

APPLICATION OF DATA MINING USING METHODS K-MEANS CLUSTERING FOR CLUSTERING BABY GOODS RENTAL PATTERNS (CASE STUDY: BABY KHA HOUSE STORE)

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Abstract

A baby item rental business is a practical option for parents who want to fulfill their baby's needs without buying them. Babykhahouse is one store that offers rental services for various kinds of mother, baby, and child equipment. As the volume of data related to rental transactions increases, it is also increasingly difficult to know and understand the rental patterns found at the Babykhahouse store. This research aims to get a rental pattern that can later be considered for the store when determining promos and adding stock items. In handling these problems, data mining methods, especially clustering, are applied to group data and classify it based on certain groups. The clustering method used in this research is K-Means Clustering, which generates clusters to find similar rental patterns. In this study, 2 (two) types of clusters were formed, where, based on the 2 (two) clusters, it will be known which products have high and low rental rates. Based on the research, the results are 100 data in cluster 0, or unsold cluster, and 64 in cluster 1, or sold cluster. Products included in cluster 1 or in-demand clusters are products with high sales.

Keywords: Rental Pattern, Data Mining, Clustering, K-Means Clustering

Abstrak

Bisnis penyewaan perlengkapan bayi merupakan pilihan praktis bagi orang tua yang ingin memenuhi kebutuhan bayinya tanpa harus membelinya. Babykhahouse merupakan salah satu toko yang menawarkan jasa penyewaan berbagai macam perlengkapan ibu, bayi, dan anak. Seiring bertambahnya volume data terkait transaksi penyewaan, maka semakin sulit pula untuk mengetahui dan memahami pola penyewaan yang terdapat pada toko Babykhahouse. Penelitian ini bertujuan untuk mendapatkan pola penyewaan yang nantinya dapat menjadi pertimbangan pihak toko dalam menentukan promo dan penambahan stok barang. Dalam menangani permasalahan tersebut, metode data mining khususnya clustering diterapkan untuk mengelompokkan data dan mengklasifikasikannya berdasarkan kelompok tertentu. Metode clustering yang digunakan dalam penelitian ini adalah K-Means Clustering, yang menghasilkan cluster-cluster untuk menemukan pola penyewaan yang serupa. Pada penelitian ini dibentuk 2 (dua) jenis cluster, dimana berdasarkan 2 (dua) cluster tersebut akan diketahui produk mana saja yang memiliki tingkat penyewaan yang tinggi dan rendah. Berdasarkan penelitian, didapatkan hasil bahwa 100 data berada pada cluster 0 atau cluster tidak terjual, dan 64 data berada pada cluster 1 atau cluster terjual. Produk yang termasuk dalam cluster 1 atau cluster laris adalah produk dengan tingkat penjualan yang tinggi.

Kata kunci: Pola Penyewaan, Data Mining, Clustering, K-Means Clustering

INTRODUCTION

Various aspects of human life, including economics and business (Amelia, 2023; Wijaya & Susilo, 2021), have been influenced by increasingly rapidly developing technological developments (Ardiansyah, 2023). Indonesia is experiencing rapid development of information technology (Mutiasari, 2020). The purpose of technology is to

make it easier for humans to do things (Cholik, 2021). Governments, private companies, and other institutions have widely used information technology (Pivoto et al., 2023; Raynard & Wang, 2022) to process, process and analyze data, which produces data or information that is relevant, fast, clear, and accurate. Advances in information technology have opened a new chapter in society, including in the business world, because

entrepreneurs are now using it to develop their businesses (Siregar & Nasution, 2020).

Information is increasingly spread worldwide with the internet, and information technology allows everyone to get the latest information (Situmorang et al., 2022). In such situations, data mining has become useful for extracting knowledge from large and complex data sets (Purwadi et al., 2019).

Data mining, also known as knowledge discovery in databases (KDD) (Nasir, 2020), includes the collection and use of historical data to discover regularities and patterns of relationships in very large data sets (Prayitno & Sari, 2022). In the future, the results of this data mining can be used for decision-making (Panggabean et al., 2020). Grouping several objects or data into certain groups is called "clustering" (Nainggolan & Tobing, 2023; Sari & Sutabri, 2023). This process allows each object in the same group to contain data that may be somewhat similar to and different from objects in other groups (Handoko et al., 2020).

