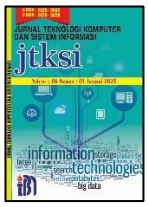

JTKSI (Jurnal Teknologi Komputer dan Sistem Informasi)

JTKSI, Volume 6, Nomor 01, Januari 2023
E ISSN: 2620-3030; P ISSN: 2620-3022, pp.66-71
Accredited SINTA 4 Nomor 200/M/KPT/2020
http://ojs.stmikpringsewu.ac.id/index.php/jtksi

Received: 13 Desember 2022; Revised: 13 Januari 2023; Accepted: 15 Januari 2023

Implementation of Data Mining Sales of Household Furniture At Smart Kitchen Shop Using The Method K-Means

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Abstract

Household furniture is an item that is in great demand by many groups, especially mothers, the higher the number, the greater the demand. To get the desired information so that a store can sort out the inventory that must be met. Then predictions are needed for sales of furniture products that are most requested by consumers which aim to facilitate the provision of stock of goods. The purpose of this study is to apply data mining to determine what products or goods are most in demand, sufficiently desirable, less desirable. From the various data that the authors observe at the Smart Kitchen Store, namely the Smart Kitchen Shop, it is still difficult to predict product supply in the future. Given this problem, we need to group data based on product sales characteristics. In the grouping process, a grouping method will be used using the K-Means Algorithm as a manual calculation method and in its implementation a data mining software using RapidMiner will be used. The results of the study consisted of 3 clusters, namely, the Most Interested Products (Double Stand Hangers, Napkins, and Stainless Plate Racks), Quite Interested (Super Mop Floor Mops, Surpets, and Electric Graters) and Less Interested (4-layer Food Covers, Ring Light, and stainless hood). in the Smart Kitchen Store, so that the data is used as a reference for the Smart Kitchen Shop to manage stock of goods so that the store does not disappoint customers because the goods or products they want to buy are not available.

Keywords: Household Products, Data Mining, Smart Kitchen Shops

I. INTRODUCTION

Along with the progress of the times, people need practicality in meeting their needs in various ways, including furniture, household appliances. What is meant by household furniture in the house are tools or goods in the house that are used or used by home users, household furniture in the house are tools or goods in the house that are used or used by home users[1].Based on the results and discussion, the conclusions of this study include, Clustering with the K-Means method results in products that sell well and those that don't. The more goods sales data are inputted, the more clustering centroids are formed in the process of the k-means method. Products that are selling well consist of food, beverages and products that are not selling mostly consist of cosmetics[2]. the test results can be concluded while Cluster 1 consisting of 4 products was not selling well and 6 best-selling products in Cluster 2. When compared by testing using Tanagra and XLMiner, testing using SPSS produce the number of products in cluster 1 and 2 different clusters. However, the product data is grouped remains the same. Namely 4 products that are not in demand and 6 best selling products[3]. Based on the experimental calculation of the k-means algorithm, the following results are obtained, Cluster 1 = 2 Members, Cluster 2 = 8 Members.

From the two clusters that are formed when viewed from the average value of each centroid clusters, the K-Means method can give an idea that cluster 1 is a cluster that sales don't sell in super build shops. While cluster 2 is the cluster that Only two items are categorized as the best-selling goods on the market in this group shows a high level of sales[4]. The K-means method can be applied in shops Sheets to determine which clothes sell well which are veryin demand, in demand and less in demand Application of the K-Means method to Strand stores, namely by grouping stock data gown, then choose 3 clusters randomly as the initial center of mass. After the data on each cluster is not arbitrary, then it can it is known that the end result is in high demand there are 11 articles, there are 55 best-selling articles and 34 less selling articles[5].Based on the results of the cluster groupings formed in table 4, it can be seen that the cluster grouping results above are as shown below. Cluster Name, Best-selling item (C1) = 8 items, Best - selling item (C2) = 26 items, Unsold goods (C3) = 16

items[6]. Based on the results and discussion, the conclusions of this study include, Grouping with the K-Means method results in seeds with good behavior and those with bad behavior. The more goods sales data are inputted, the more clustering centroids are formed in the K-means method process. Seeds that performed well consisted of SC 1. and seeds that did not perform well consisted of AV4,AV5,AV7,AV8[7]. Based on the level of community needs, this study proposes using the K-means method. Clustering refers to grouping data, observations or cases based on the similarity of the objects studied. Cluster is a collection of data that is similar to other data or different in other groups (Larose, 20ss05). Clustering described by (Xu & Wunsch II, 2009) is defined by dividing data objects (forms, entities, examples, obedience, units) into several groups (groups, sections or categories)[8]. The software used to support data processing is RapidMiner. RapidMiner is a reliable and accurate application for predicting big data, the explanation above or from the explanation above, the researcher took the title: "Implementation of Data Mining sales Household Furniture in Smart Kitchen Shops Using the K-Means Method"[9].

