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Classification of Generation By Population by Region in Indonesia Using K-Means Algorithm

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Abstract

Population growth caused by the year of birth led to the classification of population groups into several generations. Classification is important because in each generation there is based on population growth has different characteristics and traits in each generation. This research was conducted to try to group generations based on provinces in Indonesia based on the number of residents owned. When researchers analyzed the data obtained from population census data conducted by the central statistics agency (BPS). The method used in generation classification grouping uses the K-Means algorithm method based on 3 clusters. Based on the results of calculations carried out for 3 clusters obtained cluster 1 has 25 provinces, cluster 2 has 3 provinces and cluster 3 has 6 provinces. Based on the 2020 census that has been conducted, the current population is generation Z, generation and Pre Boomer generation is last in line so that from the available data can provide information about mapping in 34 provinces to be able to improve communication patterns between generations and fulfill public facilities that can be used every generation.

Keywords: *Generation clustering, K-Means, Clustering*

1. Introduction

The 2020 population census conducted by the central statistics agency conducted in February - September 2020 [1], based on the census of the population of Indonesia as many as 270,203,917 people who have a distribution of population that can be classified based on the generation seen based on the year of birth of the population. Based on the results of the 2020 census, Indonesia's population is dominated by generation Z who were born between 1977 and 2012, and then the millennial generation whose population was born from 1981 to 1996. In the process of classifying done for the population group using the literature of William H Frey. In every generation in Indonesia so that from the process can create a good communication process. From this background, generation grouping is needed to make it easier to know the number of generation clustering deployments in provinces in Indonesia. Based on the above assessment several methods can be done to find out the clustering process based on previous research[2][3][4]. Clustering is a method used to analyze data used to solve problems based on data grouping[5][6][7]. For the calculation process, researchers use the K-Means method as an algorithm in the data mining method in the process of grouping data[8]. In this research activity, the data used is divided into post generation Z, Generation Z, Millennial, Generation X, Boomer, Pre Boomer based on the population of 34 provinces, namely the spread of generation with a number that dominates, dominate and less dominates.

2. Research and Methodology

To conduct research is needed by using the overall literature of the recording of total demographic data in Indonesia from the BPS website related to the 2020 census data and also looking for references related to problems from books and related journals to be able

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to get problem-solving and using K-Means algorithm in the calculation process based on 3 specified clusters that are very dominating, Dominate and dominate less.

2.1. Data Collection Stages

In the process of collecting data researchers take data from secondary parties based on population surveys conducted from census records conducted from February 2021 to September 2021 conducted online or by BPS officers then the data can be accessed on the BPS website.

2.2. Stages of Data Processing and Analysis

The generation clustering in 34 provinces that have been obtained will be processed first to be able to determine a cluster. The clustering process divides into 3 classes based on the data provided. Then the data is analyzed by calculating the weight of each index by selecting a randomly selected centroid number for the cluster.

2.3. Stages of Application of K-Means Algorithm Method

To be able to complete the K-Means algorithm several stages can be done including

a) Determining the number of clusters formed from available data is 3 clustering: Very domineering, Dominating, and Less domineering.
b) Determining cluster values randomly, for initial data the specified value comes from West Sumatra Province, Riau Islands Province, and South Kalimantan Province. The results of the cluster value determination can be seen in table 2.
c) From each line that has been calculated, determine the cluster closest to the center of the cluster. This stage can be seen in table 3.
d) Determining the value for the center of the latest cluster to perform recalculation from the initial stage until the overall data from each cluster that we have no change back then the final result can be obtained and we can find out the number of clusters. This can be seen from the processing results with Rapidminer in figures 1,2 and 3.

3. Results and Discussion

To conduct the process of grouping generation classification in the territory of Indonesia is done first with the selection of centroid data conducted randomly from 33 provinces from data obtained from BPS.

Table 1. Classification of Generation by Region in Indonesia.

