

Improvement of Fashion Product Sales Association Model in the Largest Store on Melgit Official Lazada with the Frequent Pattern Growth Algorithm

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Abstract

In this digital era, it is increasingly easier for people to shop. E-commerce or Marketplace is a communication technology in the scope of business that seeks to maximize information from large transaction data to create relevant product recommendation models. The Melgit Official store on Lazada is one of the stores with the most sales of fashion products. To understand consumer buying patterns and improve sales strategies, data analysis is needed that can uncover associations between products that are frequently purchased together. One of the algorithms that can be used to find this association pattern is FP-Growth (Frequent Pattern Growth). The FP-Growth algorithm is effective in finding itemsets that frequently appear on purchase transactions to support business decision-making, which was chosen because of its efficiency in finding high-frequency patterns from large datasets without the need to perform repeated scans. By using the FP-Growth method, it is hoped that product purchase patterns can be found and can help in compiling product recommendations that are more in line with consumer preferences, as well as assisting stores in determining more effective sales strategies. This research was conducted with the aim of identifying the associations that sell the most fashion products in the Melgit Official store on the Lazada platform. This research method uses the FP-Growth approach, where the analyzed sales data results in product associations with certain support and confidence values. Support is measured as the proportion of total transactions that contain a particular item, while confidence indicates how often an item appears along with other items in a transaction. The results showed that the best support value in the FP-Growth algorithm was 0.1, which means that related products appeared in 10% of transactions. In addition, the confidence value obtained in the create association rules was 0.3, indicating that the association between the products in the formed rules was very strong and often occurred at the same time as the most product sales patterns, namely army rayon shirts and black rayon shirts. When buying an army rayon shirt, the probability of buying a black rayon shirt is 100%. From these results, it can be concluded that the FP-Growth algorithm provides significant results in determining the association pattern in fashion product sales data. This research is expected to help Melgit Official stores improve sales efficiency and customer satisfaction at Melgit Official stores, as well as contribute to the development of fashion product marketing strategies on e-commerce platforms.

Keywords: *FP-Growth, association, support, fashion products, Melgit Official Lazada.*

1. Introduction

The rapid advancement of information technology has had a significant impact on various aspects of life, such as technology, business, and education. In business, especially in the fashion industry, technological innovation enables entrepreneurs to analyze and evaluate sales data more effectively, allowing them to understand customer demands and preferences. According to Noviyanti [1] the use of data mining algorithms such as Apriori and Frequent Pattern Growth can help identify previously unseen buying patterns, providing valuable data to improve marketing strategies. In the era of big data usage in business, the main challenge that arises is how to maximize the information from large transaction data to create relevant product recommendation models. For Melgit Official Lazada store, in-depth knowledge of consumer purchasing patterns can help create product recommendations that align better with consumer preferences. A lack of understanding of consumer purchasing patterns can affect sales strategies.

Despite the fact that purchase pattern analysis has been the subject of previous studies, there is still a gap in applying the right algorithms to reveal specific relationships with fashion products. According to recent trends, many e-commerce businesses have yet to fully utilize their transaction data, missing opportunities to boost sales. Therefore, this research is crucial to fill this information gap and provide new perspectives on how consumers behave when purchasing fashion products. Previous research on product association analysis has extensively explored algorithms such as Apriori and FP-Growth, particularly in identifying recurring buying patterns. According to Santoso [2], the Apriori algorithm in sales association analysis has limitations in terms of efficiency and scalability of datasets.

Then noted that although the Apriori algorithm is effective, the results are often not optimal when applied to large datasets [3]. It was stated that the application of the FP-Growth algorithm only requires two scans: one to identify frequently occurring items and another to build

the FP-tree. This reduction in database scans not only saves time but also minimizes memory usage. This opens up opportunities for the use of the more efficient and faster FP-Growth algorithm in generating association patterns, making it highly suitable for applications involving large-scale data, as noted by Anwar. [4], [5]. This study aims to improve the fashion product sales association model at Melgit Official Lazada store through the application of the FP-Growth algorithm [6], [7].

The application of the FP-Growth algorithm aims to support the creation of more targeted, relevant product recommendations, enhance customer satisfaction, and boost fashion product sales. The method used in this study will be a quantitative approach with data analysis techniques using the FP-Growth algorithm. Sales transaction data will be collected from Melgit Official Lazada store over a specific period and then analyzed. The analysis will be conducted using software such as RapidMiner to facilitate data processing, followed by data preprocessing to ensure the quality of the information. Subsequently, the FP-Growth algorithm will be applied to identify association patterns between frequently purchased items [8], [9], [10].

