



Designing Applications For Damage Reporting Of Public Facilities Using K-Means Clustering Algorithm

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ABSTRACT

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Public facilities are facilities provided for public purposes such as roads, street lighting, bus stops, sidewalks, and pedestrian bridges. The facilities provided are facilities that provide convenience for the community so that they must be maintained properly. Data mining is a process of dredging or collecting important information from large data. The data mining process often uses statistical, mathematical methods, to utilize artificial intelligence technology. The application designed uses 50 datasets which, after normalization, the number of data becomes 350 data, and after preprocessing the data used in the study is 81 data, with 4 attributes and 3 clusters. The results of the data processing resulted in the first data clustering based on the facility attributes produced as many as 29 data, the second data clustering based on the year attribute produced was 12 data, the third data clustering based on the attribute the resulting amount was 40 data

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1. Introduction

Public facilities are facilities provided for public purposes such as roads, street lighting, bus stops, sidewalks, and pedestrian bridges. The facilities provided are facilities that provide convenience for the community so that they must be maintained properly. Pedestrian facilities function to separate pedestrians from vehicle traffic lanes to ensure pedestrian safety and smooth traffic [1]. However, damage is often found in public facilities provided, thus requiring information and communication technology in providing complete information on the damage that occurs.

The application of Information and Communication Technology is also not only directly applied [2]. The application of information and communication technology which is currently being widely used in assisting decision-making and information, among others, is data mining. Data mining is a process of dredging or collecting important information from large data. The data mining process often uses statistical, mathematical methods, to utilize artificial intelligence technology [3]. One method of clustering that is more popular than other clustering algorithms is K-means because of the simplicity of the algorithm and its efficiency. The simplicity of the algorithm makes the K-means algorithm applicable in various fields, such as research conducted by previous studies [4]. Based on the description of the background and problems, this research will take the title "Designing Applications For Damage Reporting Of Public Facilities Using K-Means Clustering Algorithm"

2. Method

The stages to obtain the dataset in this study are as follows:

2.1 Data Collection

There are several techniques that can be used in collecting data from research, including the following:

- a. Literature Study



In this literature study, it is done by collecting data by searching for several journals, books and modules related to Data Mining, using the K-Means Clustering method.

b. Dataset

The application designed uses 50 datasets which, after normalization, the number of data becomes 350 data, and after preprocessing the data used in the study is 81 data, with 4 attributes and 3 clusters. The following is transaction data for 2017-2021 which has been entered into the table:

Table 1.
First Dataset

Damage To Public Facilities Due To Disaster In Ntb 2017							
City	Education Facility (Unit)	Medical Facility	Worship Facilities	Bridge (Unit)	Embankment (M)	Dam (Unit)	Irrigation Channel (M)
Mataram	0	0	0	0	0	0	0
Lombok Barat	0	0	0	0	0	0	0
Lombok Tengah	0	0	0	0	0	0	0
Lombok Timur	0	0	0	3	0	0	0
Lombok Utara	0	0	0	0	0	0	0
Sumbawa Barat	0	0	0	1	0	0	0
Sumbawa	0	0	0	0	0	0	0
Dompu	0	0	0	0	0	0	0
Bima	0	0	0	1	0	0	0
Kota Bima	0	0	0	0	0	0	0
Damage To Public Facilities Due To Disaster In Ntb 2018							
City	Education Facility (Unit)	Medical Facility	Worship Facilities	Bridge (Unit)	Embankment (M)	Dam (Unit)	Irrigation Channel (M)
Mataram	0	0	0	0	0	0	0
Lombok Barat	169	60	413	155	2	0	0
Lombok Tengah	214	12	24	0	0	0	0
Lombok Timur	1010	9	110	360	195	0	0
Lombok Utara	248	39	879	6	0	0	0
Sumbawa Barat	0	0	0	3	0	0	0
Sumbawa	1	0	0	1	0	0	0
Dompu	0	0	0	0	0	0	0
Bima	0	0	0	5	0	0	0
Kota Bima	0	0	0	0	0	0	0
Damage To Public Facilities Due To Disaster In Ntb 2019							
City	Education Facility (Unit)	Medical Facility	Worship Facilities	Bridge (Unit)	Embankment (M)	Dam (Unit)	Irrigation Channel (M)
Mataram	0	3	0	0	0	0	0
Lombok Barat	0	0	0	0	0	0	0
Lombok Tengah	0	0	0	0	0	0	0
Lombok Timur	1	50	4	0	0	0	0
Lombok Utara	0	0	0	0	0	0	0
Sumbawa Barat	1	0	1	1	0	1	0
Sumbawa	1	2	1	0	0	0	0
Dompu	5	1	3	0	0	0	0
Bima	0	1	0	3	0	0	0
Kota Bima	0	0	0	0	0	0	0
Damage To Public Facilities Due To Disaster In Ntb 2020							
City	Education Facility (Unit)	Medical Facility	Worship Facilities	Bridge (Unit)	Embankment (M)	Dam (Unit)	Irrigation Channel (M)
Mataram	0	0	0	0	0	0	0
Lombok Barat	1	0	0	0	0	0	0
Lombok Tengah	1	0	1	1	0	0	0
Lombok Timur	3	1	1	1	70	0	0
Lombok Utara	0	0	0	2	0	0	0
Sumbawa Barat	0	0	0	0	20	0	0
Sumbawa	2	1	3	0	10	2	0

