

Implementation Of Data Mining Clustering Astra Vehicle Insurance Customers With The Clustering Method

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Abstract

Data mining, which is referred to as knowledge discovery in databases (KDD), means the nontrivial process of extracting implicit, previously unknown and useful information such as knowledge rules, descriptions, regularities, and major trends from large data bases. Data mining is developing in a multidisciplinary field, including database technology, machine learning, artificial intelligence, neural networks, information retrieval, and so on. K-Means is a non-hierarchical clustering method that tries to partition existing data into one or more clusters/groups. So that data that has the same characteristics and data that has different characteristics are grouped into other groups. The purpose of this research is to find out what types of insurance groups are most interested in based on their respective addresses, especially the city of Medan. The method used is group analysis with the K-Means method. As for the results of grouping the two variables, namely the type of insurance that is in great demand for the first place is the Planned Scholarship (D6) with a total of 10 and the second order is Dwiguna Prima (DP) with a total of 40 and for the third order is Lifetime Prima (WP) with a total of 50.

Keywords: *Data Mining, Clustering, Insurance Customers*

1. Introduction

Data mining is a series of processes to extract added value in the form of information that has not been known manually from a database by extracting patterns from data with the aim of manipulating data into more valuable information obtained by extracting and recognizing important patterns or draw from the data contained in the database.

Data mining is a very useful new technology to help companies find very important information from their data warehouses. The availability of a lot of data and the need for information or knowledge to support decision making to create business solutions and infrastructure support in the field of informatics engineering are the forerunners of the birth of data mining technology. So that this information can be used as a decision-making solution in the business world, for business development. PT. AJB Bumiputera 1912 is the oldest insurance company in Indonesia which has existed since 1912, this insurance company offers protection services to its customers. The service products provided by PT. AJB Bumiputera 1912 is Dwiguna Prima (DP), Planning Scholarship (D6), Prima Lifetime (WP), Gems (PM), Scholarship Partners (MP), EkaTime Ideal (ZI), Self-funding (P1), Dwiguna Us Dollar (RI), Multipurpose Prima (AP) Mitra Pusaka (PD), Stages Partners (TP). The large number of PT AJB Bumiputera 1912 customers each year makes

it difficult for this company to classify customer data. The problem that often arises in insurance companies is that many customers are in arrears in paying premiums, so a system is needed to classify/classify which customers fall into the current group, the substandard group and which customers fall into the non-standard group in paying premium contributions. . So that the insurer can solve the problem early on. An insurance company must have such a large amount of data. Many do not realize that the processing of these data can provide information in the form of clarification of customer data that will join the company itself. The use of data mining techniques is expected to be able to provide useful information about customer data clarification techniques that will join the current group, substandard group or non-standard in paying premiums.

By using the approach of applying data mining in grouping insurance customers using the clustering method, it can be used by PT. AJB Bumiputera 1912 to determine the grouping of insurance customers. As for one method of applying data mining is the Clustering method which can be used to group data with the same characteristics to the same area and data from different characteristics to other regions for grouping insurance customers. One of the most widely used methods is the non-hierarchical clustering method which seeks to partition existing data into clusters or groups so that data with the same characteristics are grouped into the same cluster.

Grouping insurance customers using the method *clustering* can be from all the groupings that have been determined, the result of which is what type of insurance is in great demand at each address where the customer lives (A) and what type of insurance is not in great demand at each address where the customer lives (B). based on the results of these groupings, the author will dig up important information that classifies customers for clustering in the data. The purpose of this study is to determine the variables used in grouping customer data, to describe the process of grouping customer data using clustering and to design a data mining application for grouping insurance customers for PT. AJB Bumiputera 1912 Medan Branch.

2. Methodology

Clustering analysis is a data mining technique that aims to identify groups of objects that have certain characteristics in common that can be separated from other groups of objects, so that objects in the same group are relatively more homogeneous than objects in different groups. This algorithm uses the principle of minimum distance which begins with finding the two closest objects and the two of them form the first cluster. In the next step there are two possibilities, namely:

- a. The third object will join the cluster that has been formed.
- b. The other two objects will form a new cluster.
- c. Furthermore, this process will continue until finally a single cluster is formed.

In this algorithm the distance between clusters is defined as the shortest distance between its members.

