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The Implementation of the apriori algorithm to increase sales of clothing stores based on purchase patterns

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ABSTRACT

In the growing digital era, retail industries face significant challenges and opportunities. Clothing stores, as one type of retail industry, need to adapt to changes in consumer behavior that are increasingly complex. With the increasing variety of choices and easy access to information, understanding customer purchasing patterns is key to gaining a competitive advantage. Purchasing patterns reflect consumer preferences, not only that but can also reveal something hidden that if analyzed properly, can be utilized for a more effective marketing strategy. By applying a data-driven approach, it is hoped that clothing stores can formulate more targeted marketing strategies, improve customer satisfaction, and ultimately, drive sustainable sales growth. This research approach is exploratory quantitative, which aims to find customer purchase patterns from clothing store transaction data using the Apriori algorithm. The results of data exploration are used to develop data-based sales strategies.

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1. INTRODUCTION

In the growing digital era, retail industries face significant challenges and opportunities. Clothing stores, as one type of retail industry, need to adapt to changes in consumer behavior that are increasingly complex. With the increasing variety of choices and easy access to information, understanding customer purchasing patterns is key to gaining a competitive advantage."[1][15]. One of the main challenges is how to utilize the growing amount of transaction data to identify buying patterns that can be used as a basis for decision-making. Without an effective data-driven strategy, apparel stores risk missing opportunities to increase sales and maintain customer loyalty[14].

Purchasing patterns reflect consumer preferences, not only that but can also reveal something hidden that if analyzed appropriately, can be leveraged for more effective marketing strategies. Thus the Apriori algorithm emerged as a promising analytical tool[2] . This algorithm is able to identify relationships between products based on transaction data, providing deep insights into the interrelationships between items purchased by customers.Indexing and abstracting services depend on the accuracy of the title, extracting from it keywords useful in cross-referencing and computer searching. An improperly titled paper may never reach the audience for which it was intended, so be specific.

However, the application of the Apriori algorithm to analyze purchasing patterns is still rarely done by clothing stores, especially small to medium-sized stores. Most of the related research is still focused on the supermarket sector or large e-commerce.In fact, clothing stores have unique purchasing pattern characteristics, such as seasonal trends, product variations, and customer lifestyle preferences, which can be a great opportunity if managed with a data-driven approach [3]. By applying a data-driven approach, it is expected that clothing stores can formulate more targeted marketing strategies, improve customer satisfaction, and ultimately, drive sustainable

sales growth[4].This research not only contributes to the development of science in the field of business intelligence and informatics engineering, but also provides practical guidance for retail industry players to transform towards the data-driven era.

2. METHOD

Explaining research chronological, including research design, research procedure (in the form of algorithms, Pseudocode or other), how to test and data acquisition [5]–[7]. The description of the course of research should be supported references, so the explanation can be accepted scientifically [2], [4]. Figures 1-2 and Table 1 are presented center, as shown below and cited in the manuscript [5], [8]–[13]. Figure 2(a) shown response for return loss and and Figure 2(b) shown response for insertion loss of SIW resonator.

This research approach is exploratory quantitative, which aims to find customer purchase patterns from clothing store transaction data using the Apriori algorithm. The results of data exploration are used to develop data-based sales strategies [5].

This research was conducted through several systematic stages to ensure valid and relevant analysis.

