

DATA MINING K-MEANS: CLUSTERING HEALTH AND COMPLAINTS RESIDENT IN INDONESIA

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ABSTRACT

This study aims to utilize the Clustering Algorithm in grouping the population Which have complaint health with algorithm K-means in Indonesia. Source data study This collected based on the information documents. The total population of the province have complaints health produced by the Central Bureau of National Statistics. The data used in this study are data for 2013-2017 which consists of 34 provinces. The method used in this research is K-means algorithm. The data will be processed by clustering in 3 clusters, namely level clusters high health complaints, clusters of moderate and low health complaints. Data center for clusters high population level 37.48, Centroid data for clusters of moderate population level 27.08, and Centroid data for low population level cluster 14.89. So that the acquisition of the assessment is based on the population index owned health complaints with 7 provinces with high levels of health complaints, namely Central Java, in Yogyakarta, Bali, Nusa Southeast West, Nusa Southeast East, Borneo South, Gorontalo, 18 province level complaint moderate health, and 9 other provinces including low levels of health complaints. It can be input to the government to pay more attention to residents in each area that has high health complaints through improving public health services so that the Indonesian population becomes healthier without exists complaint health.

Keywords: data mining, complaint health, clustering, k-means, resident Indonesia

1. INTRODUCTION

Health complaints are disturbances to physical and mental conditions, including due to accidents, or other things that interfere with daily activities. In general, the main health complaints are that many residents experience are fever, headache, cough, runny nose, diarrhea, asthma/shortness of breath, toothache. Person Which suffer disease chronic considered have complaint health although on time survey (One month last) concerned does not cure the disease. There are several efforts that we can do in cope problem complaint health like enhancement nutrition, addition facility health, implementation However, provide service health free, procurement drug generic, addition amount power medical, and conduct education on the importance of cleanliness and healthy lifestyle. health service quality, including inside it handling complaint public, influenced by availability means and infrastructure including fund. In matter This expected to government for do evaluation handling complaint For repair or increase service health. Constitution Number 36 Year 2009 about Health states that health efforts are any activity and/or series of activities carried out collectively integrated, integrated And He For look after And increase degrees health public in the form of disease prevention, health promotion, disease treatment, and health restoration by government and/or public (chapter 1), every person entitled get environment Which Healthy for Warning of health degree (article 6), everyone has the right to get information and education about balanced and responsible health (article 7), everyone has the right to obtain information about his personal health data including actions and treatment that he has received or will receive from the staff health (chapter 8).

Data Which used in study it's based documents Which generated by Body Center National Statistics through the site <https://www.bps.go.id>. In this case the researcher raised the topic of the population have health complaints by province where the method used is clustering. Result of clusters can be used as input for the government so that provinces that are included in the high cluster get attention more. Process clusters are divided inside 3 (three) clusters namely complaint health tall, complaint health moderate and low health complaints. Cluster analysis is a statistical analysis that aims to solve it object inside a number of group

Which have characteristic different between group Which One with Which other.

In this analysis each group is homogeneous between members in the group or object variations in the smallest possible group. Algorithms commonly used in data mining namely algorithm *ID3* [1]–[3], *C4.5* [1], [4]–[8], *K-Means* [9], [10][11]–[13], *Naive Bayes* [14], [15], *Support Vector Machine* [2], *Priori* [16] And a number of algorithm data mining other. Algorithm *K-Means* can used for study various type matter, among them study related [17] who do study about grouping in classifying the number of villages/kelurahan that have health facilities by province with k- method. In order to obtain an assessment based on the Village/Kelurahan Index with Health Facilities with 4 provinces with high level of health facilities namely North Sumatra, West Java, Central Java, East Java, 14 provinces have a moderate level of health facilities, and 16 other provinces have a low level of health facilities. Rohmawati [18] grouped data on Student Learning Assistance (BBM) scholarship applicants, for measurement algorithm performance, this measurement is seen from the cluster results by calculating the purity value (purity measure) from each – each group which in earn.

2. LITERATURE REVIEW

2.1. Data Mining

Data mining is a data processing method to find hidden patterns from data the. The results of data processing with this data mining method can be used to make decisions in the future. Data mining is also known as pattern recognition [19][12]. Data mining is large-scale data processing methods therefore data mining has an important role in the field industry, finance, weather, knowledge And technology. kindly general study data mining discuss methods like, clustering, classification, regression, selection variable, and market basket analysis [19].