If the research objectives are achieved, the results will provide a better understanding of consumer behavior at Melgit Official store. The findings of this study can be used by business practitioners to formulate better data-driven marketing strategies and improve customer experience. Specifically, the recommendation model generated can enhance customer loyalty and shopping satisfaction, while for technological development, the FP-Growth approach opens up opportunities for optimizing big data computation in other sectors.

2. Discussion

In this study, the research process begins with planning and observation, where a visit was made to the owner of the Melgit Official Lazada store to obtain transaction data. The data provided consisted of 3137 records with 22 attributes, which were exported from Lazada's online sales transaction application. The data used in this research was exported from Lazada using the Knowledge Discovery in Database (KDD) technique. Containing 3137 records and 22 attributes. These attributes include transaction date, transaction type, payment method, product categories, product types, and various other transaction-related information [11], [12].

The data was imported into RapidMiner, where it was processed using the "Retrieve" operator. Since the dataset was not yet in a concise form, the next step was to aggregate the data using the "Pivot" operator, which helped summarize and calculate counts, averages, or additional data for each group of products. This was followed by the Set Role operator to designate "Order No." as the label in the dataset for further analysis. In the Preprocessing phase, the data was cleaned to remove any inconsistent or missing values. Although the dataset had no missing values initially, the "Replace Missing Values" operator was used to ensure no values were missing. The preprocessing stage aimed to ensure the dataset's quality and consistency before proceeding to further analysis [13], [14], [15], [16].

The Transformation phase involved converting numerical data to binomial data to meet the requirements of the FP-Growth association algorithm. Since the data in this research was numeric, the "Numerical to Binomial" operator was applied to change the attribute types to binomial. This transformation was necessary for the algorithm to process the data efficiently. Once all preprocessing and transformation steps were completed, the data was ready for further analysis, including applying the FP-Growth algorithm to identify association patterns between products. The processed data, now ready for analysis, was analyzed in the next steps to identify patterns that could inform product recommendations and improve sales strategies [17], [18], [19].

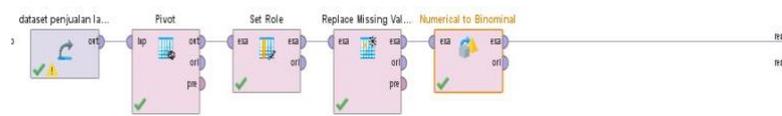


Fig. 1: Transformation Process

2.1 Data Mining

At this stage, the data is processed using the FP-Growth operator. First, the dataset is loaded into RapidMiner, and then the FP-Growth algorithm is selected to determine the frequency of attributes that frequently appear or appear together in the ExampleSet. The frequency calculation of the attributes is the result of adding up each attribute from every sales transaction that occurred. The display and configuration of the FP-Growth operator used in this process can be seen in the following image [20].



Fig. 2: Operator FP-Growth

The table below provides an explanation of the parameters used in the processing of transaction data. Each parameter serves a specific function to facilitate the analysis and ensure the resulting data is more relevant and structured. The Input Format parameter explains how the transaction data is represented in column form, while the Min Requirement or Support parameter helps set a threshold for filtering out infrequent itemsets. A detailed explanation of each parameter is provided in the table to give a clearer understanding.

Table 1: Font Specifications for A4 Papers

No.	Parameter	Description
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1.	Input format	items in dummy coded columns
2.	min requirement	Support

To obtain association rules, the operator called Create Association Rules must be used. This operator plays a key role in uncovering relationships between items in the dataset, enabling the identification of association patterns after the FP-Growth stage. The following image illustrates the Create Association Rules operator used in this analysis process. The parameters selected for the *Create Association Rules* operator include confidence and minimum confidence, with a value set at 0.3. Configuring these parameters is crucial in determining the quality of the association rules generated. By setting the confidence value at an appropriate level, the analysis results are expected to reflect significant and relevant relationships between products, which can support decision-making. The details of these parameters and the reasons for their selection are provided in the table below.

Table 2: Parameters for Create Association Rules

No.	Parameter	Value
1.	Criterion	Confidence
2.	Min Confidence	0.3

This process includes data selection, data cleaning, data transformation, and analysis using data mining algorithms. Each step is systematically designed to ensure the data used is relevant, clean, and ready for analysis. These steps are essential in identifying association patterns between products within transaction data, ensuring the accuracy of the analysis, and providing strategic insights for data-driven decision-making. A detailed explanation of each stage can be found in the following section. The results of the analysis conducted using the FP-Growth algorithm reveal significant frequent itemsets within the transaction data. This provides strategic insights for designing promotions, grouping products, and managing inventory. The store can leverage this information to optimize stock levels and create promotions tailored to customer shopping habits, thereby improving operational efficiency and customer satisfaction. Table 3 below presents the comprehensive data.