Provincial Name	Post Generation Z	Generation Z	Milenial	Generation X	Boomer	Pre Boomer
Aceh		1.531.897	1.377.887	991.294	512.865	78.737
Sumatera Utara	2.198.567	4.241.259	3.791.537	2.814.656	1.569.163	184.179
Sumatera Barat	728.658	1.558.106	1.390.340	1.074.413	677.138	105.817
Riau	975.045	1.831.988	1.704.452	1.262.954	566.314	53.334
Jambi	501.619	975.166	940.102	728.651	361.400	41.290
Sumatera Selatan	1.243.243	2.286.741	2.202.735	1.700.263	915.080	119.370
Bengkulu	280.112	553.664	532.287	407.474	211.996	25.137
Lampung	1.247.288	2.375.721	2.335.896	1.856.163	1.033.585	159.195
Kepulauan Bangka Belitung	189.584	400.381	393.664	300.597	154.159	17.293
Kepulauan Riau	306.559	562.655	578.183	430.132	168.334	18.701
DKI Jakarta	1.291.532	2.678.252	2.816.278	2.404.005	1.227.534	144.487
Jawa Barat	6.212.835	12.965.399	12.653.335	10.169.066	5.600.895	672.632
Jawa Tengah	4.312.777	9.023.730	9.125.046	8.012.090	5.241.102	801.290
DI Yogyakarta	391.116	835.000	859.386	823.953	619.663	139.601
Jawa Timur	4.565.674	9.643.116	10.028.010	9.263.150	6.154.554	1.011.192

Provincial Name	Post Generation Z	Generation Z	Milenial	Generation X	Boomer	Pre Boomer
Banten	1.675.105	3.264.335	3.258.101	2.454.483	1.138.713	113.825
Bali	475.536	1.053.952	1.057.293	982.676	630.340	117.607
Nusa Tenggara Barat	821.297	1.448.701	1.387.755	1.050.838	537.338	74.163
Nusa Tenggara Timur	879.410	1.569.178	1.316.510	914.174	551.055	95.239
Kalimantan Barat	750.200	1.521.612	1.452.788	1.071.008	546.225	72.557
Kalimantan Tengah	352.020	755.008	734.453	544.257	252.143	32.088
Kalimantan Selatan	606.227	1.092.878	1.051.899	848.903	425.910	47.767
Kalimantan Timur	502.134	1.055.423	1.023.266	778.362	362.914	43.940
Kalimantan Utara	92.259	205.124	194.197	139.566	62.778	7.890
Sulawesi Utara	322.731	661.469	645.872	562.155	365.293	64.403
Sulawesi Tengah	438.554	843.569	775.178	583.232	306.709	38.492
Sulawesi Selatan	1.144.702	2.567.400	2.312.797	1.796.402	1.060.974	191.234
Sulawesi Tenggara	402.455	786.855	682.934	476.912	242.303	33.416
Gorontalo	151.217	335.659	306.123	233.762	127.093	17.827
Sulawesi Barat	218.471	432.546	364.272	254.184	130.276	19.480
Maluku	248.588	566.464	490.013	330.631	184.047	29.180
Maluku Utara	190.938	387.963	344.657	232.997	113.825	12.557
Papua Barat	155.749	341.528	328.307	210.930	90.113	7.441
Papua	665.696	1.156.343	1.244.419	852.966	351.144	33.139

Source: BPS Data

From the initial data owned then, researchers determined centroid data that became 3 randomly selected clusters, such as the data in table 2.