Babykhahouse is a shop that offers services in the form of renting various kinds of maternal, baby, and children's toys. Starting with the baby box, bouncer, breast pumps, swings, dining chairs, children's toys, strollers, car seats, and slides.

In this research, several business aspects are of primary concern. First, this research focuses on the business side of the Baby Kha House Shop. Stores can optimize their marketing strategies and stock management by clustering baby goods rental patterns to understand better customer trends and preferences (Awalina & Rahayu, 2023). The target market is also an important part of the research. Stores can change their product and service offerings to reach more targeted market segments by understanding the needs and behavior of potential customers. Additionally, this research concentrates on specific issues related to baby goods rental, such as the most common rental patterns, purchasing tendencies, and the possibility of better customer service.

Next, the clustering results are interpreted to understand customer needs and behavior better. Therefore, Baby Kha House Store can take appropriate actions, such as changing marketing tactics, managing stock, or providing better customer service.

Increasing operational efficiency and customer satisfaction are potential benefits of implementing the K-Means Clustering Method. By knowing better rental patterns, stores can save money, reduce costs, and increase revenue. Baby Kha House stores can also strengthen customer

relationships and increase loyalty by offering services tailored to customer needs.

As a result of this research, the impact of service development in the baby rental industry could be significant. Stores can offer customers more attractive services or rental packages by understanding rental patterns in more depth, such as loyalty programs, parenting consultations, or more specialized baby equipment rentals. This will improve customer experience and make Baby Kha House Stores better known, increasing profits and brand reputation. Consequently, applying the K-Means Clustering Method in this research may sustainably affect the baby goods rental business.

RESEARCH METHODS

This research combines data mining methods to analyze and cluster baby goods rental patterns in Babykhahouse, especially the K-Means Clustering method. Data collection, data pre-processing, and application of the K-Means Clustering algorithm are the method steps followed (Putriana et al., 2023)

Types of research

This research uses data from previous baby item rental transactions at Baby Kha House, including information such as item type, rental frequency, and rental duration. The purpose of this data is to evaluate rental patterns and customer preferences.

Time and Place of Research

The research was conducted for one week, from November 16, 2023, to November 23, 2023. The research was carried out online by analyzing and calculating the data obtained.

Procedure

The following are the procedures in this research:

1. Data collection.
Data collected about each baby goods rental transaction at the Baby Kha House store is stored for a certain period. This data includes information about rented items, quantity of items, transaction date, and customer information.
2. Data Processing.
The collected transaction data is validated and cleaned of anomalies. Missing or incomplete data is removed or addressed.
3. Data Preparation.
The clustering process starts with transaction data that is clean and valid.
4. Implementation of K-Means Clustering.

K-Means clustering is applied to the prepared transaction data. The number of clusters is calculated based on how popular the item is.

5. Interpretation of Results.

The clustering results were evaluated to find various baby goods rental patterns. Each cluster is interpreted to determine its characteristics and determine customer rental habits.

6. Evaluation and Recommendations.

The clustering results will be thoroughly evaluated at Baby Kha House to determine customer rental behavior and find ways to improve their services.

This research aims to improve Baby Kha House's operational efficiency, increase customer satisfaction, and increase understanding of baby goods rental patterns in this dynamic market. This is achieved by combining Data Mining and K-means clustering techniques.

Data, Instruments, and Data Collection Techniques

This research uses 164 primary data and test data. Criteria and alternative data collection techniques used in system testing are obtained by taking a dataset of transaction data from the shop database. As information on baby goods rental data, this research uses two attributes, namely Price and Duration.

Data analysis technique

This research has qualitative and quantitative data. Researchers convert qualitative data into numbers to facilitate manual and system calculations.