Dompu	0	0	0	1	0	0	0
Bima	2	0	0	3	0	1	0
Kota Bima	0	0	0	0	25	0	0

Damage To Public Facilities Due To Disaster In Ntb 2021

City	Education Facility (Unit)	Medical Facility	Worship Facilities	Bridge (Unit)	Embankment (M)	Dam (Unit)	Irrigation Channel (M)
Mataram	0	0	0	0	0	0	0
Lombok Barat	8	1	3	0	105	0	0
Lombok Tengah	1	0	0	0	0	0	0
Lombok Timur	0	0	0	0	15	0	0
Lombok Utara	0	0	0	0	0	0	0
Sumbawa Barat	0	0	0	0	0	0	0
Sumbawa	9	1	0	6	110	0	0
Dompu	3	0	2	1	560	0	0
Bima	22	16	6	22	0	3	0
Kota Bima	0	0	0	0	40	0	0

3. Result and Discussion

The data that has been obtained will be calculated using the K-Means method. In the application of the K-Means method, the steps for completion are as follows. After preprocessing, the data can be grouped using the K-Means Clustering algorithm. The display during processing can be seen in the following figure. In the k-means algorithm, there are several processes, including:

- a. Determine k as the number of clusters you want to form. In this study the existing data will be grouped into three clusters.
- b. Generate initial k centroids (cluster center points) randomly. In this study, the center point is determined randomly and the central point of each cluster can be seen in the following table, and sample data samples are shown in the previous Table 2.

Table 2
Cluster Center Points

Initial Center Point	Facility	Year	Quantity
Cluster 1	0	0	0
Cluster 2	1	1	1
Cluster 3	2	2	2

- c. Calculate the distance of each data to each centroid. After knowing the value of k and the initial cluster center, then measuring the distance between the cluster centers using Euclidian distance, then the distance matrix will be obtained, namely C1, C2, and C3 $d(x,y) = \sum_{i=1}^n (x_i - y_i)^2$
- d. Each data selects the nearest centroid.

The distance from the calculation results will be compared and the closest distance between the data and the cluster center is chosen, this distance indicates that the data is in one group with the nearest cluster center. By comparing the results of the cluster and taking the smallest one

Table 3.
Clustering Result

No	Kota	Fasilitas	Tahun	Jumlah	Cluster
1	Lombok Timur	Bridge	2017	3	Cluster 1
2	Sumbawa Barat	Bridge	2017	1	Cluster 1
3	Bima	Bridge	2017	1	Cluster 1
4	Lombok Barat	Embankment	2018	2	Cluster 1
5	Lombok Tengah	Medical Facility	2018	12	Cluster 1
6	Lombok Tengah	Worship Facilities	2018	24	Cluster 1
7	Lombok Timur	Medical Facility	2018	9	Cluster 1
8	Lombok Utara	Medical Facility	2018	39	Cluster 1
9	Lombok Utara	Bridge	2018	6	Cluster 1
10	Sumbawa Barat	Bridge	2018	3	Cluster 1
11	Sumbawa	Education Facility	2018	1	Cluster 1
12	Sumbawa	Bridge	2018	1	Cluster 1



No	Kota	Fasilitas	Tahun	Jumlah	Cluster
13	Bima	Bridge	2018	5	Cluster 1
14	Mataram	Medical Facility	2019	3	Cluster 1
15	Lombok Timur	Education Facility	2019	1	Cluster 1
16	Lombok Timur	Medical Facility	2019	50	Cluster 1
17	Lombok Timur	Worship Facilities	2019	4	Cluster 1
18	Sumbawa Barat	Education Facility	2019	1	Cluster 1
19	Sumbawa Barat	Worship Facilities	2019	1	Cluster 1
20	Sumbawa Barat	Bridge	2019	1	Cluster 1
21	Sumbawa Barat	Dam	2019	1	Cluster 1
22	Sumbawa	Education Facility	2019	1	Cluster 1
23	Sumbawa	Medical Facility	2019	2	Cluster 1
24	Sumbawa	Worship Facilities	2019	1	Cluster 1
25	Dompu	Education Facility	2019	5	Cluster 1
26	Dompu	Medical Facility	2019	1	Cluster 1
27	Dompu	Worship Facilities	2019	3	Cluster 1
28	Bima	Medical Facility	2019	1	Cluster 1
29	Bima	Bridge	2019	3	Cluster 1
30	Lombok Barat	Education Facility	2018	169	Cluster 2
31	Lombok Barat	Medical Facility	2018	60	Cluster 2
32	Lombok Barat	Worship Facilities	2018	413	Cluster 2
33	Lombok Barat	Bridge	2018	155	Cluster 2
34	Lombok Tengah	Education Facility	2018	214	Cluster 2
35	Lombok Timur	Education Facility	2018	1010	Cluster 2
36	Lombok Timur	Worship Facilities	2018	110	Cluster 2
37	Lombok Timur	Bridge	2018	360	Cluster 2
38	Lombok Timur	Embankment	2018	195	Cluster 2
39	Lombok Utara	Education Facility	2018	248	Cluster 2
40	Lombok Utara	Worship Facilities	2018	879	Cluster 2
41	Dst.....				
81	Kota Bima	Embankment	2021	40	Cluster 3

