

IMPLEMENTATION OF APRIORI ALGORITHM WITH CUSTOMER ORDER PATTERN ANALYSIS FOR DETERMINATION OF RAW MATERIAL INVENTORY

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Abstrak

Pemesanan Product dari usaha dagang rumahan belum memanfaatkan algoritma data mining yang dapat membantu menganalisis data transaksi untuk mengoptimalkan transaksi pemesanan Product dan juga pengelolaan persediaan pada bahan baku dari Product dengan dapat mengurangi banyak bahan baku sisa maupun Product yang tidak terbeli oleh pelanggan. Untuk menghindari terjadinya banyak sisa bahan baku dari Product yang kurang peminatnya dan mengetahui jenis-jenis Product mana saja yang laris dipesan oleh pelanggan diperlukan algoritma apriori. Tujuan penelitian ini agar pemilik dapat melakukan pengelolaan yang baik dan efisien terhadap ketersediaan bahan baku dari Product agar bahan baku dapat diproses menjadi Product, yakni harus disesuaikan dengan jumlah Product yang banyak dipesan oleh pelanggan sehingga tidak terjadi penumpukan bahan baku dari transaksi pemesanan Product yang sedikit sekali dipesan oleh pelanggan. Didapat hasil dari penelitian ini yakni jika pelanggan memesan Product H maka akan memesan Product L dengan nilai support 42% dan confidence 83%, jika pelanggan memesan Product L maka akan memesan Product G dengan nilai support 67% dan confidence 90%-100%, dan jika pelanggan memesan Product H maka akan memesan Product G dengan nilai support 42% dan confidence 100%. dari aturan asosiasi ini dapat disimpulkan bahwa pemilik usaha ini dapat menentukan pengelolaan bahan baku dengan memprioritaskan bahan-bahan yang digunakan untuk membuat Product dari L, H dan G agar pembelian dan penggunaan bahan baku Product tersebut lebih terkelola dan efisien.

Kata kunci: Data Mining; Algoritma Apriori; Analisis Pola Pemesanan Product

Abstract

Ordering products from home-based trading businesses have not utilized data mining algorithms that can help analyze transaction data to optimize product order transactions and also manage inventory on raw materials from products by reducing a lot of leftover raw materials and products that are not purchased by customers. To avoid the occurrence of a lot of raw material leftovers from products that are not in demand and to find out which types of products are in demand by customers, then the apriori algorithm is needed. The purpose of this research is that the owner can carry out good and efficient management of the availability of raw materials from the product so that the raw materials can be processed into products, which must be adjusted to the number of products ordered by customers so that there is no accumulation of raw materials from fewer transactions. The results obtained from this research are if a customer orders product H, then he will order product L with a support value of 42% and 83% confidence, if a customer orders product L then he will order product G with a support value of 67% and a confidence of 90% -100%,

and if a customer orders product H, he will order product G with a support value of 42% and 100% confidence. From the rules of this association, it can be concluded that this business owner can determine the management of raw materials by prioritizing the materials used to make products from L, H, and G so that the purchase and use of raw materials for these products are more manageable and efficient.

Keywords: Data Mining; Apriori Algorithm; Product Order Pattern Analysis

INTRODUCTION

Since the emergence of the coronavirus outbreak (covid-2019) in Indonesia, March 2019, has had a considerable impact on all fields, especially in the economic sector. In the field of economic gain impact most noticeably among restaurants, even up to the business trade a home that sells pastries dry. Quite experienced the impact of a decrease in demand orders when beginning a business is run. Slowly with trying to change the method of sale that occurred a shift from transaction offline to transactions online, such as a business that is associated with food and supplements experienced a rise, just only method that is used, which occurred a shift from the transaction is offline for transactions that do it online (Prasetyo et al., 2020). An effective method of marketing can be done with 2 platform media social of which do marketing via Instagram and WhatsApp. Methods online to dominate the activities of marketing, so from a business that is already a big nor to attempt a home using media that in supporting the process of marketing its products. It mentioned no exception by business trade cake dry it, which always provides innovations in the new top product which is produced by post to the media social. Usually business trade a home is when approaching the feast of Eid al-Fitr, quite a lot of demand for orders. With so many requests for orders by customers, there must be an efficient strategy in handling the management of the supply of raw cake ingredients. Things often experienced in business trade home with the product cake dry this is the management of inventories of materials raw are not efficient (Junaidi et al., 2021). Availability of raw material that is managed by the well could affect the increased ordering products in the process of production so that the resulting lack of techniques that help manage an inventory of materials like u are not efficient from every transaction ordering(Asa Verano, 2016). For the availability of raw materials to process into products which must be adjusted by the amount of product that many ordered by customers that do not happen buildup of the material standard of transaction ordering products were slightly once ordered by the customer(Asa Verano, 2016). The owner of the

