and the behavior of the officer supported by the validity test results using TAM with the results showing that the 3 services are valid means to be a factor that can be used to increase the public satisfaction with the result obtained from the T-computed value greater than T-table with the value for the Complaint Service 4.4794, service process 2.1345 and the Officer Behavior 1.9675 of the value of the table 1.6517.

Keyword: Public satisfaction; Machine Learning; TAM (Technology Acceptance Model).

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1. Introduction

Public satisfaction is an important factor in an organization and cannot be neglected. It is the obligation of every organization to be able to guarantee quality service to the community. Civil Registry Service Office Buru South District is one of the organizers of public services to the public covering the service of Population Documents and Civil Records. Therefore, the quality of service and customer satisfaction also need to get the attention and study of the public service organizers.

In accordance with the Law No. 25 of 2009 on Public Service, public service organizers are obliged to improve the quality of their services, and to guarantee the services provided in accordance to the principles of good governance, in addition to protecting every citizen from abuse of authority related to improving the well-being and fulfilment of basic needs of public communities.

Civil Registry Service Office has improved well-being and basic needs by conducting public satisfaction surveys over the last two years by performing a manual evaluation of the survey results obtained but not maximized.

There are still weaknesses in the performance of service providers that do not meet the expectations of the public. This can be seen by the existence of complaints or grievances of the public, through the Survey of Public Satisfaction (SKM) given to the public in connection with the services performed.

The purpose of this research is to be able to analyze the system of services that has been carried out through the Public Satisfaction Survey to each service provided by Civil Registry Service Office South Buru Regency and to understand the service system that should be improved for the community by using Machine Learning Techniques so that through this research there is no

public dissatisfying with the procedure of service and can the goals and functions of the public service organizers.

2. Method

a. Related Researchers

The first research conducted by Tri Sugihartono with Rendy Rian Chrisna Putra on "Analysis of User Satisfaction Using Technology Acceptance Model on Public Service Systems" focused on analyzing the factors that influence the awareness of each user in conducting a public service system. [1].

The second study conducted by Hasada S P Pratama, Diovianto P Rakhmadani on the "Application of Technology Acceptance Model (TAM) in the Use of LinkAja Applications". This study focused on looking at the acceptance of the linkAja application at the Institute of Telecom Technology Purwokerto with the method of technology acceptance model of indicators of usability perception, ease of use, behavioral interest in using and actual use of the system. [2].

The third research conducted by Fauziah Hanum, et al about "*The Important Role of Adopting the use of Technology in Universities after Covid-19: Application of The Technology Acceptance Model*", The study focuses on studying the dominant factors affecting the use of online learning systems for students in Indonesia [3].

The fourth study conducted by Enita Rosmika, et al. on Analysis of Public Satisfaction with the Use of SiBisa Applications with TAM Approaches resulting in service satisfaction significantly influenced by ease, norm attitude and control. In this study, the focus point is to measure the level of satisfaction with the SiBisa application services that have been provided by the field manager [4].

Based on the research that has been presented above, research was carried out on the analysis of public satisfaction survey on information systems in Civil Registry Service Office Buru South district using Google Collaboratory to manage data, Machine Learning to perform predictions of services systems that need to be improved in the service given to the community and TAM (Technology acceptance model) to perform validity testing on the level of satisfaction of the prediction results obtained. So the difference between the previous research and this study is that the focus of this research is to understand the service system that needs to be improved for the community so that there is no public dissatisfaction with the service procedure.

b. Theoretical Basis

1) *Data Scientist*

Programming, statistics, and business are the three skills that individuals who work in the field of Data Scientists must possess.

As a result, the term "data scientist" itself refers to the predictive techniques used to predict the short, medium, and long-term theories of companies that are expected to help in solving problems.
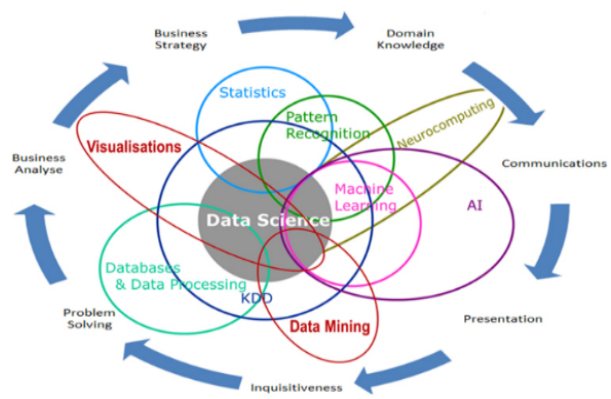

Figure 1. Data Science [5].

