Application of the K-Means Method for Clustering Land and Building Tax Payments Based on Tax Types (Case Study: BPKPAD Binjai City)

Riski Ramadhansyah[1),] Akim Manaor Hara Pardede[2),] Anton Sihombing[3)]

[1,2,3)] STMIK Kaputama Binjai, Indonesia

*Corresponding Author

Email : riskiramadhansyah77@gmail.com

Abstract

Land and Building Tax or abbreviated as PBB is a fee that must be paid for the existence of land and buildings owned by the community or residents. The determination of PBB in Binjai City is based on the application of the Land Value Zone (ZNT) which is close to the market price, which will be able to create equitable development throughout Binjai City. BPKPAD (Regional Revenue and Assets Financial Management Agency) Binjai City is a government agency that receives PBB payments from the community. Data - data on PBB payments for the people of Binjai City have been stored in an existing system and every year it will continue to increase so that it will cause data accumulation in the land and building tax archives. A data processing system is needed to manage these data, one of which can be done with data mining which can process piles of data into useful information and can be utilized by grouping PBB data based on criteria. Clustering is a method in data mining that can be used to automatically detect clusters of adjacent records that have a certain definition in all variables. K-Means algorithm is a simple algorithm to classify or group a large number of objects with certain attributes into groups (clusters). So that this system can be used as input for the Binjai City BPKPAD in finding solutions to increase regional income from PBB payments.

Keywords: Clustering, Data Mining, K-Means, PBB.

INTRODUCTION

Land and Building Tax or abbreviated as PBB is a fee that must be paid for the existence of land and buildings owned by the community or residents. Objects of land tax include rice fields, fields, gardens, land, yards and mines. Meanwhile, the object of the building tax includes residential houses, business buildings, high-rise buildings, shopping centers, luxury fences, swimming pools and toll roads.

Binjai City is one of the metropolitan cities whose growth is quite advanced and rapid. Binjai City is a city that has implemented Land and Building Tax as a local tax. The determination of PBB in Binjai City is based on the application of the Land Value Zone (ZNT) which is close to the market price, which will be able to create equitable development throughout Binjai City. The Regional Revenue and Assets Financial Management Agency (BPKPAD) of Binjai City, which is a government agency that receives PBB payments from the people of Binjai City.

The data on PBB payments for the people of Binjai City have been stored in a system in the BPKPAD. So that the amount of tax costs that must be paid by the community has been determined by the system according to the area of the land or buildings owned by the people of Binjai City. PBB payments are made once a year. Of course, data on all land, fields, rice fields, gardens and buildings have been recorded by the Binjai City BPKPAD. This data, of course, will continue to increase every year, both those who make PBB payments and those who do not. For this reason, it is very unfortunate if the data is only processed as tax payment data. If this data is allowed to continue, it will become a pile of data in the land and building tax archives. Of course this is very unfortunate if it is not used properly.

Data mining techniques are data processing techniques that can process piles of data into useful and usable information. PBB data can be processed with data mining to group PBB data

based on criteria that can be used as useful information such as area, tax costs, tax types. With these criteria, it can result in the grouping of PBB data based on which regions comply with PBB payments as well as the costs and types of taxes. From these results, it can be used as input for the Binjai City BPKPAD in finding solutions to increase regional income from PBB payments. The objectives of this research is to group PBB data by type of tax by using the K-Means method, to process PBB data using Matlab software which can cluster PBB data based on tax types, to produce new information that is useful for the progress of PBKPAD Binjai City using the K-Means method.

Many researches using data mining have been carried out, including those carried out by (Sundari et al., 2021) from the journal of the National Informatics Seminar (SENATIKA) ISBN: 978-623-95167-3-4 on Clustering of TransBinjai Bus Service Satisfaction with the Data Cluster Method Mining Case Study of Binjai City Transportation Office. With the results of the study providing information in the form of user satisfaction with the facilities and services provided by the Trans Binjai bus, it can be a reference from the transportation office of the city of Binjai as a reference for assessing the quality of facilities and services. 5 3.67 3.67) focuses on the type of teacher/teacher job, which gives an assessment of being satisfied with the facilities and satisfied with the service. Centroid 2 with a value of (2 4 3.33) is centered on the type of work of housewives, who give an assessment of being satisfied with the facilities and quite satisfied with the service. And centroid 3 with a value of (1.50 3.63 4.38) is centered on the type of student work, which gives an assessment of being satisfied and satisfied with the services provided by Trans Binjai bus employees.

Another researcher was conducted by (Akim & Budi, 2018) from the KAPUTAMA Journal, Vol.5, ISSN: 1979-6641 about Lecturer Performance Grouping Analysis with the Clustering Method at STMIK Kaputama Binjai. The results obtained from this study Data processing is carried out with the help of the matlab program (matrix laboratory) which can calculate calculations using the decludean formula. In the results of determining the group, it can be seen that group 1, which consists of 27 data, where 1 criterion is low, 2 criteria to support the assessment of lecturers is high. Group 2, which consists of 13 data from the delivery of material, discipline and low-value attitudes. Group 3 which consists of 44 data which is for material, discipline and high value attitudes.