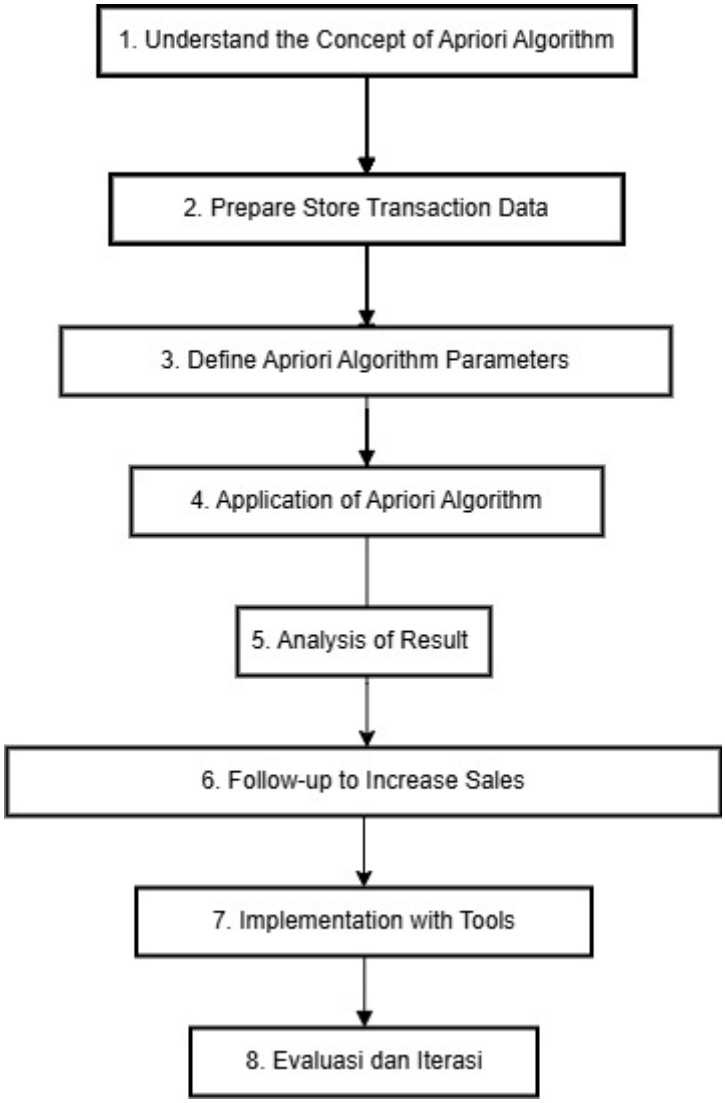

Figure 1. Research Methodology

The following is an outline explanation of the flowchart for applying the Apriori algorithm to increase clothing store sales based on purchasing patterns:

1. **Understand the Concepts of the Apriori Algorithm**: Understand the basic theory of the Apriori algorithm, which is used to find patterns of associations or relationships between frequently purchased products.

2. **Prepare Store Transaction Data:** Collect customer transaction data, which contains information on the products purchased in each transaction.
3. **Define a priori algorithm parameters:** specify the minimum support and confidence values that will be used in the algorithm to find relevant patterns.
4. **Application of a priori algorithm:** Apply algorithms to find frequent itemsets and association rules from transaction data.
5. **Outcome Analysis:** Evaluate the association rules found to identify significant buying patterns.
6. **Follow-up to Increase Sales:** Based on the patterns found, create sales strategies such as bundling products or giving discounts to increase sales.
7. **Implementation with Tools**: Use a tool or programming language (such as Python) to run a priori algorithms and get analysis results.
8. **Evaluation and Iteration**: Evaluate results and make adjustments as needed to improve the effectiveness of the sales strategy.

Here is an example of a table of purchase data for one month that can be used in analysis with the Ari algorithm. This data records purchase transactions made by customers at clothing stores over a period of one month, with each transaction containing the products purchased[12].

