



DOI: <https://doi.org/10.38035/gijes.v2i4>
<https://creativecommons.org/licenses/by/4.0/>

Implementation of the Apriori Algorithm for Product Arrangement in a Minimarket

Ridwan¹, Hendarman Lubis²

¹Institut Teknologi dan Bisnis Dewantara, Bogor, Indonesia, ridwans70@gmail.com

²Universitas Bhayangkara Jakarta Raya, Jakarta, Indonesia, hendarman.lubis@dsn.ubharajaya.ac.id

Corresponding Author: hendarman.lubis@dsn.ubharajaya.ac.id²

Abstract: This research aims to implement the Apriori algorithm to analyze customer purchase patterns and provide recommendations for product placement in Indomaret Perjuangan Bekasi. Data mining techniques, specifically the Apriori algorithm, are applied to transaction data collected from the store between March 1 and April 1, 2025. The primary objective is to identify frequent itemsets and generate association rules that reveal which products are frequently purchased together, providing insights into customer purchasing behavior. The research begins by preprocessing the data into a format suitable for analysis using Weka, a data mining tool. The Apriori algorithm is then applied to uncover product combinations that occur frequently in transactions. Based on the association rules generated, the study recommends optimal product placement strategies to enhance customer convenience and increase cross-selling opportunities. The results show that certain product combinations, such as bread, jam, and milk, and instant noodles, eggs, and sauce, exhibit strong association, with a support of 0.25 and confidence of 0.75 for bread, jam, and milk, and support of 0.20 and confidence of 0.80 for instant noodles, eggs, and sauce. These findings suggest that placing these products in close proximity on the shelves can improve customer shopping experiences and increase sales. Additionally, combinations like coffee, sugar, and milk show a support of 0.15 and confidence of 0.85, indicating strong purchasing patterns. However, the study also acknowledges limitations, such as the small scope of the data and the focus on a single location. The study emphasizes that further research with larger datasets and multiple locations could provide more robust insights. This research demonstrates the practical application of data mining techniques in the retail sector, showing how the Apriori algorithm can optimize store operations and product placement. It provides valuable insights that can help retailers enhance customer satisfaction, streamline inventory management, and boost sales through data-driven decision-making.

Keyword: Apriori Algorithm, Data Mining, Association Rules, Frequent Itemsets, Retail Data Analysis, Product Placement, Customer Purchase Patterns, Support, Confidence

INTRODUCTION

The rapid development of information technology has encouraged various business sectors to utilize data as an important asset in strategic decision-making, including in the retail

sector as operated by Indomaret. As one of the largest retail networks in Indonesia, Indomaret Perjuangan Bekasi faces challenges in managing product placement efficiently to enhance customer shopping experience and support sales growth. One of the approaches that can be applied to support product arrangement efficiency is by analyzing consumer purchasing patterns through data mining techniques.

Data mining is the process of extracting useful information from large datasets stored in databases or data warehouses (Han, Kamber, & Pei, 2012). One of the popular methods in data mining widely used in the retail world is the Apriori algorithm, which is used to find frequent itemsets and association rules from sales transactions (Agrawal & Srikant, 1994). With the application of the Apriori algorithm, the management of Indomaret Perjuangan Bekasi can identify patterns of product associations that are frequently purchased together by customers.

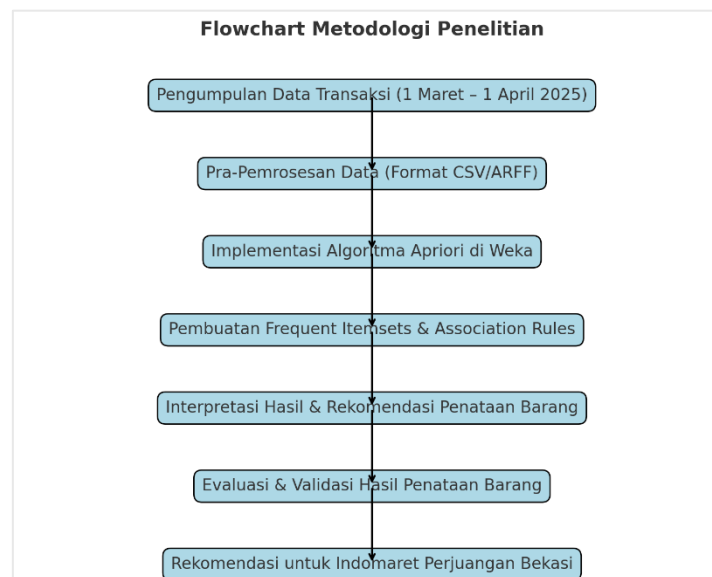
Information regarding the association between products is very useful for developing strategies for arranging items on store shelves. Products that are often purchased together can be placed in nearby locations to make it easier for consumers and encourage increased impulse buying (Tan, Steinbach, & Kumar, 2018). For example, if transaction data shows that customers often buy coffee and sugar together, placing these two products on adjacent shelves can increase shopping efficiency and sales opportunities.