RESEARCH METHODS

The research method is carried out to find something systematically using scientific methods and applicable sources. In the process of this research aimed at the Regional Revenue and Asset Financial Management Agency (BPKPAD) Binjai City, especially in grouping land and building tax payment data by providing results and obtaining the desired information. The results of the conceptualization will be poured into a complete research method with a pattern of literature study, data collection needed to analyze the data mining grouping that will be made, namely to classify land and building tax payment data using the Clustering method. In applying the clustering method, it takes a data that is used for analysis and grouping in order to obtain new information.

Clustering is a model that is carried out by segmenting a heterogeneous population into a number of homogeneous clusters. This clustering process is different from classification in that in clustering it is not known the time at which the algorithm starts. Clustering is done by collecting cognate data from a larger data set. This technique reveals a number of groups that are used as input data. With clustering, dispersed minority groups are grouped into a large group that has similar entities (Jollyta et al., (2020).

RESULTS AND DISCUSSION

Research Supporting Data

Based on the research that has been done at the BPKPAD of Binjai City, a data on the payment of building land tax is obtained, which can be seen as shown in the table below.

Table 1. Land and Building Tax Data

No	Object	Ward	Tax type	Cost
1	A	Binjai Estate	Earth and Building	Rp. 157.850
2	B	Rambung barat	Earth and Building	Rp. 151.140
3	C	Rambung Timur	Earth and Building	Rp. 103.200
4	D	Pujidadi	Earth and Building	Rp. 108.470
5	E	Bhakti Karya	Earth	Rp. 59.775
6	F	Kebun Lada	Earth and Building	Rp. 83.240
7	G	Paya Roba	Earth and Building	Rp. 86.890
8	H	Satria	Earth	Rp. 60.000
9	I	Tangsi	Earth	Rp. 38.000
10	J	Tanah Tinggi	Earth and Building	Rp. 102.870
11	K	Sumber Mulyorejo	Earth and Building	Rp. 195.840
12	L	Sumber Karya	Earth	Rp. 43.212
13	M	Dataran Tinggi	Earth	Rp. 39.148
14	N	Cengkeh Turi	Earth and Building	Rp. 41.640
15	O	Nangka	Earth	Rp. 18.000
16	P	Suka Ramai	Earth and Building	Rp. 67.036
17	Q	Bandar Senembah	Earth and Building	Rp. 234.968
18	R	Jati Karya	Earth and Building	Rp. 70.912
19	S	Jati Makmur	Earth	Rp. 49.347
20	T	Mencirim	Earth	Rp. 20.096

In using the clustering method, the initial process for cluster formation is to transform the data into numeric form with predetermined codes, then determine the code for the number of groups (K), calculate the centroid, calculate the distance of the object to the centroid and then group based on the closest distance. , if no object is moved or group then the iteration is complete.

To determine the group of an object, the first thing to do is measure the Euclidean distance between two object points (X and Y). Next, transform the criteria data above to be calculated using the clustering method.

Then form clusters into 3 groups (K=3) and determine the center point of the centroid. The clustering calculation process is as below.

K=3 Centroids

C1= (7,2,2) taken from F . data

C2=(20,2,2) taken from G . data

C3= (14,1,2) taken from H . data

After calculating using the existing cluster formula, the group based on the minimum distance to the nearest centroid is:

Old Group :   (0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0)

New Group :   (2 2 2 2 2 1 2 3 3 2 2 2 2 1 1 2 2 1 1 2)

From the above calculations, the results of the iteration 1, 2 and 3 calculations are obtained. The following are the results of iteration 3 as the last literacy.

Table 2. 3 Iteration Result

No	Object	X	Y	Z	C_1	C_2	C_3	Group
1	A	31	2	4	26,53	3,35	14,34	2
2	B	33	2	4	28,52	5,22	16,33	2
3	C	35	2	3	30,44	7,02	18,26	2
4	D	32	2	3	27,45	4,04	15,27	2
5	E	30	1	2	25,41	0,00	13,27	2
6	F	7	2	2	2,51	21,01	9,78	1
7	G	20	2	2	15,42	8,03	3,33	3
8	H	14	1	2	9,44	14,03	2,84	3
9	I	16	1	1	11,42	12,12	1,75	3
10	J	27	2	3	22,46	1,16	10,27	2
11	K	26	2	4	21,56	2,50	9,38	2
12	L	25	1	1	20,41	3,43	8,40	2
13	M	23	1	1	18,41	5,27	6,45	2
14	N	1	2	1	3,64	27,05	15,83	1
15	O	8	1	1	3,48	20,07	8,89	1
16	P	22	2	2	17,41	5,30	6,04	2
17	Q	17	2	5	12,92	11,28	2,56	3
18	R	3	2	2	1,75	25,01	13,77	1
19	S	4	1	1	0,94	24,06	12,85	1
20	T	24	1	1	19,41	4,34	7,42	2

