EIJOMS
Edusight International Journal of Multidisciplinary Studies
ISSN: 3046-8477

Volume 1, No. 2, 2024
Published on June 2024

Application of the Apriori Algorithm in Transaction Data in Rumah Makan Murah

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Abstract

This research aims to apply the Apriori algorithm in transaction data analysis at a budget-friendly restaurant to identify purchasing patterns and relationships between frequently bought items. By leveraging historical transaction data, the Apriori algorithm can discover significant associations among various menu items, which can then be used to develop more effective marketing strategies, optimize product placement, and boost sales. The research process includes the collection and preprocessing of transaction data, application of the Apriori algorithm for association rule extraction, and analysis and interpretation of the results. The findings from this study are expected to provide valuable insights for budget-friendly restaurant managers to develop more efficient, data-driven business strategies.

***Keywords**: Algorithm Apriori, Transaction Data, Data Analysis, Item Association, Business Control Database*

1. INTRODUCTION

In today's digital era this, the use of data in business decision making is becoming increasingly important. One of the sectors that can make optimal use of data is the culinary industry, include Rumah Makan Murah cheap. Rumah Makan Murah is a place to eat located in the area Cakung, East Jakarta offers dish with an affordable price However still provide good and decent food. Manager of Rumah Makan Murah often face challenges in understanding customers buying patterns and developing effective marketing strategies on a budget.

Transaction data analysis is one way to overcome these challenges by analyzing transaction data, managers of Rumah Makan Murah can identify hidden purchase

patterns, understand customer preferences, and find relationships between items that are often purchased together. One of the effective methods to do this analysis is to apply the Apriori Algorithm.

The Apriori Algorithm is an influential algorithm for mining frequent Itemset for association rules (Abdul, Hadianto, Miharja, & Rifai, 2018). The Apriori Algorithm is used to find frequent itemsets that meet the mincof of frequent itemset (Fitriani, Nama, & Mardiana, 2022). Apriori uses an iterative approach where k-itemset is used to explore (k+1)-itemset. In this algorithm the candidate (k+1)-itemset is generated by combining two itemset on the domain/size k. Candidates (k+1)-itemset that contain subset frequencies that rarely appear or are below the threshold will be trimmed and not used in determining association rules (Gama, Putra, & Bayupati, 2016).

This research aims to apply the Apriori Algorithm in the analysis of transaction data in Rumah Makan Murah. Through this research, it is expected to find significant buying patterns and associations between items that are often purchased together, so that restaurant managers can design more effective marketing strategies, optimize product placements, and increase sales. In this research, with the help of data mining, existing sales transaction data can be managed to dig up and find a new knowledge (Aditya, Fahrullah, & Sari, 2023).

The approaches carried out include collecting transaction data from Rumah Makan Murah, pre-processing data to ensure quality and consistency, application of Apriori Algorithms for the extraction of association patterns, and analysis of results to gain insights that can be applied in business strategies. Therefore, this research is expected to make a meaningful contribution in the management of data-based Rumah Makan Murah.

Various studies related and connected to the subject under discussion help provide a deeper understanding and perspective on the background and related elements that are the subject of discussion (Setiawan, et al., 2024).

The following are the theories taken as the basis in carrying out this research, with the aim of detailing the conceptual framework and theoretical foundation that will guide in the development and implementation of this research (Setiawan, et al., 2024).

1.1. Data Mining

Data mining is the process of discovering meaningful patterns, relationships, and trends from large amounts of data through statistical techniques, mathematics, and artificial intelligence technology (Priyanto, Dewanti, Tundo, Nurdin, & Kasiono, 2024). Data mining enables organizations to make better decisions by digging up hidden information from big data (Rahman & Kabir, 2019) (Tundo, Yell, Arinal, James, & Saidah, 2024).