2) Machine Learning

According to Goldberg & Holland (1988), the term "Machine Learning" refers to mathematical algorithms and computer programs that use data-based learning to make predictions of the future [6]. Moreover, machine learning is a method of adapting and replicating human decision-making capabilities. Basically, this is a subfield of artificial intelligence used to make machines capable of performing human-like tasks [7] who can do categorization and prediction [8].
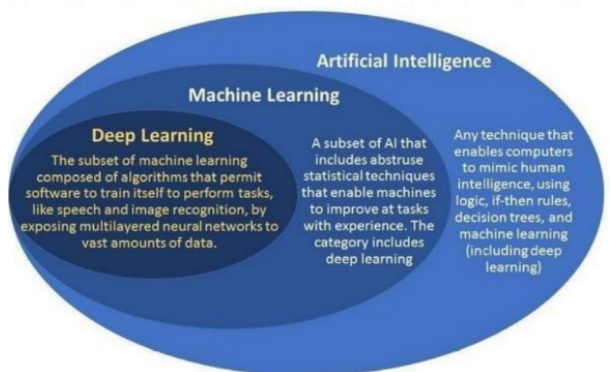
(a)
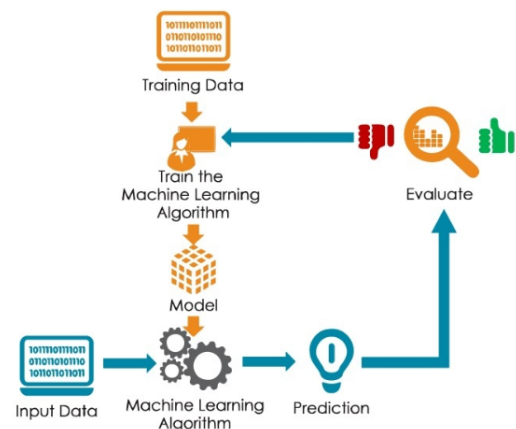
(b)

Figure 2. (a) How Machine Learning Works, (b) Relation of Artificial Intelligence and Machine Learning

3) TAM (Technology Acceptance Model)

A theory known as the Technology Acceptance Model (TAM) provides an explanation of a model of technology acceptance approach, which can be used to assess the extent to which users accept technology. Perception of the benefits of technology and perception of ease of use are two factors that influence user acceptance of technology.

Davis developed the Technology Acceptance Model (TAM), an adaptation of the Theory of Reasoned Action (TRA) dedicated to modeling user acceptance of information systems and trying to explain the factors that influence information-based technology acceptance [9] which aims to describe end user behavior.
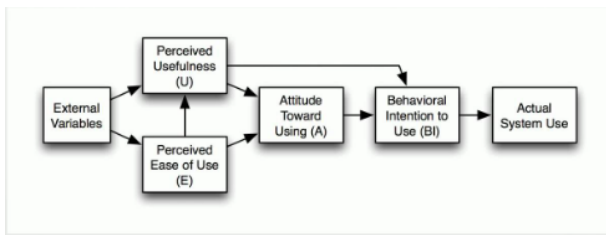

Figure 3. TAM (Technology Acceptance Model)

c. Data Set

The data collection is based on the survey method from the results of the questionnaire filled by the community. (respondent). Before the data is processed, researchers perform a data cleanup called preprocessing on data already collected in Microsoft Excel. The first step is to clean the data by removing characters that can make the data different but have the same meaning. After that, the data is stored in.exe format in Microsoft Excel for processing in the Google Collaboratory. For the problem-solving framework can be seen in the form of flowchart diagrams on the figure 4.
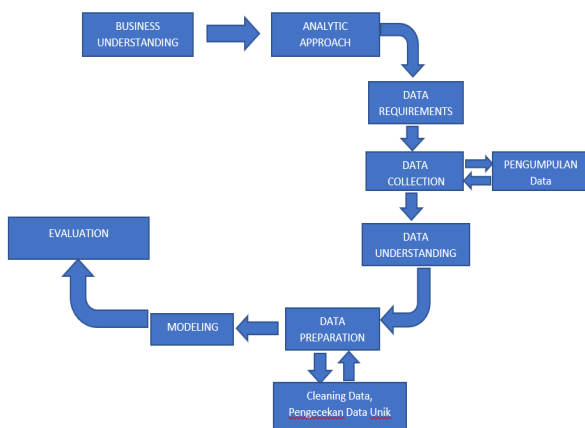

Figure 4. Problem Solving Structure

1) Data Requirements
Based on the problem found on the field is about the level of public satisfaction related to the procedures of service.