The following is a cluster graph based on the calculation of the results of data mining iterations of grouping land and building tax data. The graphs obtained are as follows:
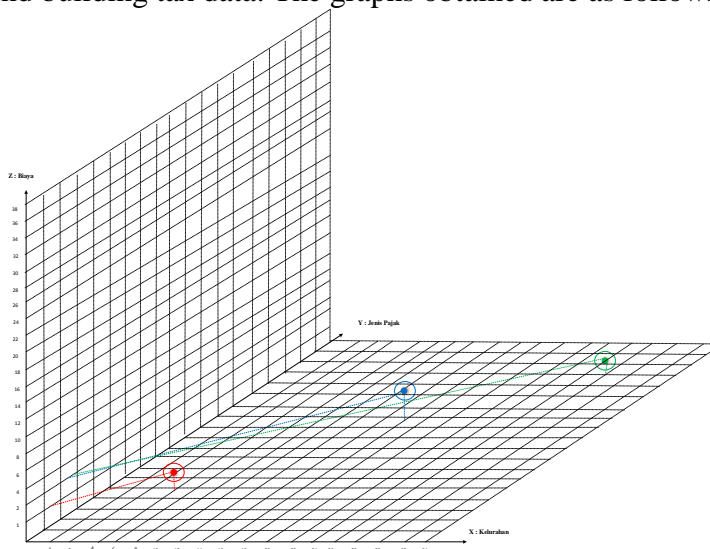

Figure 1. Cluster Graph

🔴 *Cluster* 1 : 4,60; 1,60;   1,40
🟢 *Cluster* 2 : 28;   1,64;   2,55
🔵 *Cluster* 3 : 16,75; 1,50;   2,40

Graphic Explanation:
From 20 land and building tax data, 3 groups were obtained, cluster 1 contained 5 data, cluster 2 contained 11 data, and cluster 3 contained 4 data.

1. Cluster 1 There are 5 Data

    It can be seen in cluster 1 centered on 4.60, 1.60, 1.40 (5, 2, 1), namely Jati Utomo village, the type of land and building tax with a tax cost of < Rp. 50.000,-.

2. Cluster 2 There are 11 Data

    It can be seen in cluster 2 centered on 28, 1.64, 2.55 (28, 2, 3), namely the Timbang Langkat village, the type of land and building tax for the year with a tax fee of Rp. 101.000,- - Rp. 150.000,-.

3. Cluster 3 There are 4 Data

    It can be seen in cluster 3 centered on 16.75, 1.50, 2.40 (17, 2, 2) namely Bandar Senembah sub-district, the type of land and building tax with a tax fee of Rp. 50.000,- - Rp. 100.000,-.

CONCLUSION

Based on the research that has been done, several conclusions were found.

1) The system can increase the income of a better PBB payment.
2) The system helps the Binjai City BPKPAD in processing PBB payment data.
3) The system can minimize the storage of land and building tax data archives

REFERENCES

Akim Manaor Hara Pardede, B. S. G. (2018). *Analisis Pengelompokkan Performance Dosen Dengan Metode Clustering Pada Stmik Kaputama Binjai*. December.

Jollyta, D., Ramdhan, W., & Zarlis, M. (2020). *Konsep Data Mining dan Penerapan*. CV. Budi Utama. Yogyakarta.

Lamhot Sitorus. (2015). *Algoritma Dan Pemrograman* (A. Pramesta (ed.)). CV. Andi Offset. Yogyakarta.

Mardia, Rahman Tanjung, Abdul Karim, M. I., Elmor Benedict Waglu, Eko Sudarmanto, S., Jay Idoan Sihotang, Sri Martina, E. O. P. D., & Bonaraja Purba, D. P. Y. A. (2021). *Sistem Informasi Akuntansi dan Bisnis*. Yayasan Kita Menulis, Medan.

Neni Purwati, Hendra Kurniawan, S. K. (2021). *Data Mining Volume 1*. Zahira Media Publisher, Banyumas.

Nugraha, D. D. C., Naimah, Z., Fahmi, M., & Setiani, N. (2014). Klasterisasi Judul Buku dengan Menggunakan Metode K-Means. *Seminar Nasional Aplikasi Teknologi Informasi (SNATI) Yogyakarta*, *21*(1), 1907–5022.

Prasetyo, E. (2014). *Data Mining Mengelolah Data Menjadi Informasi Menggunakan Matlab* (I). CV. Andi Offset, Yogyakarta.

Prasetyowati, E. (2017). *Data Mining Pengelompokan Data Untuk Informasi dan Evaluasi*. Duta

365

Media Publishing, Pemekasan.

Siahaan, V. (2020). *Pemrograman MATLAB Dari Nol Sampai Master Untuk Pemrosesan Citra Digital*. Balige Publishing, Balige.

Sundari, S., Buaton, R., & Saragih, R. (2021). Clustering Kepuasan Layanan Pengguna Bus Trans Binjai Dengan Metode Cluster Data Mining Studi Kasus Dinas Perhubungan Kota Binjai. *Seminar Nasional …*, *5*.