Table 2. Determination of Centroid's initial data

Post Generasi Z	Generasi Z	Milenial	Generasi X	Boomer	Pre Boomer
728.658	1.558.106	1.390.340	1.074.413	677.138	105.817
306.559	562.655	578.183	430.132	168.334	18.701
606.227	1.092.878	1.051.899	848.903	425.910	47.767

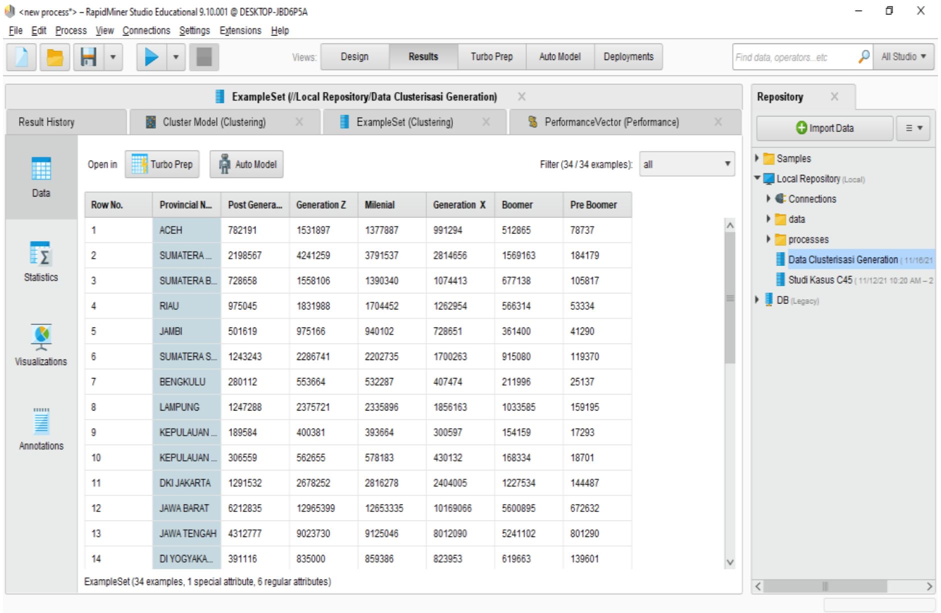
After determining the centroid center then calculated based on the available data so that 3 clusters were obtained and determined the closest distance from the centroid center and the value of the cluster for each provincial data. The results of the calculation can be seen in table 3.

Table 3. Iteration Process and Clusterization Results

C1	C2	C3	Closest Distance	Cluster
195794,4945	1497461,54	598969,6967	195794,4945	1
4353847,083	5925632,89	5014308,176	4353847,083	1
0	1584379,363	680667,924	0	1
533824,3018	2044441,651	1139876,411	533824,3018	1
904149,0954	682713,2838	236561,9432	236561,9432	3
1379920,513	2944488,962	2030948,023	1379920,513	1
1616795,03	73129,35122	953011,1436	73129,35122	2
1603927,758	3172332,995	2258661,435	1603927,758	1
1872011,148	301737,456	1209063,084	301737,456	2
1584379,363	0	915370,7266	0	2
2382666,446	3935593,104	3027603,829	2382666,446	1
19857869,04	21431486,91	20518783,83	19857869,04	1
14065985,21	15637133,62	14726769,77	14065985,21	1
992926,9787	730620,6052	443205,6762	443205,6762	3
15892659,47	17456693,22	16549908,2	15892659,47	1

C1	C2	C3	Closest Distance	Cluster
3068097,015	4626298,133	3716906,221	3068097,015	1
663254,8838	1013907,872	288424,9161	288424,9161	3
204107,6111	1493303,542	582713,5293	204107,6111	1
264546,7401	1507648,389	627443,0556	264546,7401	1
154763,2311	1561337,214	655495,1809	154763,2311	1
1297741,283	289334,3531	634664,7031	289334,3531	2
680667,924	915370,7266	0	0	3
793068,9267	799331,7683	148382,1182	148382,1182	3
2219749,733	645666,8656	1557092,481	645666,8656	2
1372711,887	270035,4309	719386,7004	270035,4309	2
1164541,462	422044,2154	501716,7612	422044,2154	2
1648814,168	3228566,16	2318550,763	1648814,168	1
1324005,505	279840,6107	666035,3305	279840,6107	2
2005075,342	435818,4547	1343570,992	435818,4547	2
1886605,249	320706,2214	1225199,683	320706,2214	2
1681259,467	146308,7524	1023807,738	146308,7524	2
1945721,004	374554,5237	1283564,704	374554,5237	2
2008999,732	434020,3346	1346268,173	434020,3346	2
589290,7715	1066645,104	224608,0134	224608,0134	3
121930015,1	123505138,3	122591681,8	121930015,1	1