2) Data Collection
Data collection is the collection of data, in this case it is carried out through an SKM (Survey of Public Satisfaction) that has been completed by the community (respondent).

3) Data Understanding
Data understanding is a stage in the development of data science and AI that aims to gain an early understanding of the data needed to solve a particular business problem [10]. When the data has been collected, the data is classified by disaggregating the data in a table in Microsoft Excel so that it can be understood for processing in the Google Collaboratory.

In this study there are 225 sheets of surveys that have been filled in by the community that are in the SKM box provided. This data is taken in every service performed in such a way that the community that performs the service of documentation is obliged to fill in the public satisfaction survey sheet provided. So the data is processed using machine learning techniques to obtain quick and easy prediction results. Besides, you can also see the total number of people who choose very satisfied, happy, neutral, unsatisfied, and very dissatisfied that can be seen in figure 5.
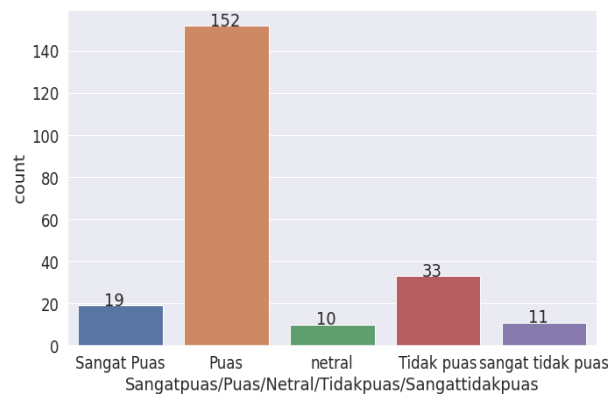

Figure 5. Amount of society versus community satisfaction

4) Data Preparation
Data preparation or pre-processing. In this case, the data that has been collected is cleaned up by means of data cleaning. The next step is to perform a unique data verification, i.e. every data character in the table is to do a character verification to adjust so that there is no data inequality that has the same meaning. Next, Encode Data. Data encoding is done in two stages: label encode and one hot encode which has the same purpose of changing the data type from object to integer by giving value.

```
Data columns (total 13 columns):
 #   Column                          Non-Null Count  Dtype
---  ------                          --------------  -----
 0   Gender                          225 non-null    object
 1   Umur                            225 non-null    int64
 2   Pendidikan_Terakhir             225 non-null    object
 3   Pekerjaan_Utama                 225 non-null    object
 4   Jenis_Layanan_yang_diterima     225 non-null    object
 5   layanan_Informasi               225 non-null    object
 6   Layanan_SOP                     225 non-null    object
 7   Layanan_Penjelasan_Petugas      225 non-null    object
 8   Proses_Pelayanan                225 non-null    object
 9   Perilaku_Petugas                225 non-null    object
 10  Layanan_Pengaduan               225 non-null    object
 11  Layanan_Sarana_dan_Prasarana    225 non-null    object
 12  Puas/TidakPuas                  225 non-null    object
```

Figure 6. Data Type

In this case, there are multiple columns in this scenario that are still subject-type data, as seen in Figure 6, therefore it is required to convert the data into integer data by giving the encode label that assigns a label to the object-type data so that it can be integer-typed. Likert Sekaran can also make advantage of the technique of labeling satisfaction levels [11] with an alternative answer given by giving a value or sequential number to be readable/ processed with machine learning.

The algorithm for encode labels in this study is first carried out model import for encoder labels then formed objects from existing encoder classes namely ['Gender'], [*Pendidikan Terakhir*], [*Jenis Layanan yang diterima*], [*layanan informasi*], [*Layanan SOP*], [*Layanan Penjelasan Petugas*], [*Proses Pelayanan*], [*Perilaku Petugas*], [*Layanan Pengaduan*], dan [*Layanan Sarana dan Prasarana*], The encoder label will be transformed against the data column. After that, the result of the transform will be stored back in the created data column and will be called for display so that the data that the object is typed will have a value that can be typed integer and can be processed.