2.2 Clustering

Clustering / Clustering analysis is the process of dividing data into a set into several groups that have the same data in a group that is larger than the similarity of the data with data in other groups. Potential grouping can be used to determine the inner structure data that can be further used in a wide variety of applications such as classification, image processing, And introduction pattern [17].

2.3 K-Means

K-Means is something algorithm Which used in grouping in a manner petition Which Finally data to in group Which different – different [20].

The *K-Means* algorithm is a method used to group data based on an iterative search for cluster centers where the location of each data cluster is found to be the minimum distance for each data to the cluster center [8]. The *K-Means* algorithm is included in the nonhierarchical method which partitions data into one or more clusters, so that data with the same characteristics are grouped in the same cluster and data with different characteristics are grouped into other clusters [3]. The *K-Means* algorithm is in their research to increase the speed of the clustering method by making centroid determination simpler [11]. *K-means* has several distinct advantages over other clustering algorithms. That is, *K-means* is an algorithm that is very simple and powerful, very efficient, and can be used for various types of data. To calculate the center of the latest cluster using the Euclidean distance formula.

$$d(x, y) = \sqrt{\sum_{i=0}^i (x_i - y_i)^2}$$

Where:

$d(x, y)$ = distance between data at point x and y

x = object data point

y = centroid data point

i = number of data Formula attribute

The formula for grouping data into clusters with the shortest distance

$$C_k = \left(\frac{1}{nk}\right) \sum di$$

Where:

C_k = cluster centroids

n_k = amount of data in cluster K

d_i = sum of the distance values included in each cluster.

3. ANALYSIS AND DISCUSSION

In study This method Which used that is method Data Mining as following:

- a. Collection stage data,
- b. Processing stage data,
- c. Stage clustering and
- d. Stage analysis

3.1 Stage Collection Data

Collection data in study This taken based on documents information Amount resident province Which own complaint health Which generated from Publication Statistics Indonesia And processed from the results of the National Socioeconomic Survey/Susenas, the Central Bureau of National Statistics. Data used in this research is data from year 2013-2017 Which consists from 34 province.

3.2 Stage Processing Data

The data that has been processed will be processed first to be clustered. In the previous stage, the data for each province will be added up for each aspect so that at this stage the value calculation has been obtained which will process on stage clustering.

3.3 Stage Clustering

Partition clustering is an unattended classification and is a process of collecting data objects from One arrange become a number of class. Matter This can done with apply various buy and sell And step-steps regarding the distance of the algorithm, namely the Euclidean Distance [21]. Cluster analysis is a method is used to divide a data set into several groups based on the similarities that have been found previously determined [22]. In determining the cluster based on the data that is already available, it takes a flowchart to make it easier to determine the flow of calculations as a flow to find the results of application of clusters to the data to be processed. The following is a flowchart in determining clusters with K-Mean [15].

3.4 Stage Analysis

At this stage data analysis is carried out on the number of residents who have health complaints. data that obtained processed using the calculation of the weight of each index. In the previous stage, it has determined will clustered to in 3 group ie group level complaint health tall, group level complainthealth medium and group level complaint health low. On it is this stage will analyzed result. In *clustering*, the data obtained will be calculated first based on the average results Number of population experiencing health complaints by Province. The data is then accumulated And taken mark average his, that is:

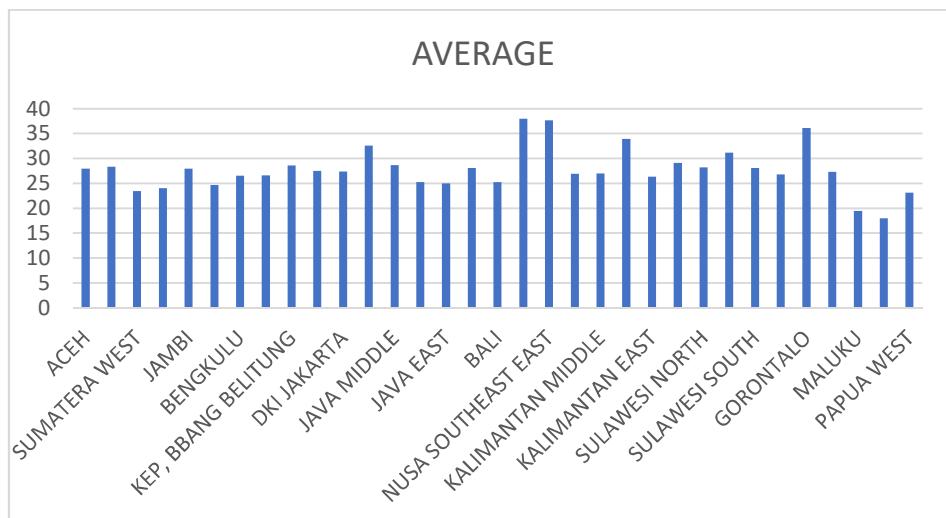


Figure 1. Mark average after alternative data accumulated

After being accumulated and looking for the average value in Figures 1 above, the value of each variable will be obtained. Then the data will enter the clustering stage by applying the K-means algorithm to group data into three groups.

3.5 Centroids Data

In application algorithm *K-means* generated mark point middle or *center of mass* from data Which got with The condition that the desired clusterization is 3. Determination of this cluster point is done by taking the largest (maximum) value for the high cluster (C1), the average (average) value for the medium cluster (C2) and the smallest (minimum) for clusters low (C3). Mark point the can is known on table following.

3.6 Clustering Data

By using these *centroids*, the data that has been obtained can be clustered into 3 clusters. Cluster process by taking the shortest distance from each processed data. From the amount data residents who experience complaint health obtained grouping on iteration 1 For 3 group the. Group resident high (C1) namely Central Java, DI Yogyakarta, Bali, West Nusa Tenggara, East Nusa Tenggara, Kalimantan South And Gorontalo. Group moderate population (C2) ie 22 Province And group low population (C3) ie 5 province other. Process search distance short, grouping data on iteration 1 And Top grouping can depicted on the table And picture following:

Table 1. calculation Distance Center Group Iteration 1

| PROVINCE | AVERAGE | C1 | C2 | C3 | DISTANCE SHORTEST |
|-------------------------|---------|-------|-------|-------|-------------------|
| ACEH | 27,61 | 9.87 | 0.53 | 12.72 | 0.53 |
| SUMATERA NORTH | 22.86 | 14,62 | 4,23 | 7.97 | 4,23 |
| SUMATERA WEST | 29,67 | 7,81 | 2.59 | 14.78 | 2.59 |
| RIAU | 27.02 | 10.46 | 0.06 | 12,13 | 0.06 |
| JAMBI | 22,26 | 15,21 | 4.82 | 7,38 | 4.82 |
| SUMATERA SOUTH | 26.8 | 10.67 | 0.28 | 11.92 | 0.28 |
| BENGKULU | 27,69 | 9.79 | 0.6 | 12.8 | 0.6 |
| LAMPUNG | 28.98 | 8.5 | 1.9 | 14.09 | 1.9 |
| KEP, BANGKA BELITUNG | 28.59 | 8.88 | 1.51 | 13.71 | 1.51 |
| KEP, RIAU | 22,42 | 15.06 | 4.66 | 7,53 | 4.66 |
| DKI JAKARTA | 30,22 | 7,26 | 3,14 | 15,33 | 3,14 |
| JAVA WEST | 28,34 | 9,14 | 1.26 | 13.45 | 1.26 |
| Central Java | 33,30 | 4,18 | 6,21 | 18,41 | 4,18 |
| YOGYAKARTA | 37,48 | 0 | 10,40 | 22.59 | 0 |
| JAVA EAST | 30,52 | 6.96 | 3,44 | 15,63 | 3,44 |
| BANTEN | 28.94 | 8.54 | 1.86 | 14.05 | 1.86 |
| BALI | 33,30 | 4,18 | 6,22 | 18,41 | 4,18 |
| NUSA SOUTHEAST WEST | 34,45 | 3.03 | 7,37 | 19.56 | 3.03 |
| NUSA SOUTHEAST | 34,64 | 2.83 | 7.56 | 19.76 | 2.83 |
| KALIMANTAN WEST | 25,22 | 12,26 | 1.86 | 10.33 | 1.86 |
| CENTRAL KALIMANTAN | 25,41 | 12.07 | 1.68 | 10.52 | 1.68 |
| KALIMANTAN SOUTH | 35.04 | 2.43 | 7.96 | 20,16 | 2.43 |
| KALIMANTAN EAST | 21.59 | 15.88 | 5,49 | 6,71 | 5,49 |
| KALIMANTAN NORTH | 14.89 | 22.59 | 12,19 | 0 | 0 |
| SULAWESI NORTH | 26.02 | 11.46 | 1.07 | 11,13 | 1.07 |
| CENTRAL SULAWESI | 29,17 | 8,31 | 2.08 | 14,28 | 2.08 |
| SULAWESI SOUTH | 24.68 | 12.8 | 2.4 | 9.79 | 2.4 |
| SULAWESI SOUTHEAST | 26.75 | 10.72 | 0.33 | 11.87 | 0.33 |
| GORONTALO | 35,84 | 1.64 | 8.76 | 20.95 | 1.64 |
| SULAWESI WEST | 28.85 | 8,63 | 1.77 | 13.96 | 1.77 |
| MALUKU | 19.05 | 18,42 | 8.03 | 4,17 | 4,17 |
| MALUKU NORTH | 16.04 | 21.44 | 11.04 | 1.15 | 1.15 |
| PAPUA WEST | 20 | 17,48 | 7.09 | 5,11 | 5,11 |

