

The Implementation of the Placement of Health Workers in Health Centers using K-Means Clustering Method: Case Study in the City of Samarinda

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Abstract: Health centers and health workers is a relationship that cannot be separated during this division process of health workers in health centers has not been evenly distributed because of the absence of a system that can split health workers evenly to the health center. There is a way that can be used to divide the health workers evenly by using a clustering method to create a decision support system divides the health workers at the health center. The method that will be used for clustering decision support system is the K-Means algorithm, the method is very suitable to divide the number of data in accordance with the criteria required for the distribution of the location of the health center are evenly distributed in accordance with the criteria that have been determined. The results of the research that has been conducted K-Means algorithm can be used as a way out to divide the 30 health workers to 10 locations puskesmas more evenly and in accordance with the criteria to improve the quality of health of the local community.

1 INTRODUCTION

Health workers have a very important role in providing services at the health center. The health center as the main door health services to the community should be able to provide basic health services for the optimal and appropriate standards of competence. Health workers according to the Law Health Law No. 36 Year 2009 is someone who has the knowledge, skills and permission to perform actions or health efforts and are willing to devote themselves to the community in the field of health (Indonesia, 2009) (Indonesia, 2014). While based on the Regulation of the Minister of Health No. 75 Tahun 2014 said that health workers who work based on standards of personnel at health centers have at least 9 different types of health workers (World Health Organization, 2014). The ratio for health workers is still very much in the distribution of health personnel, so that in the distribution of health personnel to the health center is still widely found not meet the standards, then the necessary planning and the procurement of health workers so that in the distribution of health workers can meet the standard of competence. To undergo placement of health workers require decision support systems by the

method of K-means Clustering. K-Means Clustering is included in the partitioning clustering of each data should be entered in a certain cluster and allows for any data included in the cluster in a particular stage of the process, in the next step move to other clusters. K-Means splitting the data into k regions separate section where k is an integer positive. K-Means algorithm is very famous because of its ease and its ability to classify big data and outliers with very quickly. (Kusumadewi, 2009).

Classic problem faced by Indonesia in an effort to realize the health care fair and equitable for the community is the availability of health workers at the level of basic service that is not evenly amount and its distribution in the health center. The goal is to apply the placement of health workers in health centers in the City of Samarinda.

2 LITERATURE REVIEW

Research conducted referring to the previous research by Besse Faradibah entitled “ Design of decision support systems power distribution medical health center in south Sulawesi by using the Method of Analytical Hierarchy Process (Case Study Maros).

The second is made by Tri Afriliyanti and Sri Matheus with the title "Design of Decision Support System for the Determination of the healthy Home". K-Means Clustering is included in the partitioning clustering of each data must be entered performance cluster specific and allows for any data included in the cluster in a particular stage of the process, in the next step move to other clusters. K-Means splitting the data into k regions separate section where k is an integer positive. K-Means algorithm is very famous because of its ease and its ability to classify big data and outliers with very quickly (Kusumadewi, 2009).

There are many methods that can be used in clustering example K-means clustering method. Grouping can be used as a grouping of non-hierarchy that divides the data into two or more groups. K-means clustering is a method of cluster analysis which leads to the division of N objects of observations into K groups (clusters) and any of the object of observation is owned by a group with average (mean) nearby (Prasetyo et al., 2012).

Calculate the distance between the middle point with the point of each object Using the distance formula Euclidean

$$D(i,j) = \frac{\sqrt{(X1i - Xj)^2 + (X2i - Xj)^2 + \dots + (Xi - Xj)^2}}{2} \quad (2.1)$$

Where :

D (i, j) = The distance data to the i to the center of cluster j

Xki = Data to the i on the attributes of data to k
Xkj = Point a to j on attributes into k

Grouping object to determine the members of the cluster is to take into account the minimum distance of the object.

1. Back to phase-2, do looping up to the value of the centroid of the resulting fixed and a member of the cluster does not move to the other clusters. K-Means Clustering method can only process data in the form of numbers, then to data in the form of nominal should be initialized first in the form of numbers. His pace is:

1. Sort data based on the frequency of its appearance.
2. Initialize the data starting from the data of the highest with a value of 1. Then the next data 2, 3 and so on.

2.1 Clustering

Clustering is a method of analyzing the data or objects which enter as one of the methods that the goal is to classify the data with the same characteristics in a

region of the same data and with different characteristics in the territory of the other. There are several approaches used in developing a clustering method. Two main approaches are clustering approach to partition and clustering with the approach of the hierarchy. Clustering approach to partition or often called the partition-based clustering groups the data (objects) with the selected data are analyzed in clusters that exist. Clustering with the approach of the hierarchy or often referred to as hierarchical clustering to classify the data by creating a hierarchy of the form of a dendogram which the data are similar will be placed in a hierarchy within easy reach and not on the hierarchy are far apart. In addition to the second approach, there is also a clustering approach with automatic mapping (Self-Organising Map/SOM).