Table 1. Transaction ID Date of Purchase Purchased Products

Transaction ID	Date of Purchase	Purchased Products
1	2024-12-01	T-shirts, jeans, shoes
2	2024-12-02	Jackets, Sweaters
3	2024-12-03	Chaos, Celana Jeans
4	2024-12-04	Trousers, Shoes, T-Shirts
5	2024-12-05	Jackets, Jeans
6	2024-12-06	Kaos, Sweater
7	2024-12-07	Jeans, Shoes
8	2024-12-08	Jackets, T-shirts, Trousers
9	2024-12-09	Sweaters, Shoes
10	2024-12-10	T-shirts, jeans, sweaters
11	2024-12-11	Jackets, T-shirts
12	2024-12-12	Trousers, T-shirts, Shoes
13	2024-12-13	Jackets, Jeans, Sweaters
14	2024-12-14	Trousers, T-shirts
15	2024-12-15	T-shirts, shoes, sweaters
16	2024-12-16	Jackets, Jeans, Sweaters
17	2024-12-17	Trousers, Shoes
18	2024-12-18	Chaos, Celana Jeans
19	2024-12-19	Jacket, Sweater, Sepat
20	2024-12-20	Trousers, T-shirts
21	2024-12-21	Jackets, Trousers
22	2024-12-22	T-shirts, shirts
23	2024-12-23	Jacket
24	2024-12-24	T-shirts, shoes
25	2024-12-25	Shirts, trousers
26	2024-12-26	Shoes, t-shirts
27	2024-12-27	Shoe
28	2024-12-28	Sweaters, t-shirts. Shirt
29	2024-12-29	Jackets, t-shirts, shoes
30	2024-12-30	Jeans, shoes, t-shirts

Table Description:

- Transaction ID: A unique number that identifies each transaction.
- Purchase Date: The date when the transaction was made.
- Products Purchased: A list of products purchased in the transaction. Each product is separated by a comma.

This table shows the various combinations of products purchased by customers in each transaction. For example:

- Transaction 1 (2024-12-01) records the purchase of T-shirts, Jeans, and Shoes by customers.
- Transaction 5 (2024-12-04) contains the purchase of Jackets and Jeans.
- Transaction 10 (2024-12-08) recorded the purchase of T-shirts, Jeans, and Sweaters.

This data can be used in a priori algorithms to find association rules that can improve sales strategies, such as which products are frequently purchased together, so that stores can offer product bundling or related promotions[6].

3. RESULTS AND DISCUSSION

The transaction data used in this study includes transactions that occurred within a 30-day period at a clothing store. Each transaction contains a list of products purchased by the customer. This data is processed to find frequent buying patterns, using a priori algorithm[7]. This data is then processed to find association rules using a priori algorithm with **minimum support parameters** of 0.1 and **minimum confidence** 0.7[8].

3.1. Results of the Implementation of the Apriori Algorithm

Table 2. Rules

Rules of Association	Support	Confidence	Elevator	Interpretation
Rule 1: If a customer buys jeans, they buy a t-shirt.	0,12	0,80	1,2	12% of transactions involve the purchase of jeans and t-shirts. 80% of customers who buy jeans also buy t-shirts.
Rule 2: If a customer buys a winter jacket, they buy a sweater.	0,09	0,75	1,5	% of transactions involve the purchase of winter jackets and sweaters. 75% of customers who buy winter jackets also buy sweaters.
Rule 3: If a customer buys a sports shoe, they	0,10	0,85	1,4	10% of transactions involve the purchase of sports shoes and sports shirts. 85% of customers

3.2. Discussion

3.2.1. Rule 1: Jeans and T-Shirt

- Interpretation: The first rule shows that customers who buy jeans tend to buy t-shirts in the same transaction. Support 0.12 means that 12% of all transactions contain the purchase of jeans and t-shirts. With a confidence of 0.80, this shows that 80% of transactions that buy jeans also buy t-shirts. A lift of 1.2 indicates a strong positive relationship between these two products, more than just random possibilities.
- Marketing Strategy: Clothing stores can capitalize on these findings by offering product bundling, for example by providing special discounts on t-shirt purchases when customers buy jeans. In addition, these products can be placed on the same shelf or adjacent to make it easier for customers to choose both products[9].