As for the one-hot encode is the primary task. The main job is done using one hot encoder because the main job has several categories that have to be decomposed for some kind of job so that it can be punctuated integer. The algorithm for one hot encode first carries out the import model one hot Encode then forms an object of the class one Hot Encode and the object one hotencode is housed in a variable that can form an array containing the values features that are the types of work of the column ['Major tasks']. In this study there are 11 kinds of jobs that are housed in an array that will be represented by 11digit beats for each major job so that it can form an integer value that can be processed.

5) Modeling

Data modeling, which is used to determine where data is stored and make it easier for teams and data management to communicate, relates various data elements to gain the information required. It shows that data modeling emphasizes what data is needed and what will be done for the needs of the company. In this study, the data modeling performed was a regression technique on the data to predict the accuracy of the existing service

system and use the Technology acceptance model (TAM) to test the validity of the data against the service system.

Regression is a statistical technique that defines the mathematically modeled relationship between the cause-and-effect data (independent variable) meaning a numerical data type and the category with the resulting data (variable dependent) meaning the number data type (continue) [12]. Linear regression is formulated as follows:

$$Y = a + \beta + \varepsilon \tag{1}$$

In this study there are 8 regression models that are used to obtain data accuracy levels among others: Decision Tree, KNeighbors, GaussianNB, Random Forest, Gradient Boosting, Extra Trees dan XGB.

The validity test in this study is the data test used to determine the validity and non-validity of a data or measurement instrument in this case the result of the regression technique used [13].

The hypothesis proposed for this research is seen from the services available in the public satisfaction survey. These services are also important influential services and have an impact in every service that is available on Civil Registry Service Office. The hypothesis can be described below:

a) H1: The service processes provided have a positive influence on user satisfaction.

b) H2: The complaint service provided has a positive impact on user satisfaction.

c) H3: SOP services provided have a positive impact on user satisfaction.

d) H4: Service Officer's description given has a positive influence on user satisfaction.

e) H5: Officer behavior has a positive influence on user satisfaction.

f) H6: The facilities and infrastructure services provided have a positive influence on user satisfaction.

g) H7: Service Information provided has a positive impact on user satisfaction.

Every positive service always has a good impact on every user. But are all the services received or obtained important services for the user? To that end, this research will analyze and understand the service system that is a priority to improve.

The validity test here uses Microsoft Excel to calculate and find values from tTable and tCount formulated as follows:

a) *tCount*

$$tCount = \frac{\sqrt{(n-2)} * ny}{\sqrt{1 - ny2}} \tag{2}$$

Description:
n = number of respondents
ny = correlation value

b)   *tTable*

$$tTable = t(a, db) \qquad (3)$$

Description:
α = Significant level
db = degree of freedom (n-1)

6)   Evaluation
From the results of the modeling and evaluation by training and testing data on the model used in connection with the service procedure, we can perform validity testing of data using TAM (Technology acceptance model) to find out the validity level of a data that will be used to improve the service system of the procedure.

