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Preface

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Preface

The 5th Annual Applied Science and Engineering Conference (AASEC) 2020 is hosted by Technical and Vocational Education study program, School of Postgraduate Studies, Universitas Pendidikan Indonesia (UPI), UPI Publication Center, in collaboration with other co-hosting institutions such as Universitas Negeri Jakarta, UIN Sunan Gunung Djati Bandung, Universitas Trisakti, Politeknik Enjinering Indorama, Universitas Warmadewa, Sampoerna University, Universitas Negeri Surabaya, Sekolah Tinggi Teknologi Garut, Universitas Trilogi, Institut Pendidikan Indonesia, Universitas Serang Raya, Universitas Mataram, Universitas Kanjuruhan Malang, Politeknik Negeri Malang, Universitas Negeri Gorontalo, UIN Sulthan Thaha Saifuddin Jambi, and Universitas Muhammadiyah Sidoarjo.

Unlike the previous conference whose all speakers were scientists, this year's AASEC made an attempt to attract more participation from a wider community by inviting an Indonesian public figure who is also an environmentalist, Hamish Daud Wyllie, along with the other scientists such as Fitri Khoerunnisa from Universitas Pendidikan Indonesia, Indonesia; Muhammad Aziz from Tokyo University, Japan; and Yulfian Aminanda from Universiti Teknologi Brunei, Brunei Darussalam to give a talk based on their expertise under the theme "Green Technologies for Sustainable Environmental Development". The conference was set to be carried out on 21-22 April 2020; however, due to the outbreak of COVID-19, changes arose starting from the postponement of the conference to turning it out into a virtual seminar. To this extent, the parallel presenters were required to send their presentation videos to the organizing committee to be uploaded to AASEC official Instagram account (@aasec_). The presentations proceeded based on each scope determined by the organizing committee as follows: 01 June 2020: Chemical Engineering, 02 – 08 June 2020: Civil Engineering, 15-19 June 2020: Computer and Communication Engineering, 20 June – 01 July 2020: Computer Science, 02 – 07 July 2020: Electrical Engineering, 08 – 10 July 2020: Electronics Engineering, 11 – 20 July 2020: Environmental Engineering, 21-24 July 2020: Information Engineering, 30 July – 02 August 2020: Material Engineering, 03 – 05 August 2020: Material Science and 06 -09 August 2020: Mechanical Engineering.

Despite the pandemic, AASEC 2020 still received a huge attention from the participants. There are 577 papers to be submitted to be published in the proceedings of the 5th AASEC 2020. All the papers have been through a series of rigorous review process to meet the requirements and standards of international publication.

We would like to express our deepest gratitude to the international advisory members, scientific committee, and organizing committee of AASEC 2020 for their commitment and hard work amidst this difficult time. We would also like to thank all the co-hosting institutions for their cooperation on the conference turnouts, particularly on the paper selection submitted to the committee. A huge appreciation also goes to the vice rector for research, international affairs, business, and partnership of Universitas Pendidikan Indonesia for giving constant support to the conference and other conferences held by the university. Last but not least, we thank you all presenters and participants of AASEC 2020 for the most significant contribution at the conference. We hope to see you in the 6th AASEC 2021.

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Prof. Dr. Ade Gafar Abdullah
Dr. Isma Widiaty
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HPAI consumer shopping analysis using Apriori algorithm

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HPAI consumer shopping analysis using Apriori algorithm

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Abstract. PT Herba Penawar Alwahida sells a variety of herbal products. The process of buying and selling transactions occur every day, resulting in a pile of data pretty much. However, so far the transaction data has only been used as material to make monthly reports without further use of data these, even though from these data information can be extracted to support marketing. To utilize existing transaction data, the authors make a website-based data mining application. This application will be developed by method association (Association Rule) uses apriori algorithm. So that it can be seen the level of accuracy of this application. With the application of data mining, is expected to help the distributor to get information about which HPAI products are often purchased by consumers simultaneously, so as to improve the product marketing and maintaining process availability of stock of these products to remain.

