

Purchase Pattern Analysis on Komol Kopi Transaction Data Using Apriori Algorithm

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ABSTRACT

This research aims to analyze purchasing patterns in Komol Kopi transaction data using the Apriori algorithm. This algorithm enables the discovery of relationships between items in large datasets that can be used to support business decisions, such as bundling promotions and inventory management. The dataset includes 12 transactions with various combinations of items, such as Kopi Hitam, Kopi Tubruk, and Nasi Telur. The analysis results show some significant purchase patterns with high support, confidence, and lift values. An example of an association found is between Kopi Hitam and Es Teh, which provides insights for more effective marketing strategies. This study confirms that the Apriori algorithm is an efficient tool in unearthing purchasing patterns, providing a solid foundation for the development of data-driven business strategies. Further research can integrate this analysis with recommendation systems to improve customer experience.

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1. INTRODUCTION

Advances in information technology have brought significant changes in various aspects of life, including in the management of transaction data in retail businesses. Komol Kopi, as one of the businesses in the culinary field, has transaction data that can be processed to find customer purchasing patterns. Analysis of these purchasing patterns can be used to optimize marketing strategies and inventory management. One method that can be used to analyze these patterns is the Apriori algorithm. This algorithm is effective in finding relationships between items in large-scale datasets. This research aims to identify frequent purchase patterns in Komol Kopi using the Apriori algorithm. Previous research shows that this algorithm is successfully applied in various fields, such as retail transaction analysis [6], marketing strategy optimization [11], and sales improvement [8].

This research is based on a dataset that includes purchase items such as Kopi Hitam, Kopi Tubruk, Kopi Ijo, Es Teh, Nasi Telur, Mie Goreng, and Mie Kuah, which is similar to previous studies on the application of data mining to analyze consumer shopping patterns [14][15]. In addition, the utilization of the Apriori algorithm has been proven to assist in data-driven decision-making processes, such as determining promotional strategies, product placement, and stock management [9]. This analysis can provide a competitive advantage for Komol Kopi, especially in the face of increasingly fierce competition in the food and beverage industry.

By understanding customer purchasing patterns, Komol Kopi can identify relationships between products that are often purchased together. These insights can be leveraged to improve customer satisfaction through personalized offers and product bundling strategies. Therefore, this research is expected to make a significant contribution to the development of data-driven business strategies for Komol Kopi.

2. METHOD

In order to deeply understand customer buying patterns, a structured and data-driven approach is required. Analyzing these buying patterns is essential to help businesses identify customer needs, improve operational efficiency, and devise more effective sales strategies. Therefore, this research utilizes the Apriori algorithm as the main tool to explore the relationship between products that are often purchased together. This approach not only focuses on pattern identification, but also aims to provide strategic recommendations based on the processed transaction data.

In this research, the approach used to analyze customer purchase patterns is the Apriori algorithm, a technique in data mining designed to find relationships between items in transaction data. This method is used because of its ability to identify frequent purchase patterns and generate association rules that can be applied to business strategies..

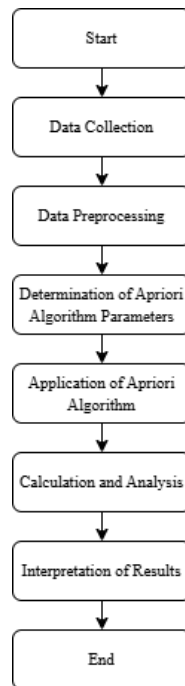


Figure 1. Research Methodology

This method involves several main stages, namely:

1. **Start** : The first step in starting the analysis process is setting the goal of analyzing customer purchasing patterns.
2. **Data Collection** : Transaction data is collected from relevant sources, such as sales databases, to form an initial dataset. At this stage, all information regarding the products purchased together by the customer is documented.
3. **Data Preprocessing** : The data that has been collected is processed to ensure quality and appropriate format. This includes steps such as cleaning data from errors or empty values, organizing data in tabular format, and coding items to facilitate analysis.
4. **Determination of Apriori Algorithm Parameters** :Parameters such as minimum support and minimum confidence are determined. Minimum support is the threshold for identifying frequently occurring itemsets, while minimum confidence determines the strength of the relationship between items.
5. **Application of Apriori Algorithm** : The Apriori algorithm is applied to the dataset to search for itemsets that frequently appear (frequent itemsets) based on predetermined parameters. This itemset is then used to generate association rules.
6. **Calculation and Analysis** : Support, confidence and lift values are calculated to evaluate the quality of the resulting association rules. This analysis helps identify significant buying patterns.