3.   Results and Discussion

The analysis process in this research uses machine learning to process data. In the process of data processing, the first thing to do is to analyze each given procedure service using Exploratory Data Analysis (EDA) which is an approach to analyzing the data by making an overall picture of the data so that it is easy to understand [14]. In this study, Exploratory Data Analysis (EDA) was carried out on several departments to be able to analyze the level of public satisfaction with the procedural services provided among others: service processes, complaint services, SOP services, officer clarification services, behavior of agents of means and goods services and information services, this is because these services have an influence on the satisfaction level.
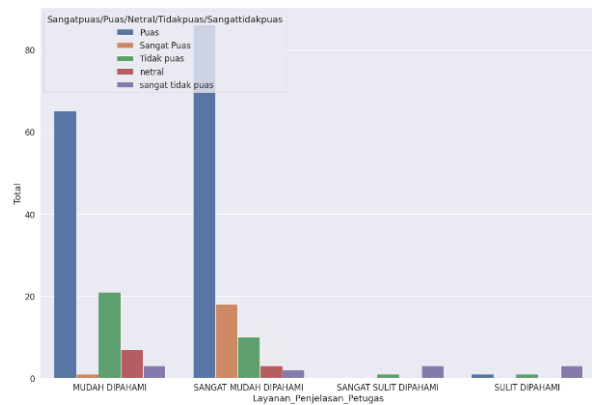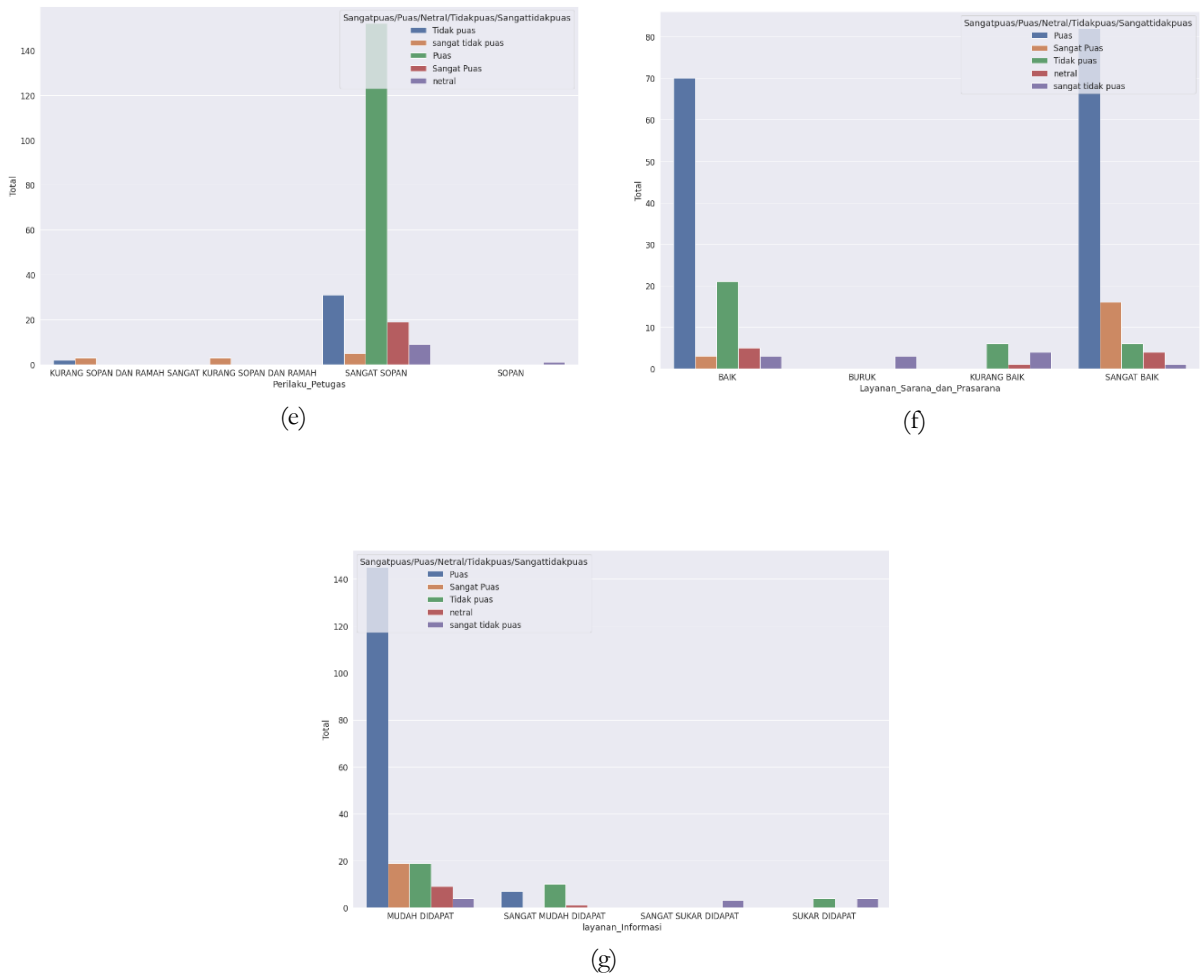

(a)

(b)