II. THEORETICAL BASIS

Data mining is often used in large data to find important information in data[10]. The application of data mining in research has been widely applied, one of which is predicting sales using Simple Linear Regression. One of them is by applying the science of forecasting[11]**.** Research related to predictive model analysis in the property sector has previously been carried out using e-commerce data and the Decision Tree and K-NN classification methods with results of accuracy of 75% and 71% for each method. Several other studies have implemented this forecasting technique by using various other methods. One of these prediction methods is the cascading series method. This method is a predictive method that estimates sales/demand in future periods using historical data. Some of the methods included in the time series method include: *Simple Moving Average* [12]*Weighted Moving Average* [13] *Exponential Smoothing* [14] and *Linear Regression.* Linear regression as a prediction method has been used to predict book sales and inventory for the coming period. In this study, a simple linear regression method will be implemented to predict property sales in the future period using sales data in the previous period. The choice of the linear regression method as a prediction method in this study is based on its advantages in estimating simple model parameters and data based on time series. In addition, this method can perform analysis using several independent variables (X) so that the prediction results can be more accurate. Linear regression is one of the methods used in production to predict or predict quality and quantity characteristics. This is because by estimating various product combinations, companies can maximize profits and estimate the right amount of production.

III. RESEARCH METHODS

Data mining is the process of extracting data from an information that is very important to explore patterns from data. These patterns are obtained from various types of databases such as relational databases, data warehouses, transaction data, and object-oriented data[5]. Data mining is solving problems by analyzing existing data in databases, where the data is stored electronically and searches are performed automatically like on a computer. The stages in the KDD process on the database are described as follows[15]:

The object of this research uses data from the Smart Kitchen Store from 2019 to 2021.

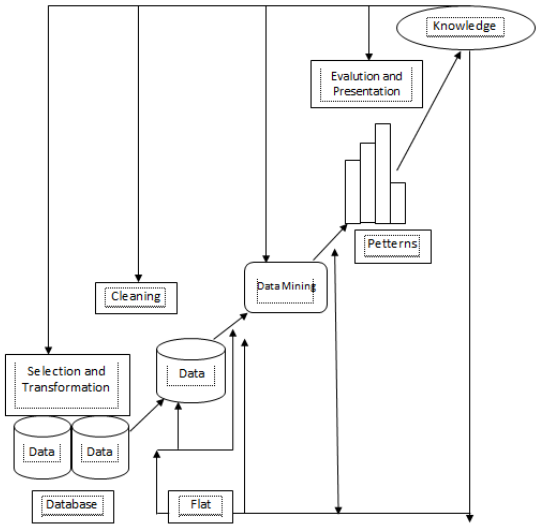

Figure1. *Knowledge discovery in database process*

Data Selection, is the selection of operational data that needs to be done before the review stage in KDD begins. Data search results will be used data mining. The data used in this research is 2019-2021. Cleaning Data, namely selecting consistent and noisy data, duplicating data, correcting errors can be enriched with relevant external data[15].

IV. RESULTS AND DISCUSSION

This study uses data from the Smart Kitchen Store from 2019 to 2021. The attributes used are product names, stock items, and total sales.

Table 1. Furniture Cleaning Data.

No	Product name	Initial Stock	Total Sales
1	Blender Cosmos	280	204
2	Wok Suggo Wok Pan	180	140
3	Ambal	200	156
4	Super Mop Floor Mop	250	173
5	Mejikom Miyako	160	98
6	Mejikom Cosmo	160	105
7	Surpet	250	122
8	Bantal Brendis	150	90

9	Double Stan Hanger	300	270
10	Rak TV Cakra	150	80
11	.....	.....	.....
120	Guitaroo Food Container	200	165

Data Cleaning is a process to be able to overcome missing values, noise and inconsistent data[15] .

1. Literacy 1

   Literacy is the ability to read and write, increase knowledge and skills, think critically in solving problems. In this first calculation, 3 random data are determined as the starting point for calculating the distance of all cluster groups, which will be formed. Cluster 1 values are taken from the 22nd row, Cluster 2 values are taken from the 79th row, and Cluster 3 values are taken from the 111th row.