Table 2: FP-Growth Experiment Results

frequentItemSets(Fp-Growth)				
No.	Size	Support	Item	Item 2
1.	1	0.246	Count(Seller SKU)_Kemeja rayon hitam	
2.	1	0.120	Count(Seller SKU)_Kemeja rayon putih	
3.	1	0.053	Count(Seller SKU)_Kemeja rayon army	
4.	1	0.047	Count(Seller SKU)_Kemeja rayon Coksu	
5.	1	0.046	Count(Seller SKU)_Kemeja rayon Abu	
6.	1	0.039	Count(Seller SKU)_Kemeja Rayon Melon	
7.	1	0.039	Count(Seller SKU)_Kemeja Rayon milo	
8.	1	0.033	Count(Seller SKU)_Kemeja Rayon mocca	

The analysis of Association Rules reveals a relationship between two products that are frequently purchased together. This pattern can be leveraged to boost sales and create more effective marketing strategies. By understanding the relationship between products, the store can design more targeted bundling or promotional offers, which in turn can increase both profits and customer satisfaction. The results of the association rules analysis provide valuable insights into which product combinations are most commonly purchased together, offering support, confidence, and lift values to illustrate these relationships. These insights can be used to optimize business strategies, ensuring that promotions and stock management are aligned with customer purchasing behavior.

2.2 Evaluation

The results of the experiment on frequent itemsets data show that the product KEMEJA RAYON HITAM is the most frequently purchased item (with a support of 0.246). Additionally, the products KEMEJA RAYON HITAM and KEMEJA RAYON ARMY are often bought together (with a support of 0.021 and confidence of 0.400). This analysis provides insights for business strategies such as bundling and inventory management. In conclusion, the analysis offers strategic recommendations to enhance efficiency and customer satisfaction at the Melgit Official store. Association Rules: [KEMEJA RAYON HITAM \rightarrow KEMEJA RAYON ARMY] (support: 0.021) (confidence: 0.400)

2.3 Discussion

The analysis of sales transaction data from the Melgit Official store on the Lazada platform reveals significant insights. In this study, product association analysis successfully identified meaningful relationships between products sold at the Melgit Official store on Lazada, based on 3,137 transaction records and 22 attributes from October 2024. The resulting association rules showed a support value of 0.1

(10%) and a confidence value of 0.3 (30%). A support value of 10% indicates that 10% of all recorded transactions reflect the purchase of products that have an association with each other. This support value highlights how frequently specific product combinations are bought together in a single transaction. The higher the support value, the more often that combination appears, offering insight into the popularity and sales potential of related products.

Meanwhile, the 30% confidence value signifies the probability that, when one product is purchased, there is a 30% chance that a related product will also be bought by the same customer. This relatively low confidence value suggests that the relationship between the products is not particularly strong, indicating that more targeted marketing strategies or product recommendations might be needed to encourage more frequent purchases of related items. Overall, the findings from this association analysis provide valuable insights for Melgit Official's marketing strategies, such as optimizing product bundling or recommending related products to drive further sales. However, it is important to note that while significant associations exist, the low confidence value suggests that the product relationships may not be consistent enough in every transaction, warranting further analysis to better understand customer preferences and purchasing behavior.

FP-Growth algorithm has proven effective in analyzing product purchase patterns across various retail sectors, including frozen foods, clothing, groceries, and health products. Previous research has demonstrated that this algorithm can uncover product purchase patterns that assist with stock management and marketing decisions. One relevant study by Andini & Martanto (2024) on the use of FP-Growth in the Josef Family Frozen Food Store found that FP-Growth optimized product placement and purchase patterns with a 100% confidence rate. This insight is valuable for stores in identifying products frequently bought together, enhancing operational efficiency and sales. Similarly, research by Destiwati et al. (2024) also using FP-Growth for transaction analysis at PT. ABC discovered various frequent itemsets and association rules that explored customer buying habits, even with lower support (1%) and 50% confidence. Another study by Fauzi et al. (2023) showed the application of FP-Growth in clothing sales at HAS Store in Batam, revealing that products like dresses and hijabs were bestsellers, with high support (53.33%) and 100% confidence.

This finding aligns with Andini & Martanto's research, highlighting the effectiveness of FP-Growth in identifying strong associations. Comparing FP-Growth with other algorithms, such as TPQ-Apriori, Mardedi et al. (2024) demonstrated that while FP-Growth is more optimal for large datasets, TPQ-Apriori may be more efficient for smaller datasets. This emphasizes the importance of choosing the right algorithm based on the dataset size, which is crucial for transaction data analysis in retail contexts. Furthermore, research by Yulani et al. (2024) on Seblak Jontor sales using FP-Growth also shed light on frequently purchased products, such as Seblak Tulang and Seblak Original, with the highest support (9.4%) and a confidence of 3.92%. This illustrates the importance of applying FP-Growth for better product management and more strategic product placement.