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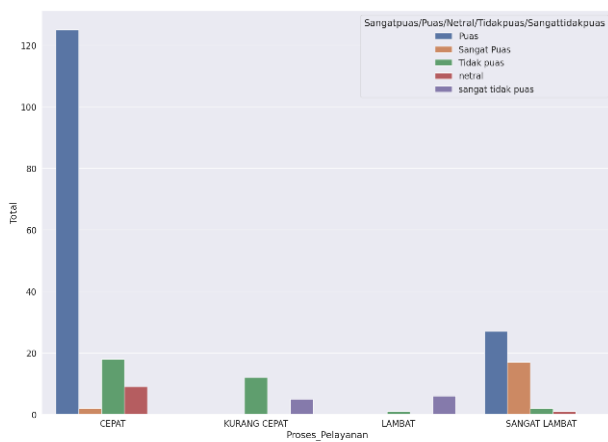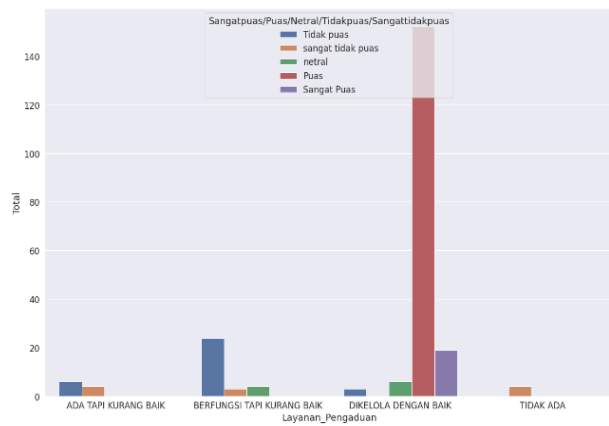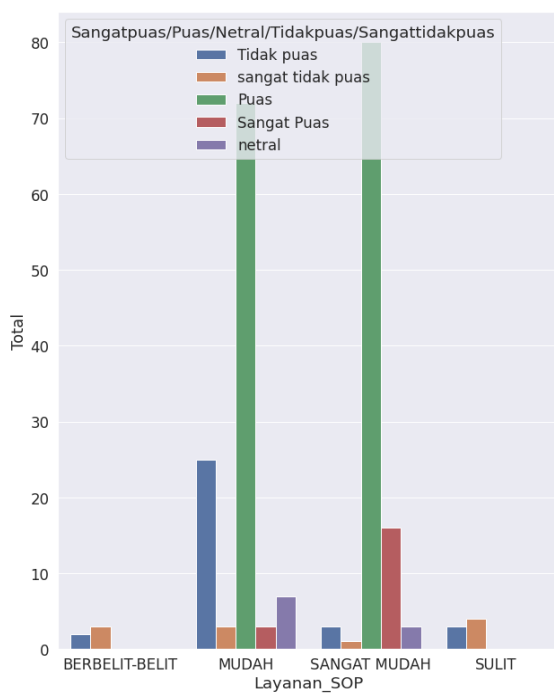
Figure 7. (a) *Proses Pelayanan,* **(b)** *Layanan Pengaduan,* **(c)** *Layanan SOP,* **(d)** *Layanan Penjelasan Petugas,* **(e)** *Perilaku Petugas,* **(f)** *Layanan Sarana dan Prasarana,* **(g)** *Layanan Informasi*
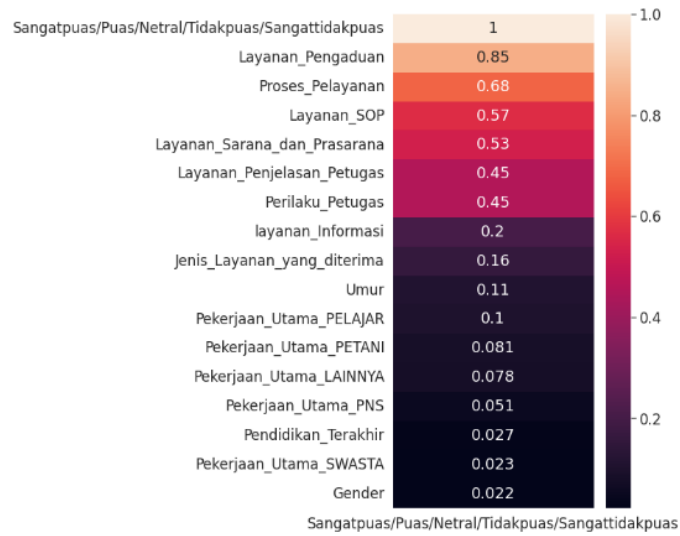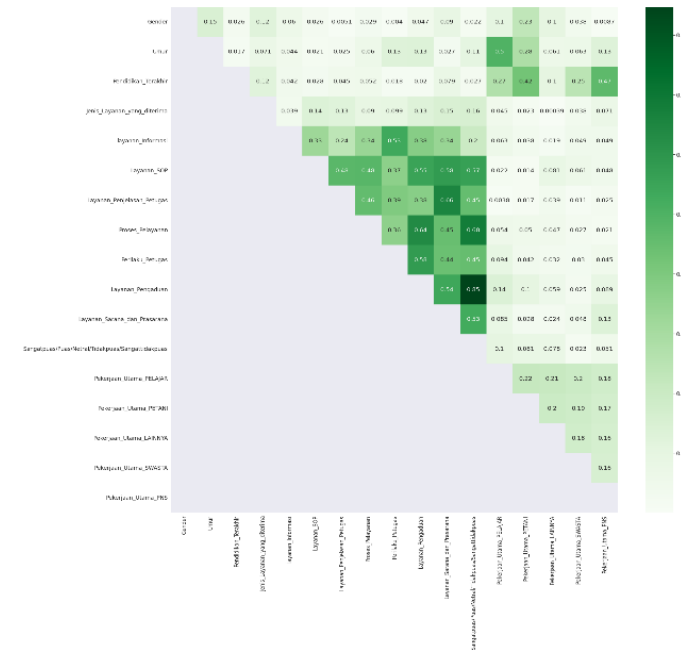