Table 2. Early Literacy Centeroid Center Points 1.

No	Product Name	Initial Stock	Total Sales
1	Cluster 1	300	287
2	Cluster 2	190	150
3	Cluster 3	150	76

2. Calculate the distance between each data and each central cluster using equation (3), namely the Euclidean Distance equation

Calculate Euclidean Distance from all data to each first center point:

[C1] (1) = √(300-300)² + (270-287)² = √289 = 17
[C1] (2) = √(300-300)² + (244-287)² = √1849 = 43
[C1] (3) = √(300-300)² + (201-287)² = √7396 = 86
[C1] (4) = √(300-300)² + (205-287)² = √6724 = 82
[C1] (5) = √(300-300)² + (254-287)² = √1089 = 33

Calculate Euclidean Distance from all data to each central point Second:

[C2] (1) = √(300-190)² + (270-150)² = √26.500 = 162.788
[C2] (2) = √(300-190)² + (244-150)² = √20.936 = 144,693
[C2] (3) = √(300-190)² + (201-150)² = √14.701 = 121,248
[C2] (4) = √(300-190)² + (205-150)² = √15.125 = 122,984
[C2] (5) = √(300-190)² + (254-150)² = √22.916 = 151,38
[C2] (120) = √(120-190)² + (85-150)² = √9.125 =95,525

Calculate the Euclidian Distance from all data to every third center point:

[C3] (1) = √(300-150)² + (270-76)² = √60.136 = 245,226
[C3] (2) = √(300-150)² + (244-76)² = √50.724 = 225,22
[C3] (3) = √(300-150)² + (201-76)² = √38.125 = 195,256
[C3] (4) = √(300-150)² + (205-76)² = √39.141 = 197,841
[C3] (5) = √(300-150)² + (254-76)² = √54.184 = 232,775
[C3] (120) = √(120-150)² + (85-76)² = √981 = 31.321

The above calculation produces a distance table like table 3.

Table 3. Calculation of Euclidean Distance Literacy 1

No	C1	C2	C3
1	17	162.7882	245.2264
2	43	144.6928	225.2199
3	86	121.2477	195.2562
4	82	122.9837	197.8408
5	33	151.3803	232.7746
…..	…..	…..	…..
120	270.5624	95.52487	31.32092

Members are selected from the smallest among the 3 Clusters, if the smallest is in section C1 then it is included as a member of C1, namely 42 data, if the smallest is in section C2, then it is included as a member of C2, namely 53 data, and if the smallest is in section C3, it is included as a member of C3, namely 25 data.

3. Do Literacy 2

Average = Total number of data groups (X), (Y) in each Cluster / Total Data.

1. Member C1 = Average = (12,530/42 = 298,333) (10,467/42 = 249,214)
2. Member C2 = Average = (11,060/53 = 208,679) (8459/53 = 159,603)
3. Member C3 = Average = (3513/25 = 140.52) (2278/25 = 91.12)

Table 4. Early Literacy Centeroid Center Points 2.

No	Product Name	Initial Stock	Total Sales
1	Cluster 1	298.333	249.214
2	Cluster 2	208.679	159.603
3	Cluster 3	140.52	91.12

Next, calculate the distance of each data with each central cluster. The calculation is the same as the calculation stage in literacy 1.

Calculate the Euclidian Distance from all data to each first center point:

[C1] (1) = √(300-298.333)² + (270-249.214)²= √434,83 = 20,852
[C1] (2) = √(300-298.333)² + (244-249.214)² = √29,964 = 5, 547
[C1] (3) = √(300-298.333)² + (201-249.214)² = √2.327 = 48,243
[C1] (4) = √(300-298.333)² + (205-249.214)² = √1.957 = 44,246
[C1] (5) = √(300-298.333)² + (254-249.214)² = √25,684 = 5,0676
[C1] (120) = √(120-298.333)² + (85-249.214)² = √58.768 = 242,42

Calculate the Euclidian Distance from all data to each central point Second:

[C2] (1) = √(300-208.679)² + (270-159.603)² = √20.527 = 143,27
[C2] (2) = √(300-208.679)² + (244-159.603)² = √15.462 = 124,35
[C2] (3) = √(300-208.679)² + (201-159.603)² = √8.339 + 1.713 = √10.046 = 100,27
[C2] (4) = √(300-208.679)² + (205-159.603)² = √8.339 + 2.060 = √10.400 = 101,27
[C2] (5) = √(300-208.679)² + (254-159.603)² = √8.339 + 8.910 = √17.250 = 131,34
[C2] (120) = √(120-208.679)² + (85-159.603)² = √13.429 = 115,89