Table 1. Dataset

# Data	Variant	Product Category	Price	Duration (Days)	Status	Extension
1	Little Tikes Unicorn	Toy	350000	28	Already Back	No
2	Doona Liki Trike	Toy	600000	56	It has been sent	No
3	Doona Liki Trike	Baby Stroller	370000	29	Be extended	No
4	Doona Liki Trike	Baby Stroller	370000	28	Be extended	No
5	Doona Liki Trike	Baby Stroller	370000	28	It has been sent	Yes

Table 1 shows a visual representation of the dataset. The top five data from the dataset display products such as Little Tikes Unicorn and Doona Liki Trike, with detailed information about product category, price, loan duration, return status, and whether the loan was extended.

RESULTS AND DISCUSSION

The following is the preparation of this project based on proper procedures using the CRISP-DM method.

1. Business Understanding

These results are hoped to help determine the level of product inheritance that will be offered to tenants and can also be a consideration for stores in increasing the stock of goods to be rented out.

2. Data Understanding

Using the Order dataset from October 1, 2023 to October 31, 2023, for 1 month. The data contains customers who rented each product from Babykhahouse. The data also contains customer demographics. Has 307 rows and 43 columns.

3. Data Preparation

The data used does not include all columns in the dataset. Some unused variables will be dropped. So, the dataset only includes the variables Variant, Product Category, Price, Duration (days), status, and Extension.

4. Modeling

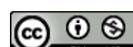
The algorithm used for clustering is k-means. K-means is used to find out data patterns and create groups/clusters.

Two clusters will be formed because it will be known which products have high and low rental rates from these clusters. The following dataset will be used: the top 5 data.

a. Transformation

Table 2. Price Transformation

Is	Code
<= 200000	1
<= 400000	2
<= 600000	3
<= 800000	4
<= 1000000	5



Based on Table 2 shows the results of the price transformation, where the "Price" column shows a certain price range, "Ket" shows the description, and "Code" shows the product category.

Table 3. Extension Transformation

Extension	
Is	Code
Of	1
Not	2

Table 3 shows how the extension category was changed into two categories, one for "Yes" and two for "No." This transformation can be used to classify or analyze renewal information, such as in the context of contract management or other decisions related to renewal aspects. Renewal status can be identified by category code, allowing further analysis.

Table 4. Extension Transformation

Duration	
Is	Code
<= 20	1
<= 40	2
<= 60	3

Table 4 shows the results of the duration transformation, where the "Duration" column shows the specific time range, "Ket" shows the description, and "Code" shows the identified extension category.

Table 5. State Transformation

Duration	
Is	Code
Be extended	1
Preparation	2
It has been sent	3
Already back	4

Table 5 shows the transformation of the borrowing status of goods, with the "Status" column, which contains various conditions, the "Ket" column, which functions as a description, and the "Code" column, which functions as status identification.

Table 6. Variant Transformation

Variant	
Is	Code
Around We Grow 360° Activity Table	1
Avent Sterilizer Uap	2
Baby Carrier Ergobaby Hipseat	3
Baby Elle EZ Switch	4
Baby Fence Big Donut 14+2 Panel	5
Baby Jogger City Tour Lux	6

Variant	
Is	Code
Baby Tafel Bath & Changing Table	7
Baby Walker Ocean 2 in 1	8
Baby Walker Walk Around 360°	9
Babydoes Travel Seat	10
Babyelle Linx Bronze	11
Babyelle Rider	12
Babyelle Wave	13
Banz Earmuff	14
Booster Seat Chicco Bunny	15
Bouncer Bright Starts Harmony	16
Bouncer Nuna Leaf Curv	17
Bouncer Nuna Leaf Double Pad	18
Bouncer Nuna Leaf Grow 2021 Biscotti	19
Box Baby Joie Commuter Logan	20
Brachiation 6 in 1 Foldable Gym	21
Bright Starts Nemo	22
Bright Starts Safari	23
Bumpermat Role Play Series Garage	24
Bunny Single Slide	25
Bus Slide Swing	26
Chicco Baby Bed Next To Me	27
Chicco Panda 123	28
Chicco Walky Talky	29
Chingching Tree House	30
Classic Choo Choo Train	31
Climb and Slide 4in1 Activity	32
Cobyhaus Starlight	33
Cocolatte Minima Plus	34
Cocolatte Verza	35
Cybex Eazy S Twist 360°	36
Doctor Dolphin Octopus 3in1	37
Doona Liki Trike	38
Easy Walker Buggy XS Disney	39
Eduplay Playhouse	40
ELC Baby Walker Blossom Farm	41
ELC Kitchen	42
ELC Ride On Car 3 in 1	43
Padded Jr. Terrytorri Buckle	44
Fisher Price Zebra	45
Giraffe Single Slide 2in1	46
Graco 4Ever True Shield	47
Grow n Up Scramble	48
Happy Playhouse	49
High Chair Nuna Zaaz	50
Ibebe Single Swing Forest Pink	51
Joie Every Stage Fx Siganture	52
Joie Pact Lite	53
Joie Spin 360	54
Joie Starry Night	55
Joie Tilt	56
Joie Tourist	57
Labeille 2in1 Crocodile Seesaw	58
Labeille Piggyback	59
Lerado Roller Coaster	60
Lerado Towh House Climb	61
Little Giggles Jump & Learn	62
Little Tikes Plastic Horse	63
Little Tikes Unicorn	64
Mamacoco Edu Bumpermat	65
Mesin AUTO	66