3 RESEARCH METHOD

This study uses a model of the process is the Waterfall or often also referred to as the waterfall model, the waterfall method includes two stages, namely :

3.1 Stage Definition and Requirements Analysis

The analysis is carried out to collect data centers and health workers, and then specify criteria for the determination of which is used in the process of placement of health workers. The analysis includes input, process and output.

3.2 Stage of System Design and Software

At the design stage is done the design process which can then be used for the construction of the system. The design process itself consists of the design of the groove decisions, the design of the decision table, the design of process modeling, design data modeling and perancangan user interface.

4 RESULT AND DISCUSSION

4.1 System Design

This system helps in taking the decision to determine the placement of health workers who are already in the count based on the criteria that has been set. This system will ensure that all required data has

been available, then the system will process using K-Means Clustering algorithm, the output of which is produced in the form of reports the location of the placement of health workers at the health center that has been set i.e. Puskesmas Sidomulyo, Puskesmas Lempake, Puskesmas Mangkupalas, health centers Trauma Centra, Puskesmas Pasundan, Puskesmas Teen, Puskesmas Sungai Kapih, health center New Hope, health centers, Water, and health centers Spe.

4.2 Context Diagram

Describe the context diagram and entity –entity outside of the other which gives the input output is.



Figure 1: Context Diagram Determine Power Health.

In the design flow chart on decision support system placement of Health Workers in health centers of the city was using the method of k-means clustering aims to provide a general overview on the flow diagram or flowchart in figure 2.

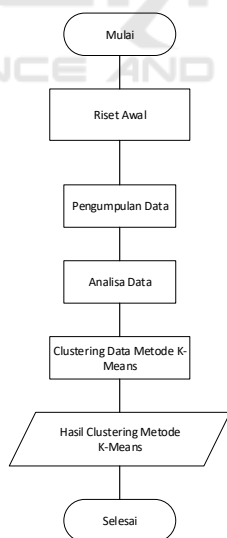


Figure 2: Flow diagram.

4.3 Calculation Data

The Parameters of The Placement of Health Workers The limits given in the completion of the placement of Health workers in health centers of the city was as follows:

1. The Data used as a reference or parameter in determining the placement of health workers is work experience, quality of work, cooperation, responsibility.
2. In this study, only using 30 data health workers drawn from the office of the City health department Was as a sample calculation of the K-Means Clustering.

4.4 The Calculation of The K-Means Clustering

Determine a centroid randomly with values between the lowest value to the highest value on the initial data contained in table 1 is the centroid of the first that will be used is a:

Table 1: Is The Centroid Of The Initial.

CENTROID	V	W	Y	Z
C1	10	90	90	90
C2	9	95	90	95
C3	7	80	79	84
C4	1	78	95	87
C5	7	75	70	75
C6	4	69	69	70
C7	3	86	78	90
C8	1	78	80	85
C9	2	90	84	96
C10	5	80	78	86

Description :

- V = Work Experience
- W = Quality Of Work
- Y = Cooperation
- Z = Responsibility

Calculation of the distance of the object to the centroid by using the formula ecludien with the formula contained in equation 1.

Calculation of the distance data of Health Workers one with a centroid 1 is

$$x_{(d1,c1)} = \sqrt{(1 - 10)^2 + (69 - 90)^2 + (96 - 90)^2 + (100 - 90)^2} = 25.65$$

Calculation of the distance data of Health Workers one with a centroid 2 is

$$x_{(d1,c2)} = \sqrt{(1 - 9)^2 + (69 - 95)^2 + (96 - 90)^2 + (100 - 95)^2} = 28.30$$

Calculation of the distance data of Health Workers one with the center of the centroid of the 3 is

$$x_{(d1,c3)} = \sqrt{(1-7)^2 + (69-80)^2 + (96-79)^2 + (100-84)^2} = 26.50$$

Calculation of the distance data of Health Workers one with a centroid 4 is

$$x_{(d1,c4)} = \sqrt{(1-1)^2 + (69-78)^2 + (96-95)^2 + (100-87)^2} = 15.84$$

Calculation of the distance data of Health Workers one with a centroid 5 is

$$x_{(d1,c5)} = \sqrt{(1-7)^2 + (69-75)^2 + (96-70)^2 + (100-75)^2} = 37.05$$

Calculation of the distance data of Health Workers one with a centroid 6 is

$$x_{(d1,c6)} = \sqrt{(1-4)^2 + (69-69)^2 + (96-69)^2 + (100-70)^2} = 40.47$$

Calculation of the distance data of Health Workers one with a centroid 7 is

$$x_{(d1,c7)} = \sqrt{(1-3)^2 + (69-86)^2 + (96-78)^2 + (100-90)^2} = 26.78$$

Calculation of the distance data of Health Workers one with a centroid 8 is

$$x_{(d1,c8)} = \sqrt{(1-1)^2 + (69-78)^2 + (96-80)^2 + (100-85)^2} = 23.71$$

Calculation of the distance data of Health Workers one with a centroid 9 is

$$x_{(d1,c9)} = \sqrt{(1-2)^2 + (69-90)^2 + (96-84)^2 + (100-96)^2} = 24.54$$

Calculation of the distance data of Health Workers one with a centroid 10 is

$$x_{(d1,c10)} = \sqrt{(1-5)^2 + (69-80)^2 + (96-78)^2 + (100-86)^2} = 25.63$$

The results of the clustering method K-Means algorithm at iteration 1 with the point of the centroid of the early that has been in the specify the data to be members due to have the closest distance to the center point to the centroid.