Solution steps:

1. Search for objects with minimum distance.
2. Calculates the distance between clusters and other objects.

3. Searches for objects with the closest distance.
4. Calculates the distance between clusters and other objects.
5. Looking for the shortest distance between the cluster and the object and the object joining the cluster is obtained.
6. In the final step, the clusters are joined to form a single cluster

The K-Means algorithm is an algorithm that is included in a distance-based clustering algorithm that divides data into a number of clusters and this algorithm only works on numeric attributes:

Grouping data with the K-Means Algorithm, the following steps are taken:

1. Determine the number of groups
2. Allocate data into groups randomly
3. Calculate the center of the group (centroid/average) from the data in each group. The centroid location for each group is taken from the average (mean) of all data values for each feature. If M represents the amount of data in a group, i represents the i -th feature in a group, and p represents the dimensions of the data, then the equation for calculating the centroid of the i th feature is used by equation 1. Equation 1 is carried out as many p dimensions from $i=1$ to $i=p$.
4. Allocate each data to the nearest centroid/average. There are several ways that can be done to measure the distance of data to the center of the group, one of which is Euclidean. Measurement of distances in the Euclidean distance space can be found using equation 2. Re-allocation of data into each group in the K-Means Algorithm is based on a comparison of the distance between the data and the centroid of each group. Data is explicitly reallocated to the group that has the centroid with the shortest distance from the data. The allocation of this data according to MacQueen (1967) can be determined using equation 3. The objective function used for the K-Means Algorithm is determined based on the distance and the value of data membership in the group. The objective function according to MacQueen (1967) can be determined using the equation. n is the number of data, k is the number of groups, a_{i1} is the membership value of data point x_i to the c_1 group followed. a has a value of 0 or 1. If the data is a member of a group, the value of $a_{i1} = 1$. If not, the value of $a_{i1} = 0$.
5. Return to step 3, if there is still data moving between groups or if there is a change in the centroid value above the specified threshold value, or if the value change in the objective function used is still above the specified threshold value

Table 1. Regional grouping by type of insurance

| No. | Region | Insurance Type | | | |
|-----|------------------|----------------|--------------|----------|---------|
| | | Link Units | dual-purpose | Lifetime | Futures |
| 1 | KC Binjai | 4 | 2 | 3 | 2 |
| 2 | KC Medan Kesawan | 1 | 0 | 2 | 1 |
| 3 | KC Lhokseumawe | 3 | 0 | 3 | 2 |
| 4 | Langsa KC | 1 | 0 | 0 | 0 |

| | | | | | |
|----|----------------------------|---|---|---|---|
| 5 | KC Blang Pidie | 1 | 1 | 0 | 1 |
| 6 | KC Stabat | 1 | 0 | 0 | 0 |
| 7 | KC Banda Aceh Kuta Alam | 1 | 0 | 2 | 1 |
| 8 | KC Banda Aceh Baiturrahman | 0 | 0 | 1 | 1 |
| 9 | KC Lubuk Pakam | 4 | 1 | 5 | 2 |
| 10 | KC Medan, Serdang | 1 | 0 | 1 | 2 |
| 11 | KC Medan Petisah | 1 | 0 | 0 | 0 |
| 12 | KC Medan Baru | 6 | 2 | 6 | 4 |
| 13 | KC Medan Pulo Brayon | 1 | 1 | 2 | 0 |
| 14 | KC Nias | 2 | 0 | 3 | 3 |
| 15 | KC Takengon | 3 | 1 | 3 | 2 |
| 16 | KCP Medan Polonia | 1 | 0 | 0 | 0 |
| 17 | KCP Medan Maimun | 0 | 0 | 1 | 1 |
| 18 | KCP Medan Timur | 1 | | | |
| 19 | KCP Medan, Johor | 1 | 1 | 2 | 0 |
| 20 | KCP Banda Aceh Kuta Raja | 0 | 0 | 0 | 1 |
| 21 | KCP Medan Sunggal | 1 | 0 | 0 | 0 |

Implementing the K-Means Algorithm

The following is the application of the K-Means Algorithm in grouping customer data on life insurance. Then the sample data taken per year as many as 10 customers only.

1. Determine the number of clusters (C)

In determining the number of clusters, several data samples were taken as many as 3 clusters and only 3 variables were determined for the cluster center, namely B, E and F.

