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Implementation of Apriori Algorithm on Wet Cake Sales

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ABSTRACT

This research implements the Apriori algorithm on wet cake sales data to identify frequent purchase patterns. In an era of intense business competition, efficient inventory management and sales strategies are essential, especially for perishable products. Daily sales data is analyzed using a quantitative approach, focusing on support and confidence as the main parameters. The analysis results show product combinations that are often bought together, such as {Bolu Pisang, Martabak}, with a support value of 42.86% and confidence of 75.00%. The findings provide valuable insights for designing marketing and stock management strategies, which can improve business competitiveness and sustainability. This research also encourages the application of similar techniques in other business sectors to improve operational efficiency.

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1. INTRODUCTION

The use of information technology to aid in decision-making is critically needed in a time of heightened corporate competitiveness. Due to its perishable nature and strong demand, the wet cake sales sector necessitates rigorous inventory and sales strategy management. Daily sales data recording has the ability to yield important information if handled properly. The Apriori Algorithm is one method for identifying high frequency patterns. Items in a database that exhibit high frequency patterns are those whose frequency or support exceeds a threshold known as minimal support [1][2]. One of the algorithms used in data mining, a procedure for gleaning valuable information from large amounts of data, is the apriori algorithm [3][4][5]. In data mining there are many methods, including association, clustering, and classification. [6][7][8].

This research aims to implement the Apriori algorithm on wet cake sales data to identify frequent purchase patterns. With this insight, businesses can optimize product offerings, design targeted promotions, and manage stock efficiently. In addition, this research also evaluates the application of Apriori algorithm in the context of wet cake sales which has unique challenges compared to other products [9]. Through this implementation, it is hoped that businesses can improve their competitiveness and business sustainability and inspire other business sectors to utilize data mining to support strategic decision making. The application of the Apriori algorithm in the context of wet cake sales enables the analysis of purchase patterns and interrelationships between items in transaction data. By using minimum support and confidence as parameters, the analysis results can provide more effective promotion recommendations. Previous research shows that the use of Apriori algorithm can help in determining the combination of products that are often purchased together, so that companies can design better marketing strategies.

Research conducted by [10] shows that the Apriori algorithm is effective for analyzing shoe sales data. The data collected over several months showed that the shoes most demanded by consumers were New Balance with a sales percentage of 91.67%, followed by shoes 1 (75%), shoes 2 (50%), shoes 3 (41.67%), and shoes 4 (41.67%). The analysis also shows a transaction pattern where New Balance buyers tend to buy Adidas, and vice versa. Using support and confidence values, the research retains item combinations that have a minimum support of 30%. Research conducted by [11] discusses the application of the Apriori algorithm to analyze drug purchase patterns at Ashari Farma Pharmacy. This research aims to find combinations of items that are often purchased

together by consumers, which can help pharmacies make decisions regarding stock arrangements and marketing strategies. From the analysis conducted, several frequently purchased drug combinations were found, such as Sterile Gauze and Rivanol 100 ml, with a support value of 1.13% and confidence of 66.67%. In addition, the combination of Rivanol 100 ml and Sterile Gauze has a support of 1.13% and a confidence of 100%.

Research conducted by [12] discusses utilizing the Apriori algorithm for data mining in order to enhance drug sales trends at the Pusaka Arta Pharmacy. The results showed that by using a minimum support value of 20% and a minimum confidence of 50%, the algorithm successfully identified several itemsets that passed, such as combinations of drugs that are often purchased together. This provides valuable insights into drug sales patterns, which can be used to improve marketing strategies and stock management. Research conducted by [13] This article discusses the application of the Apriori algorithm to sales data at Barbar Warehouse, an online retailer that sells fashion products and baby needs. This research aims to analyze sales patterns to find out the most sold product categories. The analysis results show that the most sold products are bedding and watch categories, with support and confidence values reaching 100% each. With this information, the owner of Barbar Warehouse can optimize stock management to increase sales.

2. METHOD

This study used a quantitative approach consisting of four main steps. First, wet cake sales data was collected from various sources such as daily transaction records or point-of-sale (POS) systems that included information on the type of cake, purchase amount and transaction time. Second, the data was exploratively analyzed and visualized to reveal basic transaction patterns and sales trends. Next, the processed data is processed identifying association patterns with the Apriori algorithm between frequently purchased products together[14] . In this stage, parameters such as support, confidence, and lift are used to filter out the most relevant association rules. Finally, the analysis results are evaluated to ensure the patterns found are valid and applicable. These patterns are then integrated into business intelligence strategies, including stock management, product bundling offers, and promotion placement to improve operational efficiency and support strategic decision-making in the wet cake business.