1.2. Algorithm A priori

The Apriori algorithm is one of the data mining algorithms used to find association rules between items in a transaction dataset. This algorithm was first introduced by Agrawal and Srikant in 1994 (Surur, Saputro, & Azizah, 2022). Apriori works by exploring the combinations of items that often appear together in transactions, and calculating the value of support and confidence to determine how often and strong the relationship between the items is (Putra, G, & Setyawan, 2019). The support score of an item is obtained based on the formula below (Merliani, Khoerida, Widiawati, Triana, & Suharkah, 2022) (Abizal, Syahra, & Hafizah, 2022):

$$\text{Support (A)} = \frac{Transaction\ Amount\ A}{Total\ Transaction} \text{x } 100\% \quad (1)$$

The support score of 2 items is obtained based on the formula as below (Merliani, Khoerida, Widiawati, Triana, & Suharkah, 2022)

$$\text{Support (AB)} = \frac{Transaction\ Amount\ \ A\ and\ B}{Total\ Transaction} \text{x}100\% \quad (2)$$

The confidence score of the A→B rule is obtained from:

$$\text{Confidence} = \text{P(AB)} = \frac{Transaction\ Amount\ \ A\ and\ B}{Total\ Transaction}100\% \quad (3)$$

1.3. Data Sets

Dataset is a collection of data used in the data analysis process. Datasets can consist of various types of data, such as transaction data, sensor data, medical data, and others. In the context of this research, the dataset used is a collection of sales transaction data at cheap food stalls that contain information about products purchased by customers in each transaction (Sari, Prasetyo, & Widodo, 2020).

1.4. Association Rule

Association analysis serves to look for patterns that describe the interconnectedness of items in the data. Usually the resulting pattern is in the form of an implication rule that aims to find interesting patterns efficiently. The following is the basis of association analysis :

a. Support to support interconnected items a and item b

Confidence to see how the combination of associations that often appears (Fitriani, Nama, & Mardiana, 2022).

2. RESEARCH METHOD

Research is a methodical activity process that aims to add knowledge by making original contributions. While the research method is a procedure or step in obtaining scientific or scientific knowledge. So the research method is a systematic method to compile science (Suardi, S, & Sunardi, 2023). The following is an overview of the research methods in this study, which is shown in figure 1.

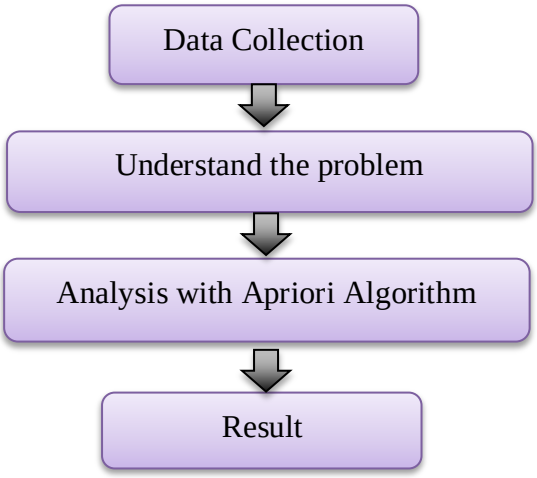

Figure 1. Metode

2.1. Data collection

In this research, collecting these data is sourced from primary data sources as well as secondary data:

a. Primary data

Primary data was obtained by making observations and interviews directly to cheap food stalls

b. Secondary Data

Secondary data is obtained indirectly in the form of journals and articles. In obtaining journals and articles, internet searches were carried out (Merliani, Khoerida, Widiawati, Triana, & Suharkah, 2022). The following is a table of data that has been collected in table 1.