2. Calculate the distance to the center of the cluster

To determine the distance to the center of the cluster, the square root is calculated from the customer data to the cluster center which has been determined using the equation, namely . From the equation above, it is used because the attributes used are 3. For example, the distance from the first customer data to the center of the first cluster will be calculated with the equation: $d(pq) = \sqrt{(P1 - q1)^2 + (P2 - q2)^2 + p3 - q3)^2}$

$$D(1,1) = \sqrt{(1 - 1)^2 + (1 - 2)^2 + (3,48 - 3,33)^2} = \sqrt{(0)^2 + (-1)^2 + (0,15)^2} = \sqrt{0 + (-1) + 0,0225} = \sqrt{1,0225}$$

D(1,1)=1.011

From the example above, the distance from cluster 1 is obtained. And so the next process is to get the distance to the center of the cluster

Table 2. Distance to the center of the cluster

| Cluster | C1 | C2 | C3 |
|---------|-------------|-------------|-------------|
| center | B | E | F |
| A | 0 | 200033,8715 | 300000 |
| B | 200181,2235 | 4835 | 500072,517 |
| C | 200406,6943 | 9080 | 500162,8166 |
| D | 300191,4339 | 500049,531 | 10719 |
| E | 200033,8715 | 0 | 500013,5496 |
| F | 300000 | 500013,5496 | 0 |
| G | 200212,4082 | 400038,3488 | 100424,1425 |
| H | 200054,5615 | 991 | 500021,8271 |

3. Specifies the min distance and the square of the min distance

Determine min distance and min squared distance by taking min values from c1 and c3 so that they can be formed in the following table

Table 3. Determine the min distance and the square of the min distance

| Customer | Minimum distance | Min Distance | Square |
|----------|------------------|--------------|--------|
| C1 | 0 | 0 | |
| C2 | 4835 | 23377225 | |
| C3 | 9080 | 82446400 | |
| C3 | 10719 | 114896961 | |
| C2 | 0 | 0 | |
| C3 | 0 | 0 | |
| C3 | 100424,1 | 10085008400 | |
| C2 | 991 | 982081 | |
| Total | | 10306711067 | |

4. Forming a new cluster center

To determine a new cluster, it is taken from if the customer is the same as the cluster center, then the cluster exists. For more details, it can be seen in the following table.

Table 4. Forming a new cluster center

| C1 | | C2 | | C3 | |
|--------|-------------------|--------|-------------------|--------|-------------------|
| Amount | Premium Insurance | Amount | Premium Insurance | Amount | Premium Insurance |
| 1381 | 500000 | | | | |
| | | 22397 | 300000 | | |
| | | | | 2664 | 300000 |

| | | | | | |
|-------|--------|-------|--------|-------|--------|
| | | | | 24600 | 800000 |
| | | 17562 | 300000 | | |
| | | | | 13881 | 800000 |
| | | | | 23101 | 700000 |
| | | 18553 | 300000 | | |
| 13881 | 500000 | 19504 | 300000 | 22056 | 650000 |

5. Establish the distance between cluster centers

To get the distance between cluster centers d is done by using the equation: so that it can be generated in the following table: $d(pq) = \sqrt{(P1 - q1)^2 + (P2 - q2)^2 + p3 - q3)^2}$

Table 5. Establishing the distance between cluster centers

| Distance Between Cluster Centers | | Results |
|---|----|-------------|
| C1 | C2 | 200033,8715 |
| C1 | C3 | 300000 |
| C2 | C3 | 500013,5496 |
| BCV | | 1000047,421 |

6. Form a ratio table

To get the ratio, it can be taken from the total cluster center distance divided by the total min distance and the min squared of the distance. For more details can be seen in the following table:

Table 6. Forming a ratio table

| | |
|-----------------|--|
| Ratio | 9.70288E-05 |
| Prior Ratio | |
| Current Ratio > | Previous Ratio, Then Iteration Continues |

7. New cluster center

To determine the distance to the center of the cluster, the square root is calculated from the customer data to the cluster center which has been determined using the equation, namely . From the equation above, it is used because the attributes used are $3d(pq) = \sqrt{(P1 - q1)^2 + (P2 - q2)^2 + p3 - q3)^2}$