| PROVINCE | AVERAGE | C1 | C2 | C3 | DISTANCE SHORTEST |
|----------|---------|-------|-----|-----|-------------------|
| PAPUA | 17,68 | 19.79 | 9.4 | 2.8 | 2.8 |

Table 2. Iteration 1 grouping results

| PROVINCE | C1 | C2 | C3 | PROVINCE | C1 | C2 | C3 |
|---------------------|----|----|----|---------------------|----|----|----|
| ACEH | | X | | NUSA SOUTHEAST WEST | X | | |
| SUMATERA NORTH | | X | | NUSA SOUTHEAST EAST | X | | |
| SUMATERA WEST | | X | | KALIMANTAN WEST | | X | |
| RIAU | | X | | KALIMANTAN MIDDLE | | X | |
| JAMBI | | X | | KALIMANTAN SOUTH | X | | |
| SUMATERA SOUTH | | X | | KALIMANTAN EAST | | X | |
| BENGKULU | | X | | KALIMANTAN NORTH | | | X |
| LAMPUNG | | X | | SULAWESI NORTH | | X | |
| KEP, BBANG BELITUNG | | X | | SULAWESI MIDDLE | | X | |
| KEP, RIAU | | X | | SULAWESI SOUTH | | X | |
| DKI JAKARTA | | X | | SULAWESI SOUTHEAST | | X | |
| JAVA WEST | | X | | GORONTALO | X | | |
| JAVA MIDDLE | X | | | SULAWESI WEST | | X | |
| IN YOGYAKARTA | X | | | MALUKU | | | X |
| JAVA EAST | | X | | MALUKU NORTH | | | X |
| BANTEN | | X | | PAPUA WEST | | | X |
| BALI | X | | | PAPUA | | | X |

K-means process will continue to iterate until the data grouping is the same as the data grouping iteration previously. In other words, the process will continue to iterate until the data in the last iteration are equal previous iteration. After getting the midpoint or *centroid value*, the same process is carried out by searching closest distance. The shortest distance search process, data grouping in the last iteration and data clustering can depicted on table following:

Table 3. Centroids Data Iteration 4

| PROVINCE | AVERAGE | C1 | C2 | C3 | DISTANCE |
|--------------------|---------|-------|------|-------|----------|
| SUMATERA SOUTH | 26.8 | 10.67 | 0.28 | 11.92 | 0.28 |
| SULAWESI SOUTHEAST | 26.75 | 10.72 | 0.33 | 11.87 | 0.33 |
| ACEH | 27,61 | 9.87 | 0.53 | 12.72 | 0.53 |