Figure 8. Public Satisfaction to Service Correlation

Figure 9. Correlation Matrix

	model	Accuracy training	Accuracy test	gap
4	RandomForestClassifier	1.000000	0.853333	0.146667
7	XGBClassifier	0.976667	0.840000	0.136667
5	GradientBoostingClassifier	1.000000	0.826667	0.173333
1	LogisticRegression	0.847778	0.822222	0.025556
6	ExtraTreesClassifier	1.000000	0.822222	0.177778
0	DecisionTreeClassifier	1.000000	0.804444	0.195556
2	KNeighborsClassifier	0.724444	0.671111	0.053333
3	GaussianNB	0.567778	0.502222	0.065556

Figure 10. Regression Model Comparison Results

Figure 7 (a) – (g) is a graph of data visualization of a representation Exploratory Data Analysis (EDA) That is the number of people who feel satisfied and dissatisfied with the procedures provided. For the service process and service explanation officer levels of satisfaction and dissatisfaction equal. This is because of the fact that the satisfaction and dissatisfaction of the service process also depends on the explanation of the officer. The amount of satisfaction and dissatisfaction with the complaint service is directly compared to the behavior of the officer and the level of SOP services is equal to the service of means and supplies. From this Exploratory Data Analysis (EDA) correlation and prediction of service procedures can be seen in Figure 8 and 9.

In this figure 8 a service procedure that has a customer satisfaction correlation value close to 1 is Complaints Service with a score of 0.85, Process Service score 0.68, SOP service score of 0.57, Facilities and supplies service of 0.53, Officer explanation service of 0.45, Officer behavior score of 0,45 and others get a score below or equal to 0.2. Figure 9 shows the correlation matrix as a result.

Further to the data modeling, the researchers used data regression techniques, using eight regression models to compare the accuracy levels of the data. From the result of the regression data obtained later, the researchers used the result regression model which has not far different values or values that are close to each other so that it becomes a reference used to make predictions against each procedure service. The results of the prediction values obtained were tested using the Technology acceptance model. (TAM). This test aims to test the validity of the predictions of service procedures obtained from the regression model used to obtain service features that need to be improved. From the regression results, the researchers used the Random Forest Classifier to be used as an accuracy measure because the test and training results are not very different. The results of the data regression model comparison can be seen in Figure 10.

From the results of the comparison above, the data is trained to make predictions so that you can find the correlation, then you can test the data to see the level of accuracy when using the Random Forest Classifier model. Random Forest Classifier is a popular method used for ensemble-based classification and decision tree grouping (Decision tree) [15]. From the data test results performed performance measurements to compare actual values and predictive values or called confusing matrix obtained as in figure 11.

After testing the data on the selected regression model, the researchers also performed feature importance as a measure of the size of the contribution of various features trained to the performance of the predictive model and obtained results that can be seen in Figure 12.
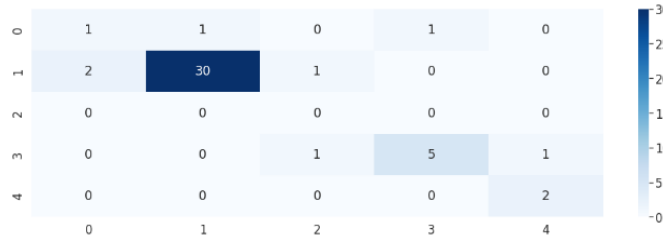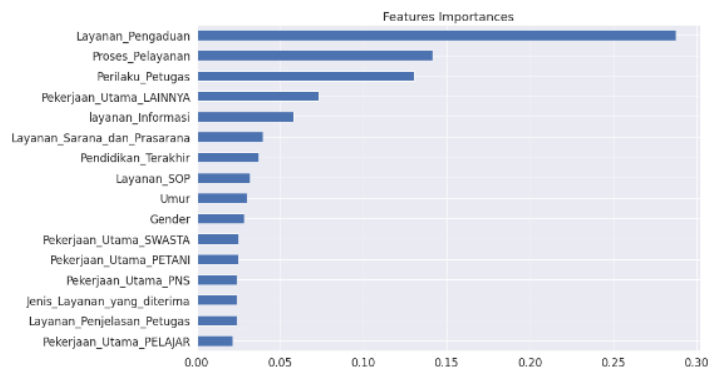