Table 1. Data collection

No	Transaction Date	Transaction Code	Menu will be Purchased
1	01/10/2021	0001	ayam presto cabe hijo, ayam sambal kemangi, nila sambal kemangi, mie goreng, nasi goreng, lemontea, capucino
2	02/10/2021	0002	nila sambal kemangi, bebek sambal kemangi, gurami sambal kemangi, mie goreng, alpukat, strowberry, sosro/fruitea
3	03/10/2021	0003	bebek sambal kemangi, gembung sambal kemangi, mie goreng, nasi goreng ayam, lemontea, capucino, sosro/fruitea
4	04/10/2021	0004	ayam sambal kemangi, nila sambal kemangi, gurami sambal kemangi, mie goreng, nasi goreng ayam, lemontea, strowberry
5	05/10/2021	0005	nila sambal kemangi, bebek sambal kemangi, mie goreng, lele sambal kemangi, lemontea, capucino, alpukat
6	06/10/2021	0006	ayam presto cabe hijo, gembung sambal kemangi, mie goreng, nasi goreng, lemontea, strowberry, sosro/fruitea
7	07/10/2021	0007	ayam sambal kemangi, nila sambal kemangi, lele sambal kemangi, nasi goreng ayam, capucino, alpukat, lemontea
8	08/10/2021	0008	nila sambal kemangi, bebek sambal kemangi, gurami sambal kemangi, nasi goreng, lemontea, alpukat, sosro/fruitea
9	09/10/2021	0009	bebek sambal kemangi, mie goreng, nasi goreng, lele sambal kemangi, capucino, strowberry, sosro/fruitea

No	Transaction Date	Transaction Code	Menu will be Purchased
10	10/10/2021	0010	ayam presto cabe hijo, ayam sambal kemangi, gembung sambal kemangi, mie goreng, nasi goreng ayam, lemontea, strowberry, nasi goreng
….	…..	…..	…….
100	8/1/2022	0100	Bebek sambal kemangi, Gembung sambal kemangi, Lele sambal kemangi, Nasi goreng, Lemontea, Alpukat, Strowberry, Sosro/fruitea

2.3. Understand Problem

In this case, the problem identified in this study is to get recommendations related to food and beverage products marketed at Warung Makan Murah to produce maximum product sales and also be able to maximize product promotion with product sales.

2.4. Analysis with Apriori Algorithm

This research uses one of the data mining algorithm methods to process data to get results that are used as recommendations (Sari, Prasetyo, & Widodo, 2020) for Warung Makan Murah and get the knowledge obtained from existing data. The Apriori Algorithm was chosen because in addition to being able to determine the appearance of products that are often sold, it can also provide recommendations for interrelated products that may be purchased by customers. There are two stages in the basis of association analysis (Sari, Prasetyo, & Widodo, 2020).

2.4.1. Data Transformation

The following is the data transformation from this research, which is to change the transaction data whether or not there are transactions in daily transactions. In table 2, 0 symbolizes the absence of transactions and 1 symbolizes the existence of transactions.

Table 2. Data Transformation

APCI	ASK	NSK	BSK	GSK	GESK	MG	NG	LSK	NGA	LT	CC	AK	SB	SS
1	0	0	0	0	1	1	1	0	0	1	1	0	1	1
1	0	0	0	0	1	1	1	0	1	1	1	0	1	0
1	0	0	0	0	1	0	1	1	0	1	1	0	1	0
1	1	0	0	0	1	0	1	0	1	1	1	0	1	1
0	0	1	0	0	1	0	1	1	1	1	1	0	1	0
1	0	0	0	0	1	0	1	1	0	1	1	1	1	0
1	1	0	0	0	1	0	1	1	0	1	1	0	1	0
1	0	0	0	0	1	0	1	1	0	1	1	0	1	0
1	1	0	0	0	1	0	1	1	0	1	1	0	1	1
0	0	0	1	0	1	0	1	1	0	1	1	1	1	1
0	1	0	0	0	1	0	1	1	0	1	1	1	1	1
0	1	0	0	1	1	0	1	0	0	1	1	0	1	1
0	1	0	0	0	1	0	1	1	0	1	1	1	1	0
0	0	0	1	0	1	0	1	1	0	1	1	1	1	0
0	1	0	0	0	1	0	1	1	0	1	1	1	1	0
0	0	0	1	0	1	0	1	1	0	1	1	0	1	1
0	1	0	0	1	1	1	1	0	0	1	1	0	1	0
0	1	0	0	0	1	0	1	1	0	1	1	1	1	0
0	0	0	1	0	1	0	1	1	0	1	1	1	1	0
0	0	0	1	0	1	0	1	1	0	1	1	1	1	1

2.4.2. Analysis of the highest frequency pattern

In the analysis stage of the highest frequency pattern find the combination of items that meet the minimum requirements of the support score in the database.