Calculate the Euclidian Distance from all data to each central point. Third:

[C3] (1) = √(300-140.52)² + (270-91.12)² = √57.431 = 239,65
[C3] (2) = √(300-140.52)² + (244-91.12)² = √48.806 = 220,92
[C3] (3) = √(300-140.52)² + (201-91.12)² = √37.507 = 193,67
[C3] (4) = √(300-140.52)² + (205-91.12)² = √38.402 = 195,97
[C3] (5) = √(300-140.52)² + (254-91.12)² = √51.963 = 227,96
[C3] (120) = √(120-140.52)² + (85-91.12)² = √458 = 21,413

The above calculation produces a distance table like table 5.

Table 5. Calculation of Literacy Euclidean Distance 2.

No	C1	C2	C3
1	20.85243	143.2718	239.6496
2	5.474171	124.3471	220.9212
3	48.24308	100.2653	193.6685
4	44.24569	101.9818	195.9656
5	5.067627	131.3397	227.9556
…..	…..	…..	…..
120	242.4234	115.8867	21.41319

Members are selected from the smallest among the 3 Clusters, if the smallest is in section C1 then it is included as a member of C1, namely 42 data, if the smallest is in section C2, then it is included as a member of C2, namely 47 data, and if the smallest is in section C3, it is included as a member of C3, namely 31 data. Because the results of the 2nd literacy calculation are not the same as the 1st literacy calculation, it is necessary to re-calculate to the 3rd literacy and so on until you get the same result.

4. Do Literacy 3.
   Determine the position of the new centeroid by calculating the average of existing data in the same centeroid or the same member.

Average = Total number of data groups (X), (Y) in each Cluster / Total Data.

1. Member C1 = Average = (12,530/42 = 298,333) (10,467/42 = 249,214)
2. Member C2 = Average = (10,070/47 = 214,255) (7,726/47 = 164,382)
3. Member C3 = Average = (4,503/31 = 145,258) (3011/31 = 97,129)

Table 6. New Literacy Centroid Center Points 3.

No	Product Name	Initial Stock	Total Sales
1	Cluster 1	298.333	249.214
2	Cluster 2	214.255	164.382
3	Cluster 3	145.258	97.129

Next, calculate the distance of each data with each central cluster. The calculation is the same as the calculation stage in literacy 1 and literacy 2.

Calculate the Euclidian Distance from all data to each first center point:

[C1] (1) = $\sqrt{}$(300-298.333)² + (270-249.214)² = $\sqrt{}$434,83 = 20,852
[C1] (2) = $\sqrt{}$(300-298.333)² + (244-249.214)² = $\sqrt{}$29,964 = 5, 547
[C1] (3) = $\sqrt{}$(300-298.333)² + (201-249.214)² = $\sqrt{}$2.327 = 48,243
[C1] (4) = $\sqrt{}$(300-298.333)² + (205-249.214)² = $\sqrt{}$1.957 = 44,246
[C1] (5) = $\sqrt{}$(300-298.333)² + (254-249.214)² = $\sqrt{}$25,684 = 5,0676
[C1] (120) = $\sqrt{}$(120-298.333)² + (85-249.214)² = $\sqrt{}$58.768 = 242,42

Calculate the Euclidian Distance from all data to each central point Second:

[C2] (1) = $\sqrt{}$(300-214.255)² + (270-164.382)² = $\sqrt{}$18.507 = 136,04
[C2] (2) = $\sqrt{}$(300-214.255)² + (244-164.382)² = $\sqrt{}$13.691 = 117,01
[C2] (3) = $\sqrt{}$(300-214.255)² + (201-164.382)² = $\sqrt{}$8.693 = 93,236
[C2] (4) = $\sqrt{}$(300-214.255)² + (205-164.382)² = $\sqrt{}$9.002 = 94,878
[C2] (5) = $\sqrt{}$(300-214.255)² + (254-164.382)² = $\sqrt{}$15.383 = 124,03
[C2] (120) = $\sqrt{}$(120-214.255)² + (85-164.382)² = $\sqrt{}$15.185 = 123,23

Calculate the Euclidian Distance from all data to each central point. Third:

[C3] (1) = $\sqrt{}$(300-145.258)² + (270-97.129)² = $\sqrt{}$23.945 + 29.884 = $\sqrt{}$53.829 = 232,01
[C3] (2) = $\sqrt{}$(300-145.258)² + (244-97.129)² = $\sqrt{}$23.945 + 21.571 = $\sqrt{}$45.516 = 213,35
[C3] (3) = $\sqrt{}$(300-145.258)² + (201-97.129)² =$\sqrt{}$23.945 + 10.789 = $\sqrt{}$34.734 = 186,37
[C3] (4) = $\sqrt{}$(300-145.258)² + (205-97.129)² = $\sqrt{}$23.945 + 11.636 = $\sqrt{}$35.581 = 188,63
[C3] (5) = $\sqrt{}$(300-145.258)² + (254-97.129)² = $\sqrt{}$23.945 + 24.608 = $\sqrt{}$48.553 = 220,35
[C3] (120) = $\sqrt{}$(120-145.258)² + (85-97.129)² = $\sqrt{}$785 = 28,019

The above calculation produces a distance table like table 7.

Table 7. Calculation of Literacy Euclidean Distance 3.

No	C1	C2	C3
1	20.85243	136.0408	232.0117
2	5.474171	117.0086	213.3451
3	48.24308	93.23603	186.3713
4	44.24569	94.8783	188.6298
5	5.067627	124.0297	220.3487
…..	…..	…..	…..
120	242.4234	123.2304	28.01934

Members are selected from the smallest among the 3 Clusters if the smallest is in section C1 then it is included as a member of C1 which is as much as 42 data, if it is the smallest in section C2 then it is included as a member of C2 which is as many as 46 data, and if it is the smallest in section C3 then it is included as a member of C3 which is as many as 32 data. The 4th literacy with the 3rd literacy has the same results, so there is no need to continue to the 5th literacy or simply stop at the 3rd literacy.

Clustering of household furniture data using the k-means algorithm yields the cluster results, namely the best-selling furniture group is in cluster 1 which has 42 products, the furniture group which is quite in demand is in cluster 2 which has 46 products, and the furniture group which has less best-selling is in cluster 3 which has 32 products.

Table 10. Members of Cluster 1 (Most Preferred Furniture).

No	Product Name	Initial Stock	Total Sales
1	Double Stan Hanger	300	270
2	Serbet	300	244
3	Rak Piring Stainless	300	201
4	Toples Kaca	300	205
5	Cangkir Mahkota	300	254
	…..	…..	…..
42	Alas Kulkas	250	221

Table 11. Members of Cluster 2 (Furniture That Is Interestingly Enough).

No	Product Name	Initial Stock	Total Sales
1	Super Mop Pel Lantai	250	173
2	Surpet	250	122
3	Parutan Listrik	250	190
4	Botol Karakter Anak	250	190
5	Rak Buku Portabel	250	180
	…..	…..	…..
46	Cetakan Eskrim	180	142

Table 12. Members of Cluster 3 (Less Preferred Furniture).

No	Product Name	Initial Stock	Total Sales
1	Tudung Saji 4 susun	180	122
2	Ring Light	180	120
3	Tudung Stainless	170	120
4	Prasmanan Vicenza Bulat	170	124
5	Panggangan Putar	170	121
	…..	…..	…..
32	Cetakan Popcorn	120	85

Based on research conducted with 120 product data on smart kitchen stores that have the attributes Product Name, Product Stock, Products Sold. Then the calculation is carried out using the K-Means algorithm method using 3 clusters, namely the most desirable product, sufficient interest, and less interest. From the calculation of 120 data, the results of the calculation are as follows, Cluster 0 (Most Interested Products) = 42 Products. Cluster 1 (Products Interested enough) = 46 Products. Cluster 2 (Less desirable products) = 32 products. From the implementation of the data using RapidMiner with the k-means method with 120 data at the smart kitchen shop, it was found that 42 product data were of the most interest, 46 product data were of sufficient interest and 32 product data were of little interest.

V. CONCLUSION

The K-Means Clustering method can be used to help smart kitchen shops so that they have no difficulty predicting the inventory of 120 products. Based on the results of determining the centeroid value randomly using the Euclidean Distance formula manually with software, it turns out that the final calculation results are the same, namely 42 Products Most Interested in (Double Stand Hangers, Napkins, and Stainless Plate Racks), 46 Products Enough Interested (Super Mop Floor Mops, Surpets , and Electric Grater) and 32 Less Demanded Products (4-layer Serving Hood, Ring Light, and Stainless Hood)..

The application of using the k-means algorithm method is expected to be further developed for further research with more data and more parameters for other studies, because the results of this study are still very simple in its development.

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