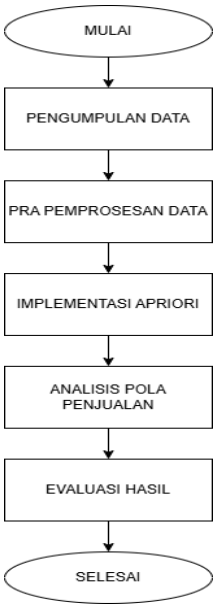

Figure 1. research stages

In the initial stage, wet cake sales transaction data was obtained from various sources, including the cashier system and the store database. The information collected includes the date of the transaction, the list of products purchased, and the number of items sold. The accuracy and completeness of the data is very important as this data becomes the foundation of the subsequent analysis. The next stage after data collection is to get the data ready for analysis using the Apriori algorithm. This preparation includes transforming the transaction data into a suitable format, which is a collection of product items purchased in each transaction. This step aims to ensure that the data is ready to be optimally processed so that it can generate relevant and useful insights for the wet cake business. The Apriori algorithm is applied to identify combinations of products that are often purchased together, known as frequent itemsets. This analysis utilizes two main metrics: Support and Confidence. [15]

Support describes how often a particular product combination appears in the overall transaction data. The basic formulas used in the Apriori algorithm include:

$$Suport\ (A) = \frac{\sum jumlah\ transaksi\ mengandung\ A}{total\ transaksi} * 100\%$$

Confidence in the Apriori algorithm is a metric used to measure how much confidence or reliability an association rule is generated. Here is the formula:

$$confidence\ (A \rightarrow B) = \frac{confidence\ (A \rightarrow B)}{suport\ (B)} * 100\%$$

Lift is used to measure the extent of relatedness between two items in an association rule compared to the expected relatedness if the two items are independent of each other. Lift formula:

$$lift\ (A \rightarrow B) = \frac{confidence\ (A \rightarrow B)}{support\ (B)} * 100\%$$

Frequent itemsets and association rules obtained from the Apriori algorithm are then further analyzed to explore the purchasing patterns of wet cake customers. Combinations of cakes that are often purchased together are evaluated with metrics such as lift ratio to find important relationships between the products. The results of this analysis can be used to design more effective business strategies, such as creating promotional package offers for wet cakes or arranging the layout of goods in the store to make it more attractive to customers. By doing so, the information obtained will help business managers make more targeted decisions and increase customer satisfaction. In addition, this analysis provides deeper insights into consumer preferences for wet cakes, which can be utilized to increase sales. After the analysis is done, an evaluation also needs to be done to measure the quality of the association rules and how effective they are, for example in terms of their impact on sales conversion or increased profits. This evaluation is very important so that the research results can be properly applied in the management of the wet cake business. With proper evaluation, businesses can ensure that the resulting strategies are actually delivering benefits. It also helps to adjust the strategy to better suit evolving market needs and consumer behavior.

3. RESULTS AND DISCUSSION

Wet cake sales data is taken on a daily basis. In this study, the data was taken for two weeks, then the data was written in tabular form to facilitate the process of identifying purchasing patterns. A table of sales transaction data is shown below :

Table 1. sales transaction

No.	Transaction Date	Purchased Items
1	5/12/2024	Apem, martabak, banana sponge cake
2	6/12/2024	Cupcakes, apem, pukis
3	7/12/2024	Cupcakes, martabak, lemper
4	8/12/2024	Lemper, banana sponge cake, pukis
5	9/12/2024	Banana cake, martabak, lemper, apem
6	10/12/2024	Cupcakes, banana sponge cake, pukis, martabak
7	11/12/2024	Cupcakes, pukis, lemper
8	12/12/2024	Lemper, apem, pukis
9	13/12/2024	Cupcakes, apem, martabak
10	14/12/2024	Martabak, banana sponge cake, lemper
11	15/12/2024	Lemper, apem, banana sponge cake, martabak
12	16/12/2024	Cupcakes, lemper, apem, pukis
13	17/12/2024	Martabak, pukis
14	18/12/2024	Cupcake, banana sponge, epem

The presentation of furniture sales transaction data in tabular form provides a well-organized structure, making it easier to analyze purchasing patterns. With this format, the frequency of product sales can be more easily identified, and data management becomes more efficient. This tabular format also facilitates the application of the Apriori algorithm in analyzing transaction data, so that the analysis results can support a more focused business intelligence strategy. The following is a tabular format table of transaction data:

Tabel 2. Tabular format

Day	Cupcakes	Banana sponge cake	lemper	apem	Martabak	pukis
1	0	1	0	1	1	0
2	1	0	0	1	0	1
3	1	1	1	1	1	0
4	0	1	1	0	0	1
5	0	1	1	1	1	0
6	1	1	0	0	1	1
7	1	0	1	0	0	1
8	0	0	1	1	0	1
9	1	0	0	1	1	0
10	0	1	1	0	1	0
11	0	1	1	1	1	0
12	1	0	1	1	0	1
13	0	0	0	0	1	1
14	1	1	0	1	0	0
Total	**7**	**8**	**8**	**9**	**8**	**7**

3.1. 1 itemset

Based on the tabular format table provided, the next step is the formation of itemset 1 (C1) using a minimum support value of 30%.