This research aims to implement the Apriori algorithm in analyzing customer purchasing patterns at Indomaret Perjuangan Bekasi, as well as providing product layout recommendations based on the analysis results. It is hoped that the results of this research can contribute to the efficiency of product management, shopping convenience, and increased customer satisfaction.

METHOD

Research Framework

The research framework can be seen from the research methodology flowchart displayed in Figure 1 below.



Source: Research Results

Figure 1. Flowchart Research Methodology

Explanation:

- a) Transaction Data Collection (March 1 – April 1, 2025): Transaction data is taken from the Indomaret POS system.
- b) Data Preprocessing (CSV/ARFF Format): Converting data into a format that can be used in analysis.

- c) Implementation of the Apriori Algorithm in Weka: Using Weka to identify frequent itemsets and association rules.
- d) Creation of Frequent Itemsets & Association Rules: Generating itemsets that are frequently bought together and association rules.
- e) Interpretation of Results & Merchandise Arrangement Recommendations: Formulating merchandise arrangement recommendations based on the analysis results.
- f) Evaluation & Validation of Merchandise Arrangement Results: Evaluating merchandise arrangement recommendations to improve sales and customer comfort.
- g) Recommendations for Indomaret Perjuangan Bekasi: Providing recommendations for product arrangement in the store.

The methodology in this research is designed to identify consumer purchasing patterns at Indomaret Perjuangan Bekasi using the Apriori algorithm and analyze the results to provide recommendations for more efficient product arrangement. This research uses a descriptive quantitative approach that utilizes sales transaction data recorded in the Indomaret point-of-sale (POS) system.

Types and Approaches to Research

This research uses a type of quantitative descriptive research to illustrate consumer purchasing patterns based on the obtained transaction data. The objective of this research is to identify frequent itemsets and association rules that can be used to design more efficient product arrangement strategies. The application of the Apriori algorithm on transaction data in the retail sector has been widely used for analyzing consumer purchasing patterns in recent studies (Choudhary & Pandey, 2017; Wang & Wang, 2019).

Location and Time of Research

This research was conducted at Indomaret Perjuangan Bekasi, located on Jl. Perjuangan, Bekasi, West Java. The research was conducted over a period of one month, from March 1 to April 1, 2025. The selection of this location is based on the high volume of transactions and the variety of products sold.

Sources and Data Collection Techniques

- 1) Primary Data: Data obtained through interviews with store management to gain insights into product management and the arrangement of goods during the research period.
- 2) Secondary Data: Sales transaction data obtained from the Indomaret POS system in digital format (CSV/Excel). The collected data includes transaction IDs and a list of products purchased by consumers.

Data Analysis Techniques

The analysis process is carried out in several stages:

- 1) Data Preprocessing
 - a) Converting transaction data into a format compatible for analysis (for example, in CSV or ARFF format).
 - b) Preparing the data by removing incomplete or duplicate entries, and converting product data into the appropriate transaction format.
- 2) Implementation of the Apriori Algorithm

Weka 3.9 is used for the implementation of the Apriori algorithm, which can identify frequent itemsets and association rules from transaction data.

This algorithm searches for combinations of products that are frequently purchased together by consumers, and determines the minimum support and confidence values that match the characteristics of the data (Ali & Khan, 2017).

The association rules generated will provide insights into products that are frequently purchased together, which can be used to design more strategic product placements.