1. Introduction

Traditional medicine is still in demand by the people of Indonesia, such as herbs and herbal products. Many companies produce herbal products, one of which is in Indonesia, namely PT. Indonesian Alwahida Penawar Herba or what people know as HPAI. The company is a network of Halal business companies in Indonesia and focuses on herbal products that are halal and of high quality and based on Thibbunnabawi. All HPAI products are distributed directly by the company to the Business Centres in each region and then distributed again to HPAI agents scattered around it. HPAI does not only sell herbal medicines, the products sold are also varied, such as supplements and beauty cosmetics. In the distribution of these HPAI products, the buying and selling process takes place. It also became a daily routine, weekly to annual. Can imagine how many transactions occur in one day and how much data has been stored in a month. However, the data set is not used, when in fact it can be processed into information that is useful for stock agents. To process the data, this is where the role of data mining is needed. Namely using the association method with apriori algorithm to determine the relationship of each product in sales, so that it can be known HPAI consumer spending patterns. The method often used to analyse consumer shopping behaviour patterns is shopping basket analysis or Market Basket Analysis (MBA). MBA is one of the most popular types of data analysis used in the marketing world [1]. This MBA is analysing consumer buying habits by finding associations between different products that consumers place in shopping basketball [2].There have been many previous studies that use the association method with this apriori algorithm, there are Implementation of Apriori Algorithm for Analysis of Consumer Purchase Patterns [3] , where this research has the aim of create an application that is used in determining consumer purchasing patterns by applying apriori algorithms and using Visual Basic 2010 as a tool for determining consumer purchase patterns. In this study, then Use of Apriori Algorithm on Building materials Sales Transaction Data of Building Materials [4] where this

research has the aim of to determine the pattern of dependency relationships between goods and other goods so that the probability of goods purchase based on other goods can be found, and Online Store Product Recommendation System Uses Apriori Method [5] this research will analyse the rules in a historical data of purchase from Online Store visitors to get recommendation of products to be displayed. the authors conducted a case study at a HPAI Distribution Center (DC) in the Sidoarjo area, namely DC Rahma Andriana. The method used is apriori algorithm. The apriori is first algorithm to generate all frequent item sets and confident association rules was the AIS algorithm by Agrawal [6-8] As a result, they have stored a lot of data but only a little information can be used to support marketing strategies. The author expects the information obtained from this study is information about HPAI consumer spending patterns in DC. Therefore, this thesis research the author has the idea of the title "HPAI Consumer Shopping Cart Analysis Using Apriori Algorithms (Case Study: DC Rahma Andriana)". It is expected that the results of this research can help DC Rahma Andriana in analysing sales transaction data to make better marketing policies and planning in the future.

2. Experimental method

Apriori Algorithms include association learning in data mining that looks for patterns of relationships of several items in a dataset. The association rule between some of these attributes is often called affinity analysis or market basket analysis so it is widely used in transaction data. For example, in a supermarket. who has a basketball market, with apriori algorithm, the supermarket owner can find out the pattern of consumer spending, if a consumer buys items A, B have a 60% chance he will buy item C, this pattern can be known from the transaction data so far. While the association analysis is a process to get all the associative rules of all transactions that meet the minimum support and minimum confidence requirements. Minimal Support is a value determined by the researcher to cut the combination of set items into fewer. Minimal Confidence is a value that is also determined by the researcher to cut the combination of each k-item set (the result of minimal support trimming) to form association rules. The basic methodology of association analysis is divided into two stages:

- Support: Support from an association rule is the presentation of the combination of items in the database, where if have item A and item B then the support is the proportion of transactions in the database containing A and B. The support value of an item is obtained by the formula [9].

$$\text{Support (A)} = \frac{\text{(the number of transactions containing A)}}{\text{transaction total}}$$

While the support value of 2 items is obtained from the following formula:

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

- Confidence: Confidence of association rule is a measure of the accuracy of a rule, which is the presentation of a transaction in a database containing A and containing B [10]

$$\text{Confidence} = P(B|A) = \frac{\sum \text{Transaction contain A and B}}{\sum \text{Transaction contain A}}$$

3. Results and discussion

3.1. Manual calculation

The data used to obtain associative rules for products purchased by HPAI consumers are from January 2017 to December 2018. The total amount of initial data (data warehouse) is 50 data, with 3 attributes namely date, member name, and name product. Apriori algorithm manual calculations for now the relationship between HPAI products that are often bought by consumers.