To perform the calculation process with the Rapidminer application, the data we have is carried out the import process into the application by adjusting the data type and determination of the id, as seen in figure 1.


<new process*> – RapidMiner Studio Educational 9.10.001 @ DESKTOP-JBD6P5A
File Edit Process View Connections Settings Extensions Help
Views: Design Results Turbo Prep Auto Model Deployments
Find data, operators...etc
All Studio
ExampleSet (//Local Repository/Data Clusterisasi Generation)
Result History
Cluster Model (Clustering)
ExampleSet (Clustering)
PerformanceVector (Performance)
Data
Statistics
Visualizations
Annotations
Open in
Turbo Prep
Auto Model
Repository
Import Data
Samples
Local Repository (Local)
Connections
data
processes
Data Clusterisasi Generation (11/16/21
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DB (Legacy)

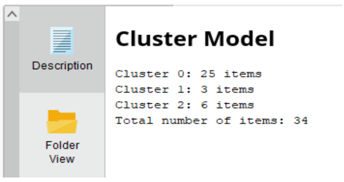
Filter (34 / 34 examples): all

Row No.	Provincial N...	Post Genera...	Generation Z	Milenial	Generation X	Boomer	Pre Boomer
1	ACEH	782191	1531897	1377887	991294	512865	78737
2	SUMATERA ...	2198567	4241259	3791537	2814656	1569163	184179
3	SUMATERA B...	728658	1558106	1390340	1074413	677138	105817
4	RIAU	975045	1831988	1704452	1262954	566314	53334
5	JAMBI	501619	975166	940102	728651	361400	41290
6	SUMATERA S...	1243243	2286741	2202735	1700263	915080	119370
7	BENGKULU	280112	553664	532287	407474	211996	25137
8	LAMPUNG	1247288	2375721	2335896	1856163	1033585	159195
9	KEPULAUAN ...	189584	400381	393664	300597	154159	17293
10	KEPULAUAN ...	306559	562655	578183	430132	168334	18701
11	DKI JAKARTA	1291532	2678252	2816278	2404005	1227534	144487
12	JAWA BARAT	6212835	12965399	12653335	10169066	5600895	672632
13	JAWA TENGAH	4312777	9023730	9125046	8012090	5241102	801290
14	DI YOGYAKA...	391116	835000	859386	823953	619663	139601

ExampleSet (34 examples, 1 special attribute, 6 regular attributes)

Figure 1. Transformation Data Process

After doing the process of reading the data, the next step is to determine the results of clustering, with K = 3 in the RapidMiner application, thus producing the cluster data output in figure 2.

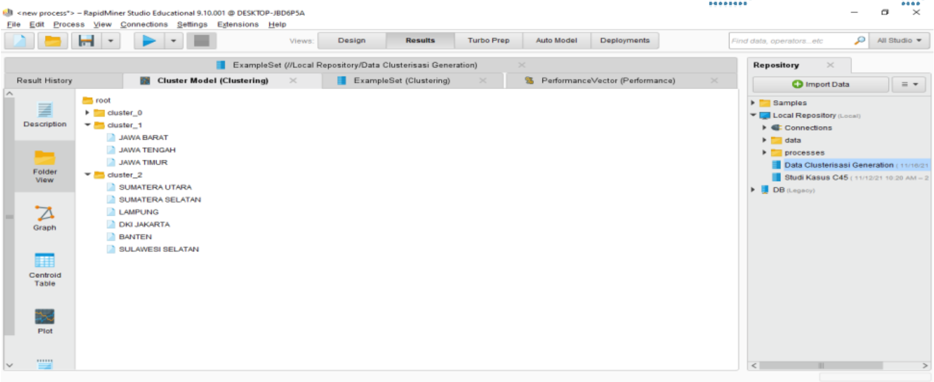


Cluster Model

```
Cluster 0: 25 items
Cluster 1: 3 items
Cluster 2: 6 items
Total number of items: 34
```