business must think critically, how the customer must always maintain his satisfaction will be the product that is ordered, due to the competition of business on a segment of this should have priority service excellence to customers plus the condition when it has been almost 2 years more since March 2019 , the covid 19 pandemic has had a very significant impact on home trading businesses like this. Therefore perform the analysis of the products that alone are always booked and also products of what course the book is simultaneously in one-time order (Waroeng et al., 2017), which during this always be a difficulty in itself for the owner of the business trade. Ith perform analyzes the pattern of orders from customers can predict the supply of products, and the management can determine an increase in bookings to a product at the same time also manage the availability of the material standard that is required (Adithama et al., 2020). The research that is done before can help optimize sales and reduce a lot of the rest of the products that are not bought by analyzing the data from the transaction sales, which generate the data products are sold and a lot of interest and then also be able to prioritize material raw of product are selling sold for the procurement of materials raw with quantity which is more than the previous(Prasetyo et al., 2020). From the results of the study that there are things that are less that the analysis of the data transaction the seller is not able to represent the management of material standard for the data results of the products are ordered , dikarenakan management of material standard for products that are sold directly to that performed by the message differently , in order to obtain results that accurately should do study back by using the data from the order transaction.

RESEARCH METHODS

Data Mining is the process of extracting and identifying knowledge that is contained in the various databases by using the technique of statistical, mathematical, and machine learning to find patterns of frequency higher among the set of itemsets (Sutrisno, 2020). The purpose of data mining find patterns that have meaning in supporting the decision, find patterns that can use the Algorithm Apriori, in seeking frequent itemset

also determine or find the rules of the database are large (Henando, 2019). Technics association rule can be used to look for the value of frequent itemset in the algorithm apriori that is, using the knowledge of the frequency of the attribute that has been known previously to process the information further. Later in determining candidates that may arise with the way pay attention to minimum support and minimum confidence (Sinaga & Husein, 2019). The rules of association provide how best to support the decision scientifically through relationships association mining among the products that have been ordered in conjunction (Manurung & Hasugian, 2019). The discovery of the relationship is to help the owner to develop a strategy of selling the expensive items that are often ordered together by the customer, respect is very important because it can help the recommendation of products that can be produced more and facilitate the management of inventories of materials (Nastuti, 2019). Analysis of the association known also as one of the techniques of data mining which became the basis of various techniques of data mining and other (Sikumbang, 2018). Analysis of the association is a technique of data mining that is used as one of the basic techniques of data mining more. Important whether or not a rule associative can be known by two parameters, namely the support and confidence (Fitriati & Hardiyanto, 2018). Support (the value of support) is the percentage of the combination of the items are in the database, while confidence (value certainty) is the strength of the relationship between -Item the rules of association (Sianturi, 2018). The following stages were carried out in the calculation of the algorithm a priori (Rahmawati & Merlina, 2018):

1. Looking for the three values that customers ordered the most, then determining the list and product order data, classifying the best-selling products that customers ordered.
2. Doing representation of data transactions
3. Tabular format creation
4. Analysis of patterns frequency high, Looking for items that meet the minimum requirements of the support value.