Table 2: The results of the Calculation Iteration 1.

No.	Point	Centroid	Name of Health Workforce	Result
1	C1	A1	A2	
			A3	3
2	C2	B1	B2	2
3	C3	C1	C2	
			C3	
			C4	3
4	C4	D1	D2	
			D3	
			D4	4
5	C5	E1	E2	
			E3	3
6	C6	F1	F2	
			F3	3
7	C7	G1	G2	2
8	C8	H1	H2	
			H3	4
9	C9	I1	I2	
			I3	3
10	C10	J1	J2	
			J3	3

To see whether there is a change point centroid at iteration 1, then do the calculation of the search is the centroid of the new, if not there is a change in the point of centroid before and after, then the calculation at the point of the centroid is considered finished.

Table 3: The Results of the Calculation Iteration 2.

No.	Point Centroid	The Name Of The Health	Result
1	C1	A1 A2 A3	3
2	C2	B1 B2	2
3	C3	C2 C3 C4 H3	4
4	C4	D1 D2 D3	3
5	C5	F3 E1 E2 E3	4
6	C6	F1 F2	2
7	C7	I3 G1 G2	3
8	C8	H1 H2 C1	3
9	C9	I1 I2 I3 D4	3
10	C10	J1 J2 J3	3

Table 4: The Results of the Calculation Iteration 3.

No.	Point Centroid	The Name Of The Health	Result
1	C1	A1 A2 A3	3
2	C2	B1 B2	2
3	C3	C2 C3 H3 C4	4
4	C4	D1 D2 D3	4
5	C5	F3 E1 E2 E3	3

6	C6	F1 F2	2
7	C7	G1 G2	2
8	C8	H1 H2 C1	3
9	C9	I1 I2 I3 D4	4
10	C10	J1 J2 J3	3

Table 5: The Results of the Calculation Iteration 4.

No.	Point Centroid	The Name Of The Health	Result
1	C1	A1 A2 A3	3
2	C2	B1 B2	2
3	C3	C2 C3 H3 C4	4
4	C4	D1 D2 D3	3
5	C5	F3 E1 E2 E3	4
6	C6	F1 F2	2
7	C7	I3 G1 G2	3
8	C8	H1. H2 C1	3
9	C9	I1 I2 D4	3
10	C10	J1 J2 J3	3

Looping stopped because of the results of the calculations on iteration 3 and iteration to 4 does not change, then the results of clustering using the placement of Health Workers in health centers of the city was using the method of K-Means to get results.

Table 6: The Results of the Placement of Health Workers Using the Method of K-Means.

No	The Name Of The Health	Power Health	The Location Of The Health Center
1	D1	Nurse	Trauma Center
2	I1	Nurse	Air Putih
3	I2	Nurse	Air Putih
4	D2	Nurse	Trauma Center
5	H1	Nurse	Harapan Baru
6	F1	Nurse	Remaja
7	H2	Nurse	Harapan Baru
8	A1	Nurse	Sidomulyo
9	C1	Nurse	Harapan Baru
10	B1	Nurse	Lempake
11	J1	Nurse	Sambutan
12	F2	Nurse	Remaja
13	A2	Nurse	Sidomulyo
14	I3	Nurse	Sungai Kapih
15	F3	Nurse	Pasundan
16	C2	Nurse	Mangkupalas
17	D3	Nurse	Trauma Center
18	B2	Nurse	Lempake
19	C3	Nurse	Mangkupalas
20	H3	Nurse	Mangkupalas
21	G1	Nurse	Sungai Kapih
22	D4	Nurse	Air Putih
23	E1	Nurse	Pasundan
24	J2	Nurse	Sambutan
25	J3	Nurse	Sambutan
26	G2	Nurse	Sungai Kapih

27	E2	Nurse	Pasundan
28	C4	Nurse	Mangkupalas
29	E3	Nurse	Pasundan
30	A3	Nurse	Sidomulyo

5 CONCLUSIONS

From the research that has been done, it can be concluded that the:

1. The method of K-Means can be applied to the decision support system the placement of Health Workers in health centers of the city of samarinda.
2. The First Cluster is the health personnel will be in place at puskesmas sidomulyo, the second cluster is the health personnel will be in place at puskesmas lempake, cluster the third is the health personnel will be in place at the health center mangkupalas, cluster fourth is the health workers who will be placed on health trauma center, cluster fifth is the health workers that will be in place at puskesmas pasundan, cluster sixth is the health personnel will be in place at the health center teen, the cluster of the seven is the most health will be in place at puskesmas sungai kapih, cluster eighth is the health personnel will be in place at the health center new hope, the cluster of the ninth is the most health will be in place at the health center white water, and cluster the tenth is the health personnel will be in place at the health center welcome.

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