Variant	
Is	Code
Mydear Manual Swing	67
Mydear OTO Machine Swing	68
Mydear Polar Automatic Swing	69
Nuna Night With Base	70
Nuna Rava	71
Nuna Rebl 360 - Suited	72
Nuna Trvl Cabin Size	73
Parklon Single Slide	74
3in1 Single Slide Elephant Slide	75
Pirate Slide	76
Pockit Plus Recline	77
Pompa ASI Double Pump Spectra 9 Plus	78
Ride On Elephant	79
Ride On Plane	80
Speeds Playmat XPE Folding	81
Sterilizer UV	82
Swing and Slide	83
Wheel On The Bus Slide	84
Woodland Climber and Slide	85
Yaya School Bus	86
Let's Nanny Lani	87
Naya Tayo Slide	88

Based on Table 6 displays a list of products and relevant descriptions and variant codes. Each product has an entry consisting of a variant code, variant name, description or related information, and caption. This table can find and categorize various products in a particular industry, such as children's toys or baby equipment.

Table 7. Category Transformation

Category	
Is	Code
Baby Activity Table	1
Baby Bath-up / Baby Bathtub	2
Baby Bumpermat / Bumperbed	3
Baby Fence / Baby Fence	4
Baby Walker / Tool for Learning to Walk	5
Baby Stroller	6
Bouncy	7
Toy	8
Baby Bouncer / Baby Swing / Baby Swing	9
Baby Box / Baby Bed / Baby Bed	10
Baby Carrier / Baby Carrier	11
Baby Carseat / Baby Car Seat	12
Baby Chair / Baby Dining Chair	13
Baby Earmuff	14
Baby Jumperoo / Trampoline Bayi / Loncat-Loncat	15
Baby Playmat	16
Baby Sterilizer	17
Baby Tafel Bath & Changing Table	18
Iron Swing Machine	19
Pump BUT	20
Pool / Pool	21

Table 7 shows the results of transforming the baby product category with products such as Baby Stroller and Baby Walker. Category codes and descriptions provide a comprehensive overview of the various products available in the baby equipment industry.

b. Data Transformation Results

Table 8. Data Transformation Results

# Data	Variant	Product Category	Price	Duration (Days)	Status	Extension
1	Little Tikes Unicorn	8	2	2	4	2
2	Doona Liki Trike	8	4	3	3	2
3	Doona Liki Trike	6	2	2	1	2
4	Doona Liki Trike	6	2	2	1	2
5	Doona Liki Trike	6	2	2	3	1

Table 8 shows the data transformation results carried out on each variable.

c. Defining variables

The initial stage that needs to be done before starting the clustering process is to determine which variables will be used in the clustering process.