7. Interpretation of Results :The results of the analysis are interpreted to develop strategic recommendations, such as product promotion strategies, bundling, or more efficient stock management.
8. End : The analysis process is complete after all results are analyzed and recommendations are prepared.

2.1 Dataset

The dataset used in this research is Komol Kopi's transaction data over a certain period. The dataset contains information on the items purchased in each transaction, which includes details of purchases from various customers at a certain time.

Table 1. Flower Sales Transaction Data

Transaksi	Item
T1	Kopi Hitam, Es Teh
T2	Kopi Hitam, Nasi Telor
T3	Kopi Tubruk, Mie Goreng
T4	Kopi Hitam, Es Teh, Mie Goreng
T5	Kopi Tubruk, Kopi Hijau
T6	Kopi Hijau, Mie Kuah
T7	Kopi Hitam, Es Teh, Nasi Telor
T8	Kopi Tubruk, Es Teh
T9	Kopi Hitam, Mie Goreng
T10	Kopi Hijau, Mie Kuah, Nasi Telor
T11	Kopi Tubruk, Es Teh, Kopi Hitam
T12	Kopi Hijau, Es Teh, Nasi Telor

2.2 Analysis Process

The method used in this research follows the approach that has been applied in several previous studies.

1. Data Preprocessing : Cleaning transaction data from errors and irrelevant data.
2. Application of Apriori Algorithm : Using software such as Python with mlxtend library to apply Apriori algorithm.
3. Parameter Determination : Determining the minimum support and minimum confidence values based on previous research recommendations.
4. Interpretation of Results : Analyzing the resulting purchasing patterns and evaluating their relevance to Komol Kopi's business strategy.

2.3 Apriori Algorithm Calculation

This section will describe the calculation steps in the Apriori algorithm which include data tabulation, calculation of support, confidence, and lift. These steps are used to identify significant purchase patterns in the Komol Kopi dataset.

Table 2. Tabulation of Transaction Data

Transaksi	Kopi Hitam	Es Teh	Nasi Telor	Kopi Tubruk	Mie Goreng	Kopi Hijau	Mie Kuah
T1	1	1	0	0	0	0	0
T2	1	0	1	0	0	0	0
T3	0	0	0	1	1	0	0
T4	1	1	0	0	1	0	0
T5	0	0	0	1	0	1	0
T6	0	0	0	0	0	1	1
T7	1	1	1	0	0	0	0
T8	0	1	0	1	0	0	0

T9	1	0	0	0	1	0	0
T10	0	0	1	0	0	1	1
T11	1	1	0	1	0	0	0
T12	0	1	1	0	0	1	0

Before starting the calculation steps, it is important to understand that each metric in the Apriori algorithm—support, confidence, and lift—works to identify and evaluate relationships between items in the dataset.

Calculating Support:

$$\text{Formula: } \text{Support} (X \rightarrow Y) = \frac{\text{Number of transactions containing } X \text{ and } Y}{\text{Total Transaction}}$$

Calculating Confidence:

$$\text{Formula: } \text{Confidence} (X \rightarrow Y) = \frac{\text{Support}(X \rightarrow Y)}{\text{Support}(X)}$$

Calculating Lift:

$$\text{Formula: } \text{Lift}(X \rightarrow Y) = \frac{\text{Confidence}(X \rightarrow Y)}{\text{Support}(Y)}$$

Combination of 2 Itemset

After calculating the support, confidence, and lift for each itemset, the next step is to analyze the combination of frequently occurring itemsets. This combination provides an overview of the relationship between products that is most relevant for business strategy.

In this section, the frequently occurring itemset combination will be analyzed based on its support value. The results of this analysis will help in identifying the relationship between the most significant items in the transaction.