The support value is obtained by the formula:

$$\text{Support (A)} = \sum \frac{\text{Transactions for A}}{\text{Transactions}} \dots\dots\dots (1)$$

The formula for 2 itemsets is obtained by the formula:

$$\text{Support (A, B)} = P(A \cap B) \dots\dots\dots (2)$$

$$\text{Support (A)} = \sum \frac{\text{Transactions for A and B}}{\text{Transactions}} \dots\dots\dots (3)$$

5. Establishment of association rules

Looking for association rules that meet the minimum requirements for confidence by calculating confidence or associative $A \cup B$. The confidence value of the rule $A \cup B$ is obtained from the following formula:

$$\text{Confidence P (B|A)} = \sum \frac{\text{Transactions for A dan B}}{\text{Transactions}} \dots\dots\dots (4)$$

RESULTS AND DISCUSSION

On stage is conducted analysis of all requirements are necessary to implement the algorithm a priori by the analysis of patterns of order customers. The data needed to implement the data mining algorithm is used product order data by customers for one transaction year (Kurniawati et al., 2019). List of products in one transaction year as follows:

Table 1. List of products

Code	Product Name
PD001	Product A
PD002	Product B
PD003	Product C
PD004	Product D
PD005	Product E
PD006	Product F
PD007	Product G
PD008	Product H
PD009	Product I
PD010	Product J
PD011	Product K
PD012	Product L
PD013	Product M
PD014	Product N
PD015	Product O
PD016	Product P
PD017	Product Q
PD018	Product R
PD019	Product S
PD020	Product T
PD021	Product U
PD022	Product V

Based on Table 1. There are 22 products list which is marketed either by message in advance and buys it directly.

Table 2. Order data for February 2020

Product Name	Amount
Product A	0
Product B	0
Product C	70
Product D	3
Product E	1
Product F	0
Product G	220
Product H	246
Product I	0
Product J	250

Product Name	Amount
Product K	0
Product L	521
Product M	0
Product N	0
Product O	180
Product P	0
Product Q	40
Product R	45
Product S	0
Product T	0
Product U	0
Product V	0

Based on Table 2. Several orders of products that most many books are the product of L with 521 orders, product J with 250 orders, and product H with 246 orders.

Table 3. Order data for March 2020

Product Name	Amount
Product A	0
Product B	0
Product C	260
Product D	0
Product E	0
Product F	0
Product G	170
Product H	50
Product I	0
Product J	75
Product K	0
Product L	205
Product M	0
Product N	0
Product O	120
Product P	0
Product Q	0
Product R	25
Product S	0
Product T	0
Product U	0
Product V	0

Based on Table 3. Several orders of products that most many books are product C with 260 orders, product L with 205 orders, and product G with 170 orders.

Table 4. Order data for April 2020

Product Name	Amount
Product A	2
Product B	0
Product C	0
Product D	0
Product E	0
Product F	0
Product G	30
Product H	0
Product I	0
Product J	0
Product K	0
Product L	85

Product Name	Amount
Product M	0
Product N	0
Product O	75
Product P	0
Product Q	0
Product R	25
Product S	3
Product T	0
Product U	0
Product V	0

Based on Table 4. The number of orders of products that most many books are the product of L with 85 orders, product O with 75 orders, and product G with 30 orders.

Table 5. Order data for May 2020

Product Name	Amount
Product A	0
Product B	0
Product C	0
Product D	0
Product E	0
Product F	0
Product G	0
Product H	0
Product I	0
Product J	0
Product K	0
Product L	0
Product M	0
Product N	0
Product O	0
Product P	0
Product Q	0
Product R	0
Product S	37
Product T	21
Product U	0
Product V	0

Based on Table 5. Several orders of products that most many books are the product S with 37 orders and product T with 21 orders.

Table 6. Order data for June 2020

Product Name	Amount
Product A	0
Product B	0
Product C	125
Product D	0
Product E	0
Product F	0
Product G	335
Product H	35
Product I	0
Product J	0
Product K	0
Product L	330
Product M	0
Product N	0
Product O	212

Product Name	Amount
Product P	0
Product Q	0
Product R	68
Product S	0
Product T	0
Product U	0
Product V	0

Based on Table 6. The number of orders of products that most many books are the product G with 335 orders, product L with 330 orders, and product O with 212 orders.

Table 7. Order data for July 2020

Product Name	Amount
Product A	0
Product B	0
Product C	0
Product D	0
Product E	0
Product F	0
Product G	195
Product H	101
Product I	0
Product J	100
Product K	0
Product L	175
Product M	1
Product N	1
Product O	100
Product P	0
Product Q	100
Product R	0
Product S	0
Product T	0
Product U	0
Product V	0

Based on Table 7. Total orders a product that most many books are the product G with 195 orders, product L with 175 orders, and product H with 101 orders.