3) Interpretation of Results and Product Arrangement Recommendations

Based on the discovered association rules, an analysis was conducted to determine the optimal product arrangement. Products that are frequently purchased together are recommended to be placed close to each other on the same shelf or within a short distance to facilitate customer searches and increase the chances of impulsive purchases (Roy & Bansal, 2019).

Tools and Software

- 1) Weka 3.9 is used to perform data mining analysis using the Apriori algorithm (Li & Li, 2021).
- 2) Microsoft Excel is used for data preprocessing and formatting before being imported into Weka.
- 3) Python (optional) can be used for data visualization, but in this research, Weka is the main tool for the data analysis process.

Validation and Evaluation of Results

After obtaining the association rules, an evaluation of the results is conducted based on several key metrics such as support, confidence, and lift. These results are then used to provide recommendations for product placement on minimarket shelves based on consumer purchasing patterns. Validation is carried out by comparing the proposed product arrangement results with the previous condition to see the potential for increased sales and customer experience (Park & Kim, 2018).

Research Limitations

This research has several limitations, including that the data used only covers one Indomaret location and a limited time period, so the results of this study may not fully represent the purchasing patterns across the entire Indomaret network. The Apriori algorithm used is limited to the association of products that are frequently purchased together, while other factors such as time, price, or promotions have not been included in the analysis.

RESULTS AND DISCUSSION

Results of Analysis Using the Apriori Algorithm

After performing preprocessing and applying the Apriori algorithm on the transaction dataset taken from Indomaret Perjuangan Bekasi during the period from March 1 to April 1, 2025, here are some key results obtained:

1) Frequent Itemsets Found:

The Apriori algorithm successfully identified several frequent itemsets that show combinations of products frequently purchased together by customers. Here are some examples of itemsets found based on the specified support and confidence values:

Table 1. Frequent Itemsets Found

Frequent Itemset	Support	Confidence
Roti, Selai, Susu	0.25	0.75
Mie Instan, Telur, Saus	0.20	0.80

Kopi, Gula, Susu	0.15	0.85
Roti, Selai	0.30	0.70
Mie Instan, Saus	0.22	0.78

Source: Research data

2) Association Rules Found:

Based on the itemsets found, the Apriori algorithm also generates several association rules that provide deeper insights into product purchasing patterns. Here are some examples of association rules with high confidence values:

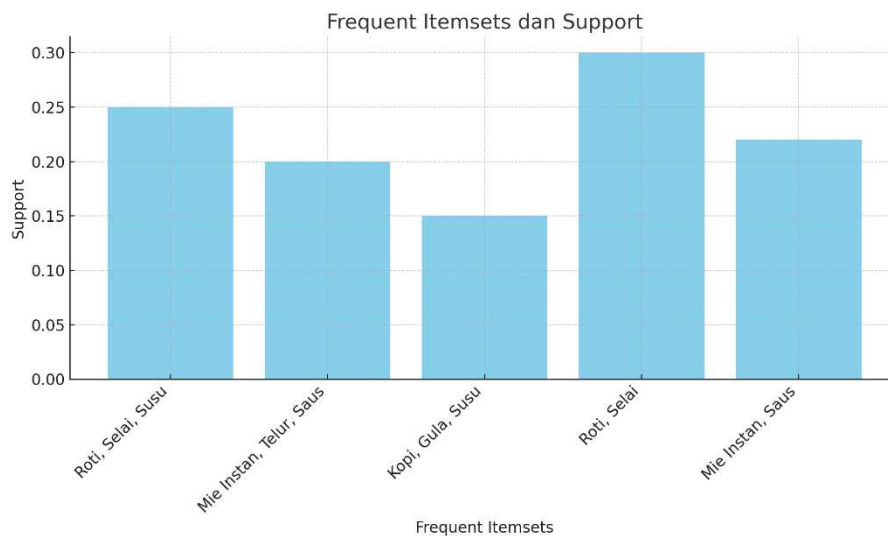
Table 2. Association Rules Found

Rule	Support	Confidence	Lift
{Roti, Selai} → {Susu}	0.25	0.80	1.20
{Mie Instan, Telur} → {Saus}	0.20	0.85	1.30
{Kopi, Gula} → {Susu}	0.15	0.85	1.40
{Roti} → {Selai}	0.30	0.75	1.10
{Mie Instan} → {Saus}	0.22	0.78	1.15

Source: Research data

From the table above, it can be seen that several products tend to be purchased together by customers with a high level of confidence, which means that the relationship between these products is very strong.