Table 7. New cluster center

| Cluster Center | | |
|----------------|---|---|
| C1 | 3 | 3 |

| | | |
|----|-------------|-------------|
| C2 | 1.25 | 1.75 |
| C3 | 4.333333333 | 2.666666667 |

8. Determine Distance

To get the distance between cluster centers d is done by using the equation: $d(pq) =$

$$\sqrt{(P1 - q1)^2 + (P2 - q2)^2 + p3 - q3)^2}$$

so that it can be generated in the following table:

Table 8. Determining Distance

| Distance to Cluster Center | | | |
|----------------------------|-------------|-------------|-------------|
| Cluster Center | C1 | C2 | C3 |
| A | 500189,563 | 500190,861 | 500189,8592 |
| B | 300831,666 | 299998.75 | 299995,6667 |
| C | 301177,4167 | 301178,8166 | 301177,6308 |
| D | 800375,0448 | 800376,348 | 800375,3371 |
| E | 300510,4299 | 300511,78 | 300510,6848 |
| F | 800117,3657 | 800118,6459 | 800117,6759 |
| G | 700377,982 | 700379,289 | 700378,2711 |
| H | 300569,9628 | 300571,3184 | |

9. Specifies the min distance and the square of the distance

Determine min distance and min squared distance by taking min values from c1 and c3 so that they can be formed in the following table.

Table 9. Determining the Min Distance and the Square of the Distance

| Membershi p Clusters | Minimum Distance | Square Minimum Distance |
|----------------------------|---------------------|-------------------------------|
| C1 | 500189,563 | 0 |
| C3 | 299995,6667 | 89997400026 |
| C3 | 301177,4167 | 90707836330 |
| C1 | 800375,0448 | 0 |
| C1 | 300510,4299 | 90306518490 |
| C1 | 800117,3657 | 0 |
| C1 | 700377,982 | 0 |
| C1 | 300569,9628 | 90342302509 |
| WCV | 0 | 0 |

10. Defining a New Cluster

To determine a new cluster, it is taken from if the customer is the same as the cluster center, then the cluster exists. For more details can be seen in the following table.

Table 10. Defining a New Cluster

| New Cluster Center | | | | | |
|--------------------|-------------------|--------|-------------------|---------|-------------------|
| C1 | | C2 | | C3 | |
| Amount | Premium Insurance | Amount | Premium Insurance | Amount | Premium Insurance |
| 13881 | 500000 | | | 22397 | 300000 |
| | | | | 26642 | 300000 |
| 24600 | 800000 | | | | |
| 17562 | 300000 | | | | |
| 13881 | 800000 | | | | |
| 23101 | 700000 | | | | |
| 18553 | 300000 | | | | |
| 18596,33 | 566666,6667 | 0 | 0 | 24519,5 | 300000 |

11. Distance between cluster centers

To get the distance between cluster centers d is done by using the equation: so that it can be generated in the following table: $d(pq) = \sqrt{(P1 - q1)^2 + (P2 - q2)^2 + p3 - q3)^2}$

Table 11. Center Distance

| Distance Between Cluster Centers | | | Results |
|----------------------------------|-----|--|-------------|
| C1 | C2 | | 2.150581317 |
| C1 | C3 | | 1.374368542 |
| C2 | C3 | | 3.216709844 |
| | BCV | | 6.741659703 |

12. The ratio obtained in the cluster calculation

To get the ratio, it can be taken from the total cluster center distance divided by the total min distance and the min squared of the distance. For more details can be seen in the following table:

Table 12. Obtained Ratio

| | |
|-------------|-------------|
| Ratio | 2.82923E-12 |
| Prior Ratio | 9.70288E-05 |

Provisions: if the current ratio is greater than the previous ratio, then the iteration is continued

13. Defining a new cluster

To determine the distance to the center of the cluster, the square root is calculated from the customer data to the cluster center which has been determined using the equation, namely . From the equation above, it is used because the attributes used are $3d(pq) = \sqrt{(P1 - q1)^2 + (P2 - q2)^2 + p3 - q3)^2}$

Table 13. Defining a New Cluster

| Clusters | Cluster Center | |
|----------|----------------|--------------|
| C1 | 3 | 3 |
| C2 | 1.25 | 1.75 |
| C3 | 4.3333333333 | 2.6666666667 |