Table 4. calculation Distance Center Group Iteration

| PROVINCE | AVERAGE | C1 | C2 | C3 | DISTANCE SHORTEST |
|----------------------|---------|-------|-------|-------|-------------------|
| YOGYAKARTA | 37,48 | 0 | 10,40 | 22.59 | 0 |
| KALIMANTAN NORTH | 14,89 | 22.59 | 12,19 | 0 | 0 |
| RIAU | 27,02 | 10.46 | 0.06 | 12,13 | 0.06 |
| BENGKULU | 27,69 | 9.79 | 0.6 | 12.8 | 0.6 |
| SULAWESI NORTH | 26,02 | 11.46 | 1.07 | 11,13 | 1.07 |
| MALUKU NORTH | 16,04 | 21.44 | 11.04 | 1.15 | 1.15 |
| JAVA WEST | 28,34 | 9,14 | 1.26 | 13.45 | 1.26 |
| KEP, BANGKA BELITUNG | 28.59 | 8.88 | 1.51 | 13.71 | 1.51 |
| GORONTALO | 35,84 | 1.64 | 8.76 | 20.95 | 1.64 |
| CENTRAL KALIMANTAN | 25,41 | 12.07 | 1.68 | 10.52 | 1.68 |
| SULAWESI WEST | 28.85 | 8,63 | 1.77 | 13.96 | 1.77 |
| BANTEN | 28.94 | 8.54 | 1.86 | 14.05 | 1.86 |
| KALIMANTAN WEST | 25,22 | 12,26 | 1.86 | 10.33 | 1.86 |
| LAMPUNG | 28.98 | 8.5 | 1.9 | 14.09 | 1.9 |
| CENTRAL SULAWESI | 29,17 | 8,31 | 2.08 | 14,28 | 2.08 |
| SULAWESI SOUTH | 24.68 | 12.8 | 2.4 | 9.79 | 2.4 |
| KALIMANTAN SOUTH | 35.04 | 2.43 | 7.96 | 20,16 | 2.43 |

| PROVINCE | AVERAGE | C1 | C2 | C3 | DISTANCE SHORTEST |
|---------------------|---------|-------|------|-------|-------------------|
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| PAPUA | 17,68 | 19.79 | 9.4 | 2.8 | 2.8 |
| NUSA SOUTHEAST | 34,64 | 2.83 | 7.56 | 19.76 | 2.83 |
| NUSA SOUTHEAST WEST | 34,45 | 3.03 | 7,37 | 19.56 | 3.03 |
| KEP, RIAU | 22,42 | 15.06 | 4.66 | 7,53 | 4.66 |
| JAMBI | 22,26 | 15,21 | 4.82 | 7,38 | 4.82 |
| DKI JAKARTA | 30,22 | 7,26 | 3,14 | 15,33 | 3,14 |
| JAVA EAST | 30,52 | 6.96 | 3,44 | 15,63 | 3,44 |
| MALUKU | 19.05 | 18,42 | 8.03 | 4,17 | 4,17 |
| Central Java | 33,30 | 4,18 | 6,21 | 18,41 | 4,18 |
| BALI | 33,30 | 4,18 | 6,22 | 18,41 | 4,18 |
| SUMATERA NORTH | 22.86 | 14,62 | 4,23 | 7.97 | 4,23 |
| PAPUA WEST | 20 | 17,48 | 7.09 | 5,11 | 5,11 |
| KALIMANTAN EAST | 21.59 | 15.88 | 5,49 | 6,71 | 5,49 |

3.7 Analysis Data

On iteration 4, grouping data Which done to 4 group with iteration 1 obtained results WhichThe same. Of the 34 known province-based population data, 7 provinces are high-level clusters 18 province group level medium and 9 province other including clusters level low.

4. CONCLUSION

To carry out an assessment of the results of population health complaints by province, you can apply the K-Means clustering method. The data is processed to obtain values from residents with complaints health by province. The data is processed using Ms. Excel to determine the inner centroid value 3 group that is group level complaint health tall, group level complaint health currently And group lellow health complaints. Cetroid data for clusters of high health complaints 37.48, Cetroid data for group level complaint health currently 27.08 And Cetroid data For group level complaint health low 14.89. In order to obtain an assessment based on the population index that has health complaints of 7 provinces with high levels of health complaints, namely Central Java, in Yogyakarta, Bali, West Nusa Tenggara, Nusa East Southeast, South Kalimantan, Gorontalo, 18 provinces with moderate health complaints, and 9 provinces others include a low level of health complaints. The results obtained from research can be input to government, province Which become attention more on resident Which own complaint health tallbased on group Which has done.

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