2.4.3. Form Establishment of association rules

After the entire high frequency pattern is obtained, then proceed to search for association rules with the minimum requirement on confidence met, for the formulation as follows: Minimum confidence = 50%.

How to use a priori algorithm to solve problems with (Sari, Prasetyo, & Widodo, 2020):

a) Determine items that are often purchased from sales transactions. The first step is done, using transaction data as much as 100 data that has the highest frequency.
b) Determine the support from the menu in the sales transaction. Also determine the support score from a combination of 1 set of items, 2 sets of items, 3 sets of items, and so on. A combination of sets of items that value less than 50% of the minimum support score requirement, will not be included in the rule association.
c) Determine the confidence value of a combination of sets of items that meet a minimum belief requirement of 50%.

Determine the association of rules of the set of combinations that meet the highest conditions and scores.

3. RESULTS AND DISCUSSION

At this stage, it will determine the frequency pattern for transaction data in cheap food stalls. After that we will find the formation of association rules based on the frequency pattern that we have determined.

3.1. Determining Frequency Patterns

Pattern 1 Itemset Minimum number *of Supports* is 20%.

3.1.1 Formation of 1 Itemset

Following is calculation of 1 itemset with minimum *support of* 20% with use equation (1). Detailed results shown in table 3.

Table 3. Formation of 1 Itemset

1 ITEM		
Items	**Amount**	**Support**
APCI	38	38%
ASK	41	41%
NSK	35	35%
BSK	47	47%
GSK	49	49%
GESK	41	41%
M.G	59	59%
NG	52	52%
LSK	38	38%
NGA	43	43%
LT	76	76%
CC	63	63%
AK	48	48%
SB	49	49%
SS	42	42%

3.1.2. Formation of 2 Itemsets

Following is calculation of 2 itemsets with minimum *support of* 20% with use equation (2). Detailed results shown in table 4.

Table 4. Formation of 2 Itemsets

2 ITEMS		
Items	**Amount**	**Support**
APCI, ASK	12	12%
APCI, NSK	8	8%
ASK, NSK	9	9%
BSK, MG	29	29%
NSK, MG	23	23%
NSK, BSK	14	14%
LT, CC	47	47%
GSK, NG	33	33%
ASK, BOD	9	9%
APCI, BOD	18	18%
ASK, GESK	2	2%
NSK, BSK	7	7%
BOD, NG	19	19%
NSK, RUSSIA	15	15%
APCI, LSK	14	14%
APCI, L.T	24	24%
APCI, GSK	20	20%
APCI, M.G	27	27%
APCI, SB	29	29%
M.G., L.T	40	40%
MG, CC	32	32%
M.G., A.K	24	24%
MG, SB	28	28%
NG, SS	22	22%
NG, LT	40	40%
NG, CC	39	39%
NG, AK	27	27%
NG, SB	33	33%
NG, SS	22	22%

OF, GESK	26	26%
BSK, GSK	25	25%
GSK, NGA	25	25%

3.1.3. Fortification 3 Itemset

Following is calculation of 3 itemsets with minimum *support of* 20% with use equation (2). Detailed results appears in table 5.

Table 5. Formation of 3 Itemsets

3 ITEMS		
Items	**Amount**	**Support**
MG, NGA, LT	19	19%
BSK, GSK, MG	17	17%
LSK, NGA, LT	10	10%
APCI, BSK, ASK	4	4%
BSK, LT, MG	19	19%
NGA, CC, SB	4	4%
MG, LT, GSK	21	21%
AK, GESK, SS	8	8%
CC, LSK, LT	23	23%
SB, APCI, NSK	7	7%
NG, SS, AK	12	12%
CC, MG, GSK	14	14%
SB, MG, NG	14	14%
GSK, NGA, LT	20	20%

3.1.4. Formation of 4 Itemsets

Following is calculation of 4 itemsets with minimum *support of* 20% with use equation (2). Detailed results appears in table 6.