Table 1. Transaction data for each item.

Product	Amount	Product	Amount	Product	Amount
Andrographis centella	5	Pegagan HS	2	Honey Premium	3
Bilberry	9	Procumin Rich Vit. E	1	Bitter Honey	1
Biosir	2	Procumin Propolis	3	Honey SJ	1
Carnocap	5	Rosella HS	1	Zaitun	13
Deep Squa	6	Siena	1	Sari Kurma	12
Diabextrac	2	Spirulina	12	Stimfibre	1
Gamat	6	Truson	3	Day Cream	7
Ginextrac	2	Centella Teh Sinergi	2	Night Cream	7
Habbassauda HPAI	8	Deep Olive	2	Deep Beauty	2
Harumi	8	Etta Goat Milk	12	Green Wash	2
Langsingin	3	Extra Food	14	Hibis	4
Laurik	4	Hpai Coffe	9	Herbal HPAI toothpaste	20
Magafit	3	Jannatea Cold	1	Promol 12	1
Mengkudu	4	Jannatea Hot	1	Kolagen Soap	14
Synergy Herb Oil	21	Coffe 7 Elemen	9	Honey Soap	14
Mustika Dara	3	Honey Multiflora	2	Propolis Soap	14
N-Green	3				

Specify the minimum value (ϕ) = 14, then specify frequent itemset. Then F1 = {Synergy Herb Oil, Extra Food, HPAI Herbal Toothpaste, Collagen Soap, Honey Soap, Propolis Soap}. From the F1 candidate will get 2-itemset of existing transaction data as in the table below.

Table 2. Candidate 2 items set.

Item	Amount
Synergy Herb Oil, Extra Food	7
Synergy Herb Oil, HPAI Herbal Toothpaste	10
Synergy Herb Oil, Collagen Soap	3
Synergy Herb Oil, Honey Soap	4
Synergy Herb Oil, Propolis Soap	6
Extra Food, HPAI Herbal Toothpaste	8
Extra Food, Collagen Soap	5
Extra Food, Honey Soap	6
Extra Food, Propolis Soap	7
HPAI Herbal Toothpaste, Collagen Soap	8
HPAI Herbal Toothpaste, Honey Soap	7
HPAI Herbal Toothpaste, Propolis Soap	7
Collagen Soap, Honey Soap	6
Collagen Soap, Propolis Soap	5
H oney Soap, Propolis Soap	7

The minimum value (ϕ) is changed to 7, then obtained F2 = {{Herbal Oil Synergy, Extra Food}, {Synergy Herb Oil, HPAI Herbal Toothpaste}, {Extra Food, HPAI Herbal Toothpaste}, {Extra Food, Propolis Soap}, {Herbal Toothpaste HPAI, Collagen Soap}, {Herbal HPAI Toothpaste, Honey Soap}, {Toothpaste Herbal HPAI, Propolis Soap}, {Honey Soap, Propolis Soap}}. Amount of candidate itemset as in the table below.

Table 3. Item set candidate.