Table 3. 1 itemset

Item	frequency	Support%	status
Cupcakes	7	7/14 = 50,00%	Escaped
Banana cakes	8	8/14 = 57,14%	Escaped
Lemper	8	8/14 = 57,14%	Escaped
Apem	9	9/14 = 64,29%	Escaped
Martabak	8	8/14 = 57,14%	Escaped
Pukis	7	7/14 = 50,00%	Escaped

3.2. 2 itemset

Next step is to form itemset 2 (C2), which involves combining each pair of items from itemset 1 (C1). By figuring out how frequently each pair of goods appears in the transaction data, and then figuring out the support. The following table shows the calculation results for itemset 2 (C2):

Tabel 4. 2 itemset

Item	frequency	Support%	status
Cupcakes, banana cake	3	21,43%	Not passed

Cupcake, Lemper	3	21,43%	Not passed
Cupcakes, Apem	5	35,71%	Escaped
Cupcakes, Martabak	3	21,43%	Not passed
Cupcakes, Pukis	4	28,57%	Not passed
Banana cake, Lemper	5	35,71%	Escaped
Banana cake, Apem	5	35,71%	Escaped
Banana cake, Martabak	6	42,86%	Escaped
Banana cake, Pukis	2	14,29%	Not passed
Lemper, apem	5	35,71%	Escaped
Lemper martabak	4	28,57%	Not passed
Lemper, Pukis	4	28,57%	Not passed
Apem, martabak	5	35,71%	Escaped
Apem, pukis	3	21,43%	Not passed

3.3. confidence value

The next step in this process is to calculate confidence with a minimum limit of 70%. The purpose of this step is to measure the strength of the relationship between items in an association rule, where a higher confidence value indicates a stronger relationship. Rules that successfully reach or exceed this minimum confidence value will be declared as valid association rules.

Table 5. Confidence value

Itemset	Frequency A	Frequency B	Confidence (A → B)	Confidence (B → A)	Status
Kue Mangkok, Apem	7	9	71,43%	55,56%	Not passed
Banana Cake, Lemper	8	8	62,50%	62,50%	Not passed
Banana cake, Apem	8	9	62,50%	55,56%	Not passed
Banana Cake, Martabak	8	8	75,00%	75,00%	escaped
Lemper, Apem	8	9	62,50%	55,56%	Not passed
Apem, Martabak	9	8	55,56%	62,50%	Not passed

3.4. passing confidence score

The following table illustrates 2-itemset or C2 combinations that meet the minimum requirements of 30% support and 70% confidence. This step aims to filter and retain only those itemset combinations that have strong and relevant associations. This is important for deeper analysis to uncover significant purchasing patterns.

Table 6. Passing confidence score

itemset	frequency	Support (%)	Confidence (A → B)	Confidence (B → A)	elevator
Banana cake, martabak	6	42,86%	75,00%	75,00%	01.05

4. CONCLUSION

The Apriori algorithm was effectively applied in this study to evaluate wet cake sales data, allowing for the discovery of recurring purchasing trends. Frequent itemsets are collections of products that are frequently bought together as a result of this study. Support and confidence are the primary analysis characteristics that are used to filter and assess the degree of product relationship. With a support value of 42.86% and a confidence level of 75.00% for both directions of association, the analysis's findings indicate that some product combinations have substantial relationships. One such combination is {Bolu Pisang, Martabak}. This data suggests that the two goods are frequently bought together, which presents a chance to create integrated promotions or bundle offer tactics to boost sales. Evaluation of the quality of association rules and their effectiveness in a business context shows that the application of data mining using the Apriori algorithm can generate relevant insights to support strategic decision-making, especially in stock management and promotion design. The findings also encourage the application of similar techniques in other business sectors to improve operational efficiency and competitiveness. Therefore, the application of the Apriori algorithm in the wet cake sales sector helps companies create more successful sales tactics and offers a greater understanding of customer preferences, both of which eventually assist the sustainability and expansion of the firm.

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