Figure 11. Confusion Matrix

Layanan_Pengaduan	0.287318
Proses_Pelayanan	0.141505
Perilaku_Petugas	0.130626
Pekerjaan_Utama_LAINNYA	0.072983
layanan_Informasi	0.058127
Layanan_Sarana_dan_Prasarana	0.039524
Pendidikan_Terakhir	0.036993
Layanan_SOP	0.031873
Umur	0.029858
Gender	0.028259
Pekerjaan_Utama_SWASTA	0.025127
Pekerjaan_Utama_PETANI	0.024619
Pekerjaan_Utama_PNS	0.024009
Jenis_Layanan_yang_diterima	0.023921
Layanan_Penjelasan_Petugas	0.023912
Pekerjaan_Utama_PELAJAR	0.021347

Figure 12. Result Features Importance with Random Forest Classifier model

The next step is to test the results of the Importance features obtained using the TAM (Technology acceptance model) by conducting a validity test of the correlation values at the top 3 services used for reference as in table 1:

Table 1. Validity test

Provided Services	ny (Corelation Score)	tTable	tCount	Status
Layanan Pengaduan	0.287318	1.65171	4.4794	Valid
Proses Pelayanan	0.141505	1.65171	2.1346	Valid

Provided Services	ny (Corelation Score)	tTable	tCount	Status
Perilaku Petugas	0.130626	1.65171	1.9675	Valid

This test is done by looking for tCount and tTable values. As for the correlation value, it is obtained from the result of correlations performed using the Random Forest Classifier algorithm. This correlation value (ny) is obtained from the calculation of the highest value on each service, in other words the greatest contribution value of any available service, namely complaint service 0.287318, service process 0.141505, officer behavior 0.130626. For the value of the Table obtained from the probability value based on the hypothesis of the number of respondents minus 2 who get the result for the three such services is 1.65171. Here is a calculation done in Microsoft Excel to find the value of tCalculate and tTable for 3 services.

a. *Layanan pengaduan:*

$$tCount = \frac{\sqrt{(225-2)} \times 0.287318}{\sqrt{1-0.287318^2}} \tag{2}$$

$$= 4.4794$$
$$tTable = 2\,(0.05.223) \tag{3}$$
$$= 1.65171$$

b. *Proses Pelayanan:*

$$tCount = \frac{\sqrt{(225-2)} \times 0.141505}{\sqrt{1-0.141505^2}} \tag{2}$$

$$= 2.1346$$
$$tTable = 2\,(0.05.223) \tag{3}$$
$$= 1.65171$$

c. *Perilaku Petugas :*

$$tCount = \frac{\sqrt{(225-2)} \times 0.130626}{\sqrt{1-0.130626^2}} \tag{2}$$
$$= 1.9675$$
$$tTable = 2\,(0.05.223) \tag{3}$$
$$= 1.65171$$

4. Conclusion

Based on the results obtained, the researchers found the three most important factors that significantly affect public satisfaction with the service procedure, among others: complaint service, service process and official behaviour.

From these results, what the researchers can use to improve the level of public satisfaction with the service in the Civil Registration and Occupation Service of Buru South district focused on three main factors: complaint service with a value of 0.2873, service process with a rating of 0.1415 and the behavior of the officer with a score of 0.1306 and supported by the validity test results with the TAM (Technology acceptance model) method which resulted that the three such services are valid because the result of the tCount value is greater than the Table with the value for *'Layanan pengaduan'* 4.4794, *'proses pelayanan'* 2.1345 and 'Perilaku petugas' 1.9675 from tTable 1.6517.

The level of public dissatisfaction with the Department of Occupation and Civil Registration of South Buru Regency can therefore be reduced if the complaint service can be managed effectively, the service process is carried out quickly, and the officers behave well.

The algorithm used in this research is using Random Forest Classifier, which is an algorithm whose learning can run slowly depending on the parameters used and cannot correct the model produced repeatedly so that for the future it can use other algorithms such as decision tree, KNeighbors, XGB and need to also be supported by the amounts of data obtained.

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