Figure 2. Clusterization results with Rapidminer

Figure 3 and figure 4 shows provincial data that is a group of calculations with Rapidminer.


<new process*> – RapidMiner Studio Educational 9.10.001 @ DESKTOP-JBD6P5A
File Edit Process View Connections Settings Extensions Help
Views: Design Results Turbo Prep Auto Model Deployments
Find data, operators...etc
All Studio
ExampleSet (//Local Repository/Data Clusterisasi Generation)
Result History
Cluster Model (Clustering)
ExampleSet (Clustering)
PerformanceVector (Performance)
Description
Folder View
Graph
Centroid Table
Plot
Repository
Import Data
Samples
Local Repository (Local)
Connections
data
processes
Data Clusterisasi Generation (11/16/21
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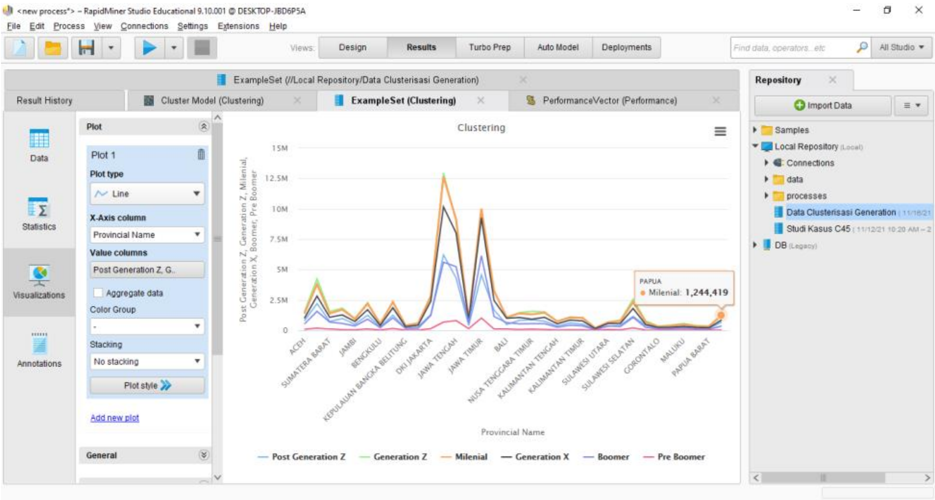
DB (Legacy)

root
- cluster_0
- cluster_1
  - JAWA BARAT
  - JAWA TENGAH
  - JAWA TIMUR
- cluster_2
  - SUMATERA UTARA
  - SUMATERA SELATAN
  - LAMPUNG
  - DKI JAKARTA
  - BANTEN
  - SULAWESI SELATAN

Figure 3. Provincial data based on clusterization



Plot type: Line
X-Axis column: Provincial Name
Value columns: Post Generation Z, G..
☐ Aggregate data
Color Group: -
Stacking: No stacking

Figure 4. Clustering calculations in diagrams

4. Conclusion

Based on the results of research that has been done can be drawn conclusions:

a. K-Means algorithm used is able to map generation clustering into 3 clusters, namely the dominant cluster has 25 provinces, the dominant cluster has 6 provinces and the non-dominant cluster has 3 provinces obtained from 34 provinces in Indonesia.

b. From the results of the research that has been done, researchers suggest that further research be conducted to provide public facilities owned by a province that can be accessed by every generation.

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