Table 8. Order data for August 2020

Product Name	Amount
Product A	7
Product B	1
Product C	0
Product D	0
Product E	0
Product F	0
Product G	247
Product H	302
Product I	0
Product J	372
Product K	0
Product L	627
Product M	0
Product N	0
Product O	340
Product P	0
Product Q	0
Product R	105

Product Name	Amount
Product S	0
Product T	0
Product U	0
Product V	0

Based on Table 8. Total orders a product that most many books are the product of L with 627 orders, product J with 372 orders, and product O with 340 orders.

Table 9. Order data for September 2020

Product Name	Amount
Product A	0
Product B	0
Product C	100
Product D	0
Product E	0
Product F	50
Product G	220
Product H	101
Product I	0
Product J	30
Product K	0
Product L	130
Product M	0
Product N	0
Product O	100
Product P	0
Product Q	0
Product R	0
Product S	0
Product T	0
Product U	0
Product V	0

Based on Table 9. The number of orders of products that most many books are the product G with 220 orders, product L with 130 orders, and product H with 101 orders.

Table 10. Order data for October 2020

Product Name	Amount
Product A	0
Product B	0
Product C	0
Product D	0
Product E	0
Product F	100
Product G	101
Product H	0
Product I	0
Product J	150
Product K	0
Product L	150
Product M	0
Product N	0
Product O	0
Product P	0
Product Q	0
Product R	0
Product S	0
Product T	0
Product U	0

Product Name	Amount
Product V	0

Based on table 10. The number of orders of products that most many books are a product J and L with 150 orders and product G with 101 orders.

Table 11. Order data for November 2020

Product Name	Amount
Product A	0
Product B	0
Product C	50
Product D	0
Product E	0
Product F	0
Product G	185
Product H	320
Product I	0
Product J	190
Product K	0
Product L	170
Product M	0
Product N	0
Product O	110
Product P	0
Product Q	70
Product R	0
Product S	0
Product T	0
Product U	0
Product V	0

Based on table 11. The number of orders of products that most many books are the product of H with 320 orders, product J with 190 orders, and product G with 185 orders.

Table 12. Order data for December 2020

Product Name	Amount
Product A	0
Product B	0
Product C	0
Product D	0
Product E	0
Product F	0
Product G	510
Product H	505
Product I	0
Product J	50
Product K	0
Product L	675
Product M	2
Product N	0
Product O	335
Product P	0
Product Q	110
Product R	0
Product S	0
Product T	0
Product U	0
Product V	0

Based on table 12. Total orders a product that most many books are the product of L with 675 orders, product G with 510 orders, and product H with 505 orders.

Table 13. Order data for January 2021

Product Name	Amount
Product A	0
Product B	0
Product C	0
Product D	0
Product E	0
Product F	0
Product G	485
Product H	310
Product I	0
Product J	0
Product K	0
Product L	390
Product M	0
Product N	0
Product O	245
Product P	0
Product Q	55
Product R	80
Product S	0
Product T	0
Product U	0
Product V	0

Based on table 13. The number of orders of products that most many books are the product G with 485 orders, product L with 390 orders, and product H with 310 orders. Doing grouping three products are the best-selling book by the customers, Based on the data order during a period of one year obtained a pattern of transactions by analyzing three products the most best-selling book every month can be seen in Table 14 below :

Table 14. Data of best-selling products ordered every month

Month	Itemset
02	Product H, Product J, Product L
03	Product C, Product L, Product G
04	Product L, Product O, Product G
05	Product S, Product T
06	Product G, Product L, Product O
07	Product G, Product L, Product H
08	Product L, Product J, Product O
09	Product G, Product L, Product H
10	Product L, Product J, Product G
11	Product H, Product J, Product G
12	Product L, Product G, Product H
01	Product G, Product L, Product H

Based on Table 14. Results of the products that best-selling book every month, then set up a table tabular which makes it easy to determine the product that

best-selling book by customers each month as follows :