Item	Amount
Synergy Herb Oil, Extra Food, HPAI Herbal Toothpaste	5
Synergy Herb Oil, Extra Food, Collagen Soap	1
Synergy Herb Oil, Extra Food, Honey Soap	3
Synergy Herb Oil, Extra Food, Propolis Soap	4
Synergy Herb Oil, HPAI Herbal Toothpaste, Collagen Soap	2
Synergy Herb Oil, HPAI Herbal Toothpaste, Honey Soap	5
Synergy Herb Oil, HPAI Herbal Toothpaste, Propolis Soap	5
Synergy Herb Oil, Collagen Soap, Honey Soap	2
Synergy Herb Oil, Collagen Soap, Propolis Soap	2
Synergy Herb Oil, Honey Soap, Propolis Soap	4
Extra Food, HPAI Herbal Toothpaste, Collagen Soap	4
Extra Food, HPAI Herbal Toothpaste, Honey Soap	6
Extra Food, HPAI Herbal Toothpaste, Propolis Soap	6
Extra Food, Collagen Soap, Honey Soap	3
Extra Food, Collagen Soap, Propolis Soap	3
Extra Food, Honey Soap, Propolis Soap	4
HPAI Herbal Toothpaste, Collagen Soap, Honey Soap	3
HPAI Herbal Toothpaste, Collagen Soap, Propolis Soap	3
HPAI Herbal Toothpaste, Honey Soap, Propolis Soap	4
Collagen Soap, Honey Soap, Propolis Soap	3

We specify the minimum value (ϕ)= 14, then we specify frequent itemset. Then F1 = {Minyak Herba Sinergi, Extra Food, Pasta Gigi Herbal HPAI, Sabun Kolagen, Sabun Madu, Sabun Propolis}. Then the minimum value (ϕ) is changed to 7, then F2 can be obtained = {{Minyak Herba Sinergi, Extra Food}, {Minyak Herba Sinergi, Pasta Gigi Herbal HPAI}, {Extra Food, Pasta Gigi Herbal HPAI}, {Extra Food, Sabun Propolis}, {Pasta Gigi Herbal HPAI, Sabun Kolagen}, {Pasta Gigi Herbal HPAI, Sabun Madu}, {Pasta Gigi Herbal HPAI, Sabun Propolis}, {Sabun Madu, Sabun Propolis}}. With ϕ = 7, F3 is obtained = {} because there is no 3-itemset whose frequency is $\geq \phi$. Because F3 = {}, then look for association rules, the frequent itemset used is F2. From the F2 that has been found, we look for the value of support and value of confidence from the prospective association rules.

Table 4. Candidates for association rules from F2.

Item	Support	Confidence
If buy Synergy Herb Oil, it will buy Extra Food	14%	33%
If buy Extra Food, you will buy Synergy Herb Oil	14%	50%
If buy Synergy Herb Oil, it will buy HPAI Herbal Toothpaste	20%	48%
If buy HPAI Herbal Toothpaste, then will buy Synergy Herb Oil	20%	50%
If buy Synergy Herb Oil, it will buy Collagen Soap	6%	14%
If buy Collagen Soap, it will buy Synergy Herb Oil	6%	21%
If buy Synergy Herb Oil, it will buy Honey Soap	8%	19%
If buy Honey Soap, it will buy Synergy Herb Oil	8%	29%
If buy Synergy Herb Oil, it will buy Propolis Soap	12%	29%
If buy Propolis Soap, it will buy Synergy Herb Oil	12%	43%
If buy Extra Food, you will buy HPAI Herbal Toothpaste	16%	57%
If buy HPAI Herbal Toothpaste, then will buy Extra Food	16%	40%
If buy Extra Food, you will buy Collagen Soap	10%	36%
If buy Collagen Soap, it will buy Extra Food	10%	36%

Table 4. Cont.

If buy Extra Food, you will buy Honey Soap	12%	43%
If buy Honey Soap, it will buy Extra food	12%	43%
If buy Extra Food, you will buy Propolis soap	14%	50%
If Propolis Soap, it will buy Extra Food	14%	50%
If HPAI Herbal Toothpaste, then will buy Collagen Soap	16%	40%
If Collagen Soap, it will buy HPAI Herbal Toothpaste	16%	57%
If buy HPAI Herbal Toothpaste, then will buy Honey Soap