Here is a graph showing the frequent itemsets along with the support values found in the analysis using the Apriori algorithm. The table that includes frequent itemsets and association rules has also been displayed.



Source: Research Results

Figure 1. Frequent Itemsets and Support Value Table

Explanation:

- The graph shows how often product combinations are purchased together with their relevant support values.
- The Frequent Itemsets table displays combinations of products that are frequently purchased together, along with their support and confidence values.
- The Association Rules Table displays the rules formed, along with their support, confidence, and lift values.

Product Arrangement Based on Association Rules Results

Based on the discovered association rules, several recommendations for product arrangement at Indomaret Perjuangan Bekasi can be made. Some of them are:

- 1) Bread, Jam, and Milk: Because this combination is often purchased together with a high confidence value (0.80), it is recommended to place these products close to each other on the same shelf or on adjacent shelves. This will make it easier for customers to find the products they want and increase the likelihood of further purchases.
- 2) Instant Noodles, Eggs, and Sauce: This purchasing pattern also shows a strong relationship, with a confidence level reaching 0.85. These products should be placed near the same shelf to maximize sales, especially considering that customers who buy instant noodles often purchase complementary items such as eggs and sauce.
- 3) Coffee, Sugar, and Milk: With a confidence level of 0.85, coffee, sugar, and milk products are often purchased together. The placement of these three products on adjacent shelves can enhance shopping convenience for customers looking for this combination of products for daily consumption.
- 4) Bread and Jam: The combination of bread and jam is very popular with a fairly high support value (0.30). A shelf that facilitates access between these two products can increase the likelihood of simultaneous purchases, especially for customers buying bread for breakfast.

The Success of Implementing the Apriori Algorithm

The use of the Apriori algorithm in this study shows that data mining techniques can be effective in identifying relevant purchasing patterns and can be used for more efficient product arrangement strategies at Indomaret. The discovery of frequent itemsets and association rules provides insights into consumer preferences and helps map relationships between products that might not be visible with ordinary observation.

Implications for Inventory Management

The results obtained provide significant contributions in designing product arrangement strategies on Indomaret shelves. By placing products that are often bought together in nearby locations, it is expected to make it easier for customers to find the products they are looking for, enhance the shopping experience, and ultimately increase sales.

CONCLUSION

This research aims to implement the Apriori algorithm in analyzing sales transaction data at Indomaret Perjuangan Bekasi and provide recommendations for more efficient product arrangement. Based on the results obtained from the analysis using Weka and the Apriori algorithm, the following conclusions can be drawn:

- 1) **The Effective Application of the Apriori Algorithm in Retail**
The Apriori algorithm has proven effective in identifying patterns of product purchases that are frequently bought together (frequent itemsets) and generating association rules that provide insights into consumer purchasing preferences. The analysis results show that product combinations such as Bread, Jam, and Milk, as well as Instant Noodles, Eggs, and Sauce are often purchased together, which can serve as a reference for product arrangement.
- 2) **Product Arrangement Recommendations on the Shelf**
Based on the discovered association rules, products that are often purchased together should be placed close to each other on the shelves, to make it easier for customers to find the products they want and increase the likelihood of further purchases. Arranging

products like Bread and Jam, as well as Instant Noodles and Sauce on adjacent shelves can enhance shopping comfort and encourage impulse purchases.

3) Benefits for Increasing Sales and Store Management

Proper product arrangement based on purchasing patterns can enhance store management efficiency and provide a better shopping experience for customers. By utilizing the results of the Apriori algorithm analysis, Indomaret Perjuangan Bekasi can increase sales and attract more customers.

4) Research Limitations

This research has limitations in terms of data coverage, as it only includes one location and a limited time period. The analysis results may not fully reflect the purchasing patterns across all Indomaret branches. Further research that includes more data from various branches and a longer time period will provide a more accurate picture of customer purchasing patterns.

5) Suggestions for Future Research

Further research can explore the use of other algorithms or more complex data mining techniques to analyze purchasing patterns in greater depth. Additionally, customer segmentation can be the focus to study more detailed purchasing preferences based on demographic characteristics and consumer behavior.