	Harga	Durasi (hari)
0	2	2
1	4	3
2	2	2
3	2	2
4	2	2

Figure 1. Clustered Variables

Figure 1 shows that the clustered variables are Price and Duration (days). The data used has been transformed, and the data shown in Figure 3 is only the top 5.



g. Visualization of Clustering Results

An effective way to better understand the patterns and structure of grouped data is to show the clustering results through a *scatter plot*. A *scatter plot* allows us to plot each data point in a low-dimensional space by placing each point at the coordinates corresponding to its feature values. It can be used to plot each product in feature space and color the points according to the cluster to which they belong.

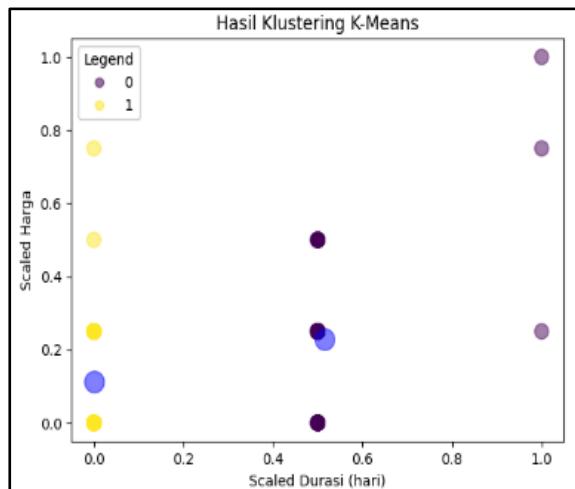


Figure 8. Display of Clustering Results Data

Based on Figure 8, the results of clustering using the K-Means method, it is concluded that there are two clusters produced:

1. *Cluster 0 (Cluster 1)*: Consists of 100 data. Patterns or characteristics found in Cluster 0 must be analyzed further.
2. *Cluster 1 (Cluster 2)*: Consists of 64 data. Cluster 1 may have more consistent or unique patterns or characteristics, even though it has less data.

h. Clustering Results

index		
Kluster	Varian	
1	Yaya Tayo Slide	1
	Classic Choo Choo Train	1
	ELC Ride On Car 3 in 1	1
	Doctor Dolphin Octopus 3in1	1
	Cyber Eazy S Twist 360°	1
...
0	Cyber Eazy S Twist 360°	1
	Cocolatte Verza	1
	Cocolatte Minima Plus	1
	Cobyhaus Starlight	3
	Mesin OTO	4

99 rows x 1 columns

Figure 9. Clustering Results for Variants

Figure 9 shows the data display of the "variant" variable, which is included in cluster 1 (best selling) and cluster 0 (not selling well), along with the number of appearances of each variant in the data.

index		
Kluster	Kategori Produk	
1	9	3
	8	13
	6	32
	5	1
	4	2
	21	1
	17	3
	16	2
	15	1
	14	3
	13	1
	11	2
0	9	16
	10	3
	11	1
	6	11
	5	9
	4	6
	3	3
	20	2
	2	1
	19	1
	17	2
	14	1
	13	4
	12	7
	8	33

Figure 10. Clustering Results for Categories

Figure 10 shows the data display of the "product category" variable, which is included in cluster 1 (best selling) and cluster 0 (not selling well), along with the number of appearances of each product category in the data.

index		
Kluster	Harga	
1	1	38
	2	24
	3	1
	4	1
0	1	24
	2	63

Figure 11. Clustering Results on Prices

Figure 11 shows the data display of the "price" variable, which is included in cluster 1 (selling well) and cluster 0 (not selling well), along with the number of occurrences of each price in the data.

index		
Kluster	Durasi (hari)	
1	1	64
0	2	97
3	3	

Figure 12. Clustering Results for Duration (days)

Figure 12 shows the data display of the "duration" variable, which is included in cluster 1 (best selling) and cluster 0 (not selling well), along with the number of appearances of each duration in the data.

index		
Kluster	Status	
1	1	3
	2	2
	3	2
	4	57
0	1	15
	2	1
	3	46
	4	38

Figure 13. Clustering Results for Status

Figure 13 shows the data display of the "status" variable, which is included in cluster 1 (selling well) and cluster 0 (not selling well), along with the number of appearances of each status in the data.