Table 6. Formation of 4 Itemsets

4 ITEM		
Item	**Jumlah**	**Support**
APCI,ASK ,MG,LT	4	4%
APCI,ASK ,MG,SB	3	3%
ASK,NSK ,MG,NG	6	6%
LSK,NGA ,LT,SS	4	4%
BSK,GSK ,LSK,CC	4	4%
GESK, NG, LT, SB	20	20%
BSK, MG, LT, CC	9	9%

3.1.5. There are 5 items set

Following is calculation of 5 *itemsets* with minimum *support of* 20% with use equation (2). Detailed results appears in table 7.

Table 7. Formation of 5 Itemsets

5 ITEMS		
Items	**Amount**	**Support**
BSK, MG, NGA, LT, CC	4	4%
APCI, BSK, GSK, MG, LT	6	6%
ASK, GESK, NG, LSK, SB	6	6%
ASK, NSK, MG, LT, SS	5	5%
GESK, NG, CC, AK, SS	6	6%
GESK, NG, LT, SB, CC	20	20%

3.2. Establishment of Asociasion Rules

After all frequency patterns have been found, then the association rules are searched with frequency pattern results. Find the association rules that meet the minimum requirements for confidence, by calculating confidence or association A → B, with a minimum confidence of 50% (Kurniawan, Saedudin, & Andreswari, 2021). The

following is a confidence or associative calculation using equation (3). In detail the results are shown in table 8.

Table 8. Hasil Confidence

Menu	Support	Confident	Rank
BSK, MG	29%	49,15%	
NSK, MG	23%	38,98%	
LT, CC	47%	74,60%	
GSK, NG	33%	55,93%	
APCI, LT	24%	31,58%	
APCI, GSK	20%	40,82%	
APCI, MG	27%	45,76%	
APCI, SB	29%	59,18%	
MG, LT	40%	52.63%	
MG, CC	32%	50.79%	
MG, AK	24%	50,00%	
MG, SB	28%	57.14%	
NG, SS	22%	52,38%	
NG, LT	40%	52.63%	
NG, CC	39%	61.90%	
NG, AK	27%	56.25%	
NG, SB	33%	67,35%	
NG, SS	22%	52,38%	
OF, GESK	26%	63.41%	
BSK, GSK	25%	51.02%	
GSK, NGA	25%	58.14%	
MG, LT, GSK	21%	53%	
CC, LSK, LT	23%	76.67%	
GSK, NGA, LT	20%	80.00%	3
GESK, NG, LT, SB	20%	90,91%	2
GESK, NG, LT, SB, CC	20%	100.00%	1

The results of this study show that the Apriori algorithm is effective in identifying repeated consumer buying patterns at cheap food stalls. These findings can be used as a basis for making more targeted product recommendations, which can increase sales and customer satisfaction. For example, knowing that "fried rice and sweet iced tea" are often purchased together, food stalls can offer promotional packages for both items to attract more customers.

4. CONCLUSION

This research aims to analyze the pattern of consumer purchases at Rumah Makan Murah located on Jl. Leather Factory, RT.6/RW.4, West Cakung, District. Cakung, East Jakarta City 13910, using Apriori algorithm. From the results of transaction data analysis, a number of significant buying patterns were found that can be used to develop a more effective marketing strategy.

The application of the Apriori Algorithm in this study succeeded in identifying combinations of items that are often purchased together by customers. For example, it was found that 'fried rice and sweet iced tea' are often bought together. Using this information, Rumah Makan Murah managers can design attractive and more targeted package promotions, which can increase sales and customer satisfaction.

The results showed that the Apriori Algorithm was effective in uncovering patterns of associations between items in transaction data. This knowledge provides valuable insight for food stall managers to optimize product placement and design efficient marketing strategies, albeit on a limited budget. In addition, these findings can also help in better inventory planning, reducing the risk of running out of stock for items that are often purchased together. Therefore this research contributes to improving the management of Rumah Makan Murah data-based. This approach can be applied to other culinary businesses to achieve smarter, data-driven decision making, which can ultimately increase the competitiveness and profitability of the business.

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