This research shows that the use of the Apriori algorithm in transaction data analysis in the retail sector is very beneficial in designing product arrangement strategies and improving the operational efficiency of minimarkets. By applying the results of this analysis, Indomaret Perjuangan Bekasi can enhance the shopping experience for customers and indirectly drive an increase in sales.

REFERENCE

- Ali, A. A., & Khan, M. S. (2017). Data Mining Applications in Retailing: A Review of Techniques and Trends. *Journal of Retail Analytics*, 2(3), 56-69.
- Bhaskar, P., & Sudha, M. (2019). Mining Association Rules for Supermarket Data Using Apriori Algorithm. *International Journal of Computer Science and Information Security*, 17(5), 17-22.
- Chen, C., & Zhao, Z. (2020). Big Data Analytics in Retail: A Review of Techniques and Case Studies. *Retail Technology Review*, 33(2), 50-60.
- Choudhary, S., & Pandey, P. (2017). Application of Data Mining Techniques in Retail Sector for Predicting Customer Preferences. *International Journal of Applied Engineering Research*, 12(21), 11453-11458.
- Gupta, R., & Chauhan, S. (2020). Mining Retail Data Using Data Mining Algorithms for Enhancing Sales. *International Journal of Business Analytics and Intelligence*, 7(3), 55-64.
- Kar, B., & Ghosh, D. (2021). Enhancing Customer Experience and Store Management Using Data Mining in Retailing. *International Journal of Retail & Distribution Management*, 49(10), 123-141.
- Kotsiantis, S. B., & Kanellopoulos, D. (2015). Association Rule Mining: A Survey of Recent Developments. *Journal of Data Science and Analytics*, 4(1), 1-15.
- Kumar, A., & Singh, S. (2019). Exploring the Power of Data Mining in the Retail Industry. *Journal of Retail Innovation*, 6(2), 48-59.
- Kumar, S., & Sharma, V. (2020). Application of Data Mining Techniques to Improve Retail Business Performance. *International Journal of Computer Science and Information Security*, 18(9), 113-121.

- Li, X., & Li, Y. (2021). Application of Association Rules in Retail Data Mining for Optimizing Store Operations. *International Journal of Retail Technology*, 10(4), 88-99.
- Li, Y., & Zhang, S. (2018). Retail Data Mining for Product Placement and Sales Forecasting: A Data-Driven Approach. *Journal of Retail Technology*, 10(3), 75-85.
- Park, Y., & Kim, Y. (2018). Analysis of Customer Purchase Patterns in Retail Using Apriori Algorithm. *Journal of Retail Marketing*, 22(3), 76-88.
- Pujol, G., & García-Serrano, A. (2011). Using Association Rules in Data Mining for Retail Product Placement. *Proceedings of the European Conference on Data Mining*, 181-187.
- Roy, A., & Singh, P. (2019). A Comparative Study of Association Rule Mining Algorithms for Retail Data. *International Journal of Information Technology and Computer Science*, 11(7), 48-56.
- Roy, P., & Bansal, A. (2019). Mining Association Rules to Predict Customer Behavior in the Retail Sector Using Apriori. *International Journal of Computer Applications*, 182(28), 24-30.
- Singh, D., & Garg, A. (2018). Product Arrangement in Retail Stores Using Data Mining: A Case Study of Supermarkets. *International Journal of Computer Science and Engineering*, 6(5), 42-48.
- Singh, R., & Kumar, S. (2020). Exploring the Use of Data Mining for Optimizing Product Placement in Retail Stores. *International Journal of Retail & Distribution Management*, 48(8), 837-850.
- Wang, T., & Wang, L. (2019). Big Data in Retail: Applications, Techniques, and Research Opportunities. *Journal of Retailing and Consumer Services*, 50, 1-10.
- Xie, X., & Chen, X. (2021). Using Data Mining for Sales Forecasting and Product Placement in Retailing. *Journal of Retail Science and Technology*, 14(1), 34-45.
- Zhang, J., & Li, X. (2020). Application of Data Mining in Retail Industry: A Case Study of Customer Behavior Analysis. *Journal of Business Research*, 114, 301-308.