14. Determines the cluster center distance

To get the distance between cluster centers d is done by using the equation: so that it can be produced in the following table. $d(pq) = \sqrt{(P1 - q1)^2 + (P2 - q2)^2 + p3 - q3)^2}$

Table 14. Determining the Cluster Center Distance

| Distance to Cluster Center | | | |
|----------------------------|-------------|-------------|-------------|
| Cluster Center | C1 | C2 | C3 |
| A | 500189,563 | 500190,861 | 500189,8592 |
| B | 300831,666 | 1.754413729 | 3.983288057 |
| C | 301177,4167 | 301178,8166 | 301177,6308 |
| D | 800375,0448 | 800376,348 | 800375,3371 |
| E | 300510,4299 | 300511,78 | 300510,6848 |
| F | 800117,3657 | 800118,6459 | 800117,6759 |
| G | 700377,982 | 700379,289 | 700378,2711 |
| H | 300569,9628 | 300571,3184 | 300570,2132 |

15. Determine the Min distance and the square of the min distance

Determine min distance and min squared distance by taking min values from c1 and c3 so that they can be formed in the following table.

Table 15. Determining the Min Distance and the Square of the Min Distance

| Cluster Membership | Minimum Distance | Min Square Distance |
|--------------------|------------------|---------------------|
| C1 | 500189,563 | 2.5019E+11 |
| C2 | 1.754413729 | 3.077967534 |
| C3 | 301177,4167 | 90707836330 |

| | | |
|-----|-------------|-------------|
| C1 | 800375,0448 | 6,406E+11 |
| C1 | 300510,4299 | 90306518490 |
| C1 | 800117,3657 | 6.40188E+11 |
| C1 | 700377,982 | 4.90529E+11 |
| C1 | 300569,9628 | 90342302509 |
| WCV | | 2.29286E+12 |

16. Defining a new cluster

To determine a new cluster, it is taken from if the customer is the same as the cluster center, then the cluster exists. For more details can be seen in the following table.

Table 16. Defining a New Cluster

| C1 | | C2 | | C3 | |
|----------|-------------------|--------|-------------------|--------|-------------------|
| Amount | Premium Insurance | Amount | Premium Insurance | Amount | Premium Insurance |
| 13881 | 500000 | 22397 | 300000 | 26642 | 300000 |
| 24600 | 800000 | | | | |
| 17562 | 300000 | | | | |
| 13881 | 800000 | | | | |
| 23101 | 700000 | | | | |
| 18553 | 300000 | | | | |
| 18596,33 | 566666,6667 | 22397 | 300000 | 26642 | 300000 |

17. Determines the cluster center distance

To get the distance between cluster centers d is done by using the equation: so that it can be generated in the following table: $d(pq) = \sqrt{(P1 - q1)^2 + (P2 - q2)^2 + (P3 - q3)^2}$

Table 17. Determining the Cluster Center Distance

| Distance Between Cluster Centers D | | |
|------------------------------------|----|-------------|
| C1 | C2 | D |
| C1 | C2 | 2.150581317 |
| C1 | C3 | 1.374368542 |

| | | |
|-----|----|-------------|
| C2 | C3 | 3.216709844 |
| BCV | | 6.741659703 |

18. Determine the ratio of clusters

To get the ratio, it can be taken from the total cluster center distance divided by the total min distance and the min squared of the distance. For more details can be seen in the following table:

Table 18. Determining the Ratio of Clusters

| | |
|-------------|-------------|
| Ratio | 2.94028E-12 |
| Prior Ratio | 2.82923E-12 |

19. Results of cluster calculations

From the calculation results of the several iterations above, it can be concluded that the results of clustering and cluster customers, for more details, can be seen in the following table.

Table 19. Results of Cluster Calculations

| Clustering Results | Cluster Customers |
|--------------------|-------------------|
| A | C2 |
| B | C1 |
| C | C3 |
| D | C3 |
| E | C2 |
| F | C3 |
| G | C2 |
| H | C2 |

4. Conclusion

Based on the analysis of this research that has been done, some conclusions can be given as follows:

1. With the existence of variables to group customer data, the calculation results can be obtained.
2. By using the process clustering method, it can be seen which types of customer data are most in demand.
3. By having designed a Data Mining application with the clustering method to group customer data, so that grouping is fast and more efficient than using a manual system.

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