Table 15. Representation of tabular form of transaction data

Month	L	H	G	C	O	S	T	J
2	1	1	0	0	0	0	0	1
3	1	0	1	1	0	0	0	0
4	1	0	1	0	1	0	0	0
5	0	0	0	0	0	1	1	0
6	1	0	1	0	1	0	0	0
7	1	1	1	0	0	0	0	0
8	1	0	0	0	1	0	0	1
9	1	1	1	0	0	0	0	0
10	1	0	1	0	0	0	0	1
11	0	1	1	0	0	0	0	1
12	1	1	1	0	0	0	0	0
1	1	1	1	0	0	0	0	0

Table 15. It is a form of table tabular results of the products are the best-selling book so easy to know the products what alone are often ordered by the customer. Analysis of patterns of frequency, the process of formation of itemset (C1) with several minimum support = 30%, following the results of a resolver n her :

Table 16. Support list of each item set (C1)

Itemset	Support
Product L	83%
Product H	50%
Product G	75%
Product C	8%
Product O	25%
Product S	8%
Product T	8%
Product J	33%

Based on table 16. The support list of each item, then the result of itemset must meet the minimum support of 30% so that items that do not comply will be erased, namely as follows :

Table 17. Support itemset (C1) which meets 30% support

Itemset	Support
Product L	83%
Product H	50%
Product G	75%
Product J	33%

Next is the result of the process of forming C2 (2 itemset) :

Table 18. List of supports from the itemset (C2)

Itemset	Jumlah	Support
Product L, Product H	5	42 %
Product L, Product G	8	67%
Product L, Product J	3	25%
Product H, Product G	5	42%
Product H, Product J	2	17%

Product G, Product J	2	17%
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Based on table 18. The support list of each item, the results of 2 itemsets must meet the minimum support of 30%, so the two itemsets (C2) which do not comply will be erased, namely as follows :

Table 19. Support 2 itemset (C2) which meets 30% support

Itemset	Support
Product L, Product H	42 %
Product L, Product G	67%
Product H, Product G	42%

The process further is the pattern of frequencies higher that is found in the product of L, G, and H. Step next form of association rules that meet the required minimum by calculating confidence association rules $A \rightarrow B$. minimum confidence = 60%. To look for the value of confidence as follows: Value confidence of the rule $A \rightarrow B$.

Formation of association rules After all high-frequency patterns are found. Then the association rules are carried out with the results of the frequency patterns that have been formed in table 19. From the combination of the 2 set items that have been produced, it can be seen that the support value and the confidence value of the association rule are as follows :

Table 20. Association Rules

Rules	Confidence
If you order Product L, you will order Product H	5/10 50%
If you order Product H, you will order Product L	5/6 83%
If you order Product L, you will order Product G	9/10 90%
If you order Product G, you will order Product L	9/9 100%
If you order Product H, you will order Product G	6/6 100%
If you order Product G, you will order Product H	6/6 100%

Based on table 20. Rules association that meets the minimum confidence of 60% which is as follows :

Table 21. Final Association Rules

Rules	Support	Confidence
If you order Product H, you will order Product L	42 %	83%
If you order Product L, you will order Product G	67 %	90%
If you order Product G, you will order Product L	67%	100%
If you order Product H, you will order Product G	42%	100%
If you order Product G, you will order Product H	42%	100%

CONCLUSIONS AND SUGGESTIONS

Conclusions

Based on the results of data processing using the apriori algorithm, accuracy results are obtained with a combination of an item set in the apriori algorithm. If the customer orders product H, then he will order product L with a support value of 42% and confidence of 83%, if the customer orders product L then will order product G with a support value of 67 % and 90% -100% confidence, and if the customer orders product H, they will order product G with a support value of 42% and 100% confidence. of the rules of the association can conclude that the owner of the business can determine the management of materials raw by prioritizing the materials that are used to make products of L, H, and G to purchase and use materials of the raw product are more manageable and efficient. can be known by using the algorithm apriori, to look at products that meet the minimum support and minimum confidence, a product that is selling book is the product of L, H, and G.

Suggestions

With the already formed proceeds rules of the association, expected the owner of the business can manage the use of material raw of products whose selling book with the purpose to increase the efficiency of the material standard of what course that must be purchased. Then the suggestion in the study is that the formation of 3 itemsets can be in forward so that the rules of association which gained more closer to the results valid.

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