3.2.2. Rule 2: Winter Jackets and Sweaters

- Interpretation: This rule shows that customers who buy winter jackets are more likely to buy sweaters as well. Support 0.09 indicates that 9% of transactions recorded the purchase of winter jackets and sweaters together. With a confidence of 0.75, this means that 75% of winter jacket purchases also involve sweater purchases. Elevator 1.5 shows a very strong relationship between the two, more than random probability[10][13].
- Marketing Strategy: Stores can use this information to promote seasonal products. For example, stores can offer special discounts on sweaters for customers who buy winter jackets, or arrange these seasonal products near the entrance during the winter to attract customers.

3.2.3. Rule 3: Sports Shoes and Sports T-Shirts

- Interpretation: This rule indicates that customers who buy sports shoes often buy sports shirts as well. Support 0.10 indicates that 10% of transactions contain the purchase of sneakers and jerseys. Confidence 0.85 shows that 85% of sports shoe purchases are also followed by sports shirt purchases. Lift 1.4 shows a strong positive relationship between these two products.

- Marketing Strategy: Using this information, the store can suggest the purchase of related products, such as offering promotions or discounts on sports shirts when customers buy sports shoes. Stores can arrange these products on the same shelf or promote bundling of those products through advertisements.

3.3 Implementation of Findings in Marketing Strategy

Based on the results found, several marketing strategies can be applied to increase clothing store sales:

Table 3. Marketing Strategies

Marketing Strategy	Rules of Association	Description
Product Bundling	Jeans and coats	Offer product bundling such as discounts on buying jeans + t-shirts to attract buyers.
Placement of Nearby Products	Winter jackets and sweaters	Organize seasonal products such as winter jackets and sweaters on the same shelf for easy search
Discounts on the purchase of related products	Sports shoes and sports shirts	Giving discounts on the purchase of both products to increase the purchase of related products.

3.4 Evaluation of the Impact of Implementation

The application of a priori algorithms can have a significant impact on sales and marketing strategies. Evaluations conducted after implementation can include testing the effectiveness of bundling promotions, structuring products, and discounts on related products. Here are some of the expected results[11]:

Table 4. Impact evaluation

Expected Impact	Measurement Criteria	Purpose
Increased Sales	Sales volume of related products increased	Increase sales of products that are frequently purchased together.
Marketing Efficiency	Conversion rate measurement and campaign ROI	Optimize marketing budgets by focusing on more relevant products.
Increased Customer Satisfaction	Customer feedback and purchase satisfaction	Providing an easier and more relevant shopping experience for customers.

3.4 Conclusion of Results and Discussion

The implementation of the Apriori algorithm on clothing store transaction data has succeeded in identifying strong association patterns between products that are often purchased together. These findings provide a solid foundation for the development of more efficient marketing strategies, such as product bundling, more strategic product structuring, and more focused discount promotions. By applying the results of Apriori's algorithm, a clothing store can increase its sales and provide a better shopping experience to customers.

Further evaluation and monitoring of implementation results is essential to ensure that the strategies implemented have a positive impact and continue to be tailored to market needs.

4. CONCLUSION

This article discusses the implementation of the Apriori algorithm to increase clothing store sales based on purchasing patterns. This sees the need for clothing retail businesses to adapt to changing consumer behavior and utilize transaction data effectively. By understanding customer buying patterns, stores can improve their marketing strategies and better maintain customer loyalty.

The approach of this research is quantitative and exploratory. This research focuses on customer purchase patterns by using a priori algorithm from transaction data. A systematic methodology is elaborated, starting with understanding the algorithm, collecting transaction data, determining parameters, applying the algorithm, analyzing the results, and implementing a sales strategy based on what is found.

The analysis looks at transaction data for one month, where various combinations of products purchased are recorded. The results show associations among frequently purchased items, which illustrates how certain products are often purchased together. Three significant association rules are defined.

In conclusion, it emphasizes that the effective use of a priori algorithms can identify strong product associations, allowing stores to develop better marketing strategies and increase overall sales while improving the customer shopping experience. Continuous evaluation is necessary to adapt to market needs.

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