The implementation described above helps analyze the classification of damage to facilities. The analysis was carried out on 50 datasets in five years. In this grouping, the attributes are facilities, years, and the amount of damage. The data is processed using K-Means Clustering. The results of the study used data on damage to facilities:

a. Health Facilities

Damage to Health Facilities in 2018 in the cities of Central Lombok, East Lombok and North Lombok were included in the low damage group because they were in cluster 1, and in 2019 the cities of Mataram, East Lombok, Sumbawa, Dompu and Bima were also included in the category. the small damage group because it is also in the 1st cluster, while in 2018 the city of West Lombok was included in the moderate damage group because it was included in the 2nd cluster, and in 2020 the cities of East Lombok, Sumbawa and West Lombok were included in the group a lot of damage because it is included in the 3rd cluster, and in 2021 the cities of West Lombok, Sumbawa and Bima are also included in the large damage group because they are included in the 3rd cluster.

b. Educational Facilities

For Damage to Education Facilities in 2018 in the city of Sumbawa it was included in the group of minor damage because it was in cluster 1, and in 2019 in the cities of West Sumbawa, Sumbawa and Dompu were also included in the group of minor damage because they were in cluster 1, while in 2018 the cities of West Lombok, Central Lombok, East Lombok, and North Lombok were in the moderate damage group because they were in the 2nd cluster, and in 2020 in the cities of West Lombok, Central Lombok, East Lombok, Sumbawa and Bima there were in the large damage group because it is in the 3rd cluster, and in 2021 in the cities of West Lombok, Central Lombok, Sumbawa, Dompu and Bima, it is also included in the large damage group because it is included in the 3rd cluster.

c. Worship Facilities

Damage to worship facilities in 2018 in Central Lombok City was included in the small damage group because it was in cluster 1, and in 2019 in East Lombok City, West Sumbawa, Sumbawa, and Dompu were also included in the low damage group because found in cluster 1, while in 2018 in the cities of West Lombok, East Lombok and North Lombok, they were included in the moderate



- damage group because they were in cluster 2, and in 2020 in the cities of Central Lombok, East Lombok and Sumbawa were included in the cluster 2. in the large damage group because they are in the 3rd cluster, and in 2021 in the city of West Lombok, Dompu and Bima are also included in the large damage group because they are in the 3rd cluster.
- d. Dam
Dam Damage in 2019 in the city of West Sumbawa was included in the small damage group because it was in the 1st cluster, while in 2020 and 2021 the Bima city was included in the large damage group because it was in the 3rd cluster, and in 2020 it was in the 3rd cluster. Sumbawa city is also included in the group of large damage because it is in the 3rd cluster.
- e. Bridge
For Bridge Damage in 2017 in the cities of East Lombok, West Sumbawa, and Bima, they were included in the low damage group because they were in cluster 1, and in 2018 the cities of East Lombok, West Sumbawa, Sumbawa and Bima were also included in the damage group. which is small because it is in the 1st cluster, and in 2019 the cities of West Sumbawa and Bima were also included in the small damage group because they were in the 1st cluster, while in 2018 the cities of West Lombok and East Lombok were included in the damage group. moderate because it is in the 2nd cluster, and in 2020 in the cities of Central Lombok, East Lombok, North Lombok, Dompu and Bima are included in the group of large damage because they are in the 3rd cluster, and in 2021 in the cities of Sumbawa, Dompu and Bima is also included in the high damage group because it is in the 3rd cluster.
- f. Embankment
For Embankment Damage in 2018 in the city of West Lombok was included in the small damage group because it was in the 1st cluster, while in 2018 the East Lombok city was included in the moderate damage group because it was in the 2nd cluster, and in 2021 in the city of Dompu is included in the moderate damage because it is in the 2nd cluster, and in 2020 in the cities of East Lombok, West Sumbawa, Sumbawa and Bima City, it is included in the large damage because it is in the 3rd cluster, and in 2021 in the the cities of West Lombok, East Lombok, Sumbawa and Bima City are also included in the high damage group because they are in cluster 3.

4. Conclusion

The application designed uses 50 datasets which, after normalization, the number of data becomes 350 data, and after preprocessing the data used in the study is 81 data, with 4 attributes and 3 clusters. The results of the data processing resulted in the first data clustering based on the facility attributes produced as many as 29 data, the second data clustering based on the year attribute generated was 12 data, the third data clustering based on the resulting attribute amounted to 40 data.

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