index		
Kluster	Perpanjangan	
1	1	4
	2	60
0	1	33
	2	67

Figure 14. Clustering Results on Extension

Figure 14 shows the data display of the "extension" variable, which is included in cluster 1 (best selling) and cluster 0 (not selling well), along with the number of appearances of each extension in the data.

index	Varian	Kategori Produk	Harga	Durasi (hari)	Status	Perpanjangan	Kluster
0	0	Little Tikes Unicorn	8	2	2	4	2 0
1	1	Doona Liki Trike	8	4	3	3	2 0
2	2	Doona Liki Trike	6	2	2	1	2 0
3	3	Doona Liki Trike	6	2	2	1	2 0
4	4	Doona Liki Trike	6	2	2	3	1 0
...
159	159	Mesin OTO	9	2	2	3	2 0
160	160	Mydear Ayunan Otomatis Polar	9	1	2	4	2 0
161	161	Bright Starts Nemo	5	1	2	4	2 0
162	162	Bright Starts Safari	5	2	2	3	2 0
163	163	Chicco Walky Talky	5	1	2	1	1 0

Figure 15. Clustering Results 0 (Low)

Figure 15 shows the display of each data included in cluster 0 or the not-in-demand cluster.

index	Varian	Kategori Produk	Harga	Durasi (hari)	Status	Perpanjangan	Kluster
5	5	Lerado Town House Climber	8	2	1	4	2 1
8	8	Cybex Eazy S Twist 360°	6	2	1	4	2 1
11	11	Babyelle Rider	6	1	1	4	2 1
13	13	Cocolatte Verza	6	1	1	4	2 1
14	14	Cocolatte Verza	6	1	1	4	2 1
...
143	143	Cobyhaus Starlight	4	1	1	4	1 1
146	146	Spredits Playmat XPE Lipat	16	1	1	1	2 1
147	147	Spredits Playmat XPE Lipat	16	1	1	4	1 1
152	152	Mydear Ayunan Manual	9	1	1	4	2 1
156	156	Mesin OTO	9	1	1	4	2 1

Figure 16. Clustering 1 (High) Results

Figure 16 shows each data included in cluster 1 or the best-selling cluster.

5. Recommendation

After understanding rental patterns, researchers will offer customers more attractive rental services or packages to increase operational efficiency and customer satisfaction. Rental package suggestions will be given based on the results of cluster 1 or the best-selling product categories, taking into account variables such as Variant, Category, Price, Duration (days), Status and Renewal, as follows:

Variant : Joie Tourist
 Product Category: 6 (Baby Stroller)
 Price: 1 (<200 thousand)
 Duration: 1 (<20 days)
 Status: 4 (Immediately Returned)
 Extensions: 2 (No Extensions)

The application of data mining using the K-Means Clustering method can help shops determine the level of popularity of products that will be offered to renters. It can also be a consideration for shops when managing the stock of goods to be rented. This provides stores with knowledge to identify items requiring more stock management and promotion attention.

CONCLUSIONS AND SUGGESTIONS

Conclusion

Based on the clustering process that has been carried out on rental transaction data at the Babykhahouse store within 1 (one) month, namely during October 2023, using the K-Means Clustering algorithm, it is found that there are 100 data included in cluster 0 or the unsold product cluster and 64 data included in cluster 1 or the sold product cluster. The clustering results that were successfully obtained can be a consideration for stores when making special offers or promos that will be offered to tenants in the future. In addition, it can also be concluded that the products included in cluster 1 or the best-selling product cluster are products with high sales. Therefore, this can be a consideration for stores to increase the stock of products included in the best-selling cluster. The business implications of this study include improved operational efficiency, increased customer satisfaction, and increased knowledge of rental patterns.

Suggestion

This research shows that Babykhahouse should continue to optimize the use of Data Mining with the K-Means Clustering method to monitor and analyze baby item rental patterns. To ensure more accurate clustering results, further efforts are needed to improve data quality, expand the dataset, and explain the K parameters of the K-Means Clustering algorithm. In addition, using these clustering results, Babykhahouse can create more targeted marketing strategies, improve business sustainability, and learn more about customer needs. Considering the ever-evolving baby goods rental market changes, Babykhahouse can make significant gains if these findings are incorporated into its daily operating policies and procedures.

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