Table 3. Results of 2 item combinations

Itemset	Support
Kopi Hitam, Es Teh	0.25
Kopi Hitam, Mie Goreng	0.17
Kopi Tubruk, Es Teh	0.17

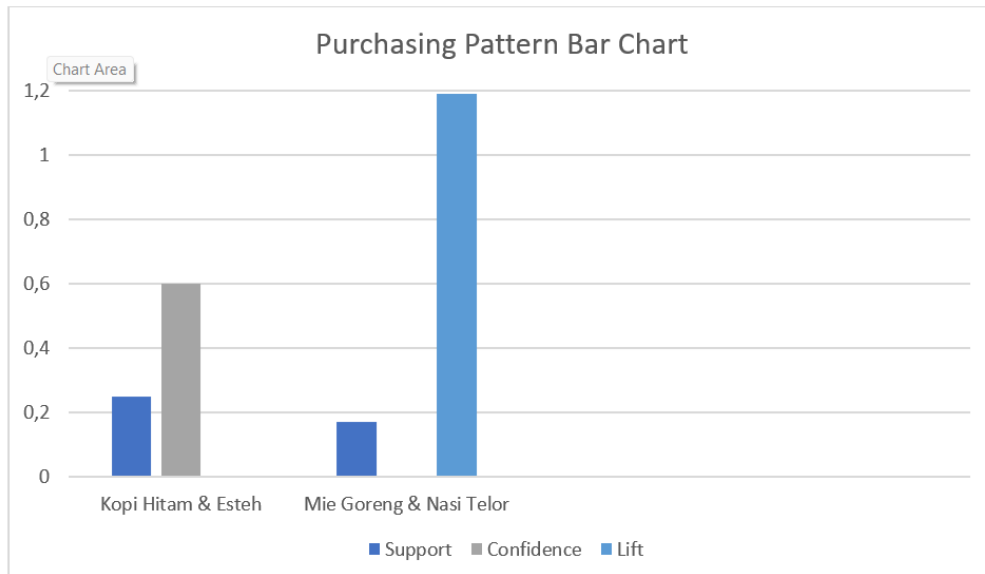
2.4 Association Rule Metrics

The application of the Apriori algorithm involves the use of metrics such as support, confidence, and lift, which have previously been proven effective in purchasing pattern analysis [6][8]. Support measures the proportion of transactions that contain a particular itemset, while confidence and lift are used to evaluate the strength of association between items [4].

3. RESULTS AND DISCUSSION

The results of the analysis show some frequent purchasing patterns at Komol Kopi. For example, there is a strong association between the purchase of “Kopi Hitam” and “Es Teh”, with a support value of 0.25 and a confidence of 0.6. Another pattern found is the association between “Mie Goreng” and “Nasi Telur”, with a support of 0.17 and a lift of 1.19. This relationship shows a significant link between the two items, providing important insights in strategizing promotion and inventory management.

To visualize these patterns, the following bar chart illustrates the support, confidence and lift values of each association found:



Support depicts how often the combination of items appears in the overall transaction, while confidence indicates the likelihood of purchasing one item followed by another. Lift, on the other hand, indicates how strong the association between items is compared to random chance.

The relationship between “Kopi Hitam” and “Es Teh” has a high confidence, thus indicating great potential for bundling promotions. Meanwhile, the significant lift value in the relationship between “Mie Goreng” and “Nasi Telur” indicates an opportunity to increase sales by placing the two items in close proximity. By understanding these patterns, Komol Kopi can optimize promotional strategies through product bundling and improve the efficiency of inventory management..

4. CONCLUSION

This research successfully identifies customer purchasing patterns using the Apriori algorithm to provide strategic insights for businesses. By analyzing transaction data, relationships were found between products that are often purchased together by customers. This allows business managers to devise sales strategies, such as product bundling or promotions, that are more effective.

The analysis results show that the Apriori algorithm is very useful in identifying frequent itemsets and generating relevant association rules. For example, certain products that are frequently purchased together can be used as a basis for optimizing stock management and improving customer experience. In addition, by utilizing visualization of the analysis results, data interpretation becomes easier, so business decisions can be made in a more informed manner.

Overall, this research emphasizes the importance of applying data mining techniques in processing transaction data to generate insights that can be directly applied to business strategies. This approach can serve as a reference for further research or implementation in different contexts.

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