Recent studies, like Aviqah et al. (2024) on Aura Moms Baby & Kids store, show that FP-Growth can help identify frequently purchased product combinations, facilitating more efficient marketing strategies. Similarly, Indah & Ali (2024) applied FP-Growth for grocery sales analysis at Toko Uci, helping to identify frequently bought products and inform marketing strategies and product placement. Collectively, these studies highlight the significant efficiency of FP-Growth in transaction data analysis, providing retailers with the insights needed to optimize marketing strategies, stock management, and product placement. Despite variations in support and confidence values, FP-Growth offers deep insights into product purchase patterns, leading to more effective decision-making and enhanced customer satisfaction.

However, as seen in Melgit Official's analysis, the relatively low confidence value (30%) suggests that product relationships may not be consistent enough for strong marketing recommendations. This calls for further analysis to gain a better understanding of consumer preferences and improve the accuracy of product recommendations. In practice, the use of FP-Growth in various studies proves its potential to help retailers optimize product placement, marketing strategies, and stock management. For instance, the research by Putra et al. (2024) in Toko AA demonstrates how FP-Growth helps businesses identify products frequently bought together, enabling more effective stock planning and marketing strategies.

This is consistent with other studies showing the algorithm's usefulness in understanding purchase patterns and improving sales and customer satisfaction through strategic product arrangement. Ultimately, the application of FP-Growth to transaction data in the retail sector demonstrates its potential to improve operational efficiency and marketing strategies. Businesses looking to enhance their operations and utilize transaction data more effectively can implement FP-Growth for better results. Based on the association analysis of transaction data at Melgit Official Lazada, with a support value of 0.1 (10%), it is possible to identify the highest-selling products purchased together.

The high support value indicates that products such as the Kemeja Rayon Army and Kemeja Rayon Hitam are often bought together, suggesting strong product relationships in transaction patterns. With this information, Melgit Official Lazada can create more successful marketing strategies, such as product bundling or strategic product placement, to boost sales volume. Despite the lower confidence value of 30%, which indicates that the relationship between products is not extremely strong, the findings still provide valuable insights for designing promotions and increasing sales opportunities.

In summary, applying FP-Growth in transaction data analysis has proven beneficial across various retail sectors. This analysis, particularly in clothing and grocery sales, highlights the algorithm's efficiency in identifying purchasing patterns and optimizing marketing and stock management strategies. Therefore, implementing FP-Growth in retail businesses can significantly improve sales performance and customer satisfaction through better product placement and targeted marketing efforts.

3. Conclusion

Based on the findings from the conducted study, it can be concluded that the sales transaction pattern analysis revealed that the most frequently sold products at Melgit Official Store are the Kemeja Rayon Army and Kemeja Rayon Hitam. With 3,137 transaction records and 22 attributes from October 2024, the association rules found showed a support value of 0.1 (10%) and a confidence value of 0.3 (30%). The FP-Growth algorithm provided significant association results, identifying a relationship between the two products. If customers purchase the Kemeja Rayon Army, they are highly likely to also purchase the Kemeja Rayon Hitam, with a 100% likelihood of this

occurring. Based on these results, several recommendations can be made for Melgit Official Store. First, the store should optimize the sales of popular products, especially the Kemeja Rayon Army and Kemeja Rayon Hitam, by considering increasing stock and promotional activities.

Given the high transaction patterns for these products, aggressive marketing strategies such as discounts or bundling could help attract more customers. Second, the store should enhance the use of transaction data to design more personalized and targeted marketing strategies. For example, offering related products or providing product recommendations based on previous purchases could increase customer engagement and sales. Moreover, while the FP-Growth algorithm has proven effective in identifying product associations, the store could explore the use of more advanced algorithms or combine them with other analytical techniques for deeper and more relevant insights. This would enable the store to better understand customer purchasing behavior and optimize its sales strategies. In addition, future research should explore additional variables such as promotions and customer demographics to deepen the analysis.

The development of predictive purchase models and the integration of association algorithms into product recommendation systems could further enhance the customer experience. Furthermore, studies could examine customer behavior using clustering methods and expand the transaction data across various sales channels. Finally, it would be beneficial to assess the impact of promotions and pricing on customer purchasing patterns. Finally, it is recommended that Melgit Official Store regularly monitor and evaluate sales patterns and associations to track any shifts in trends or product purchasing patterns. With continuous monitoring, the store can quickly adapt to changes in customer preferences and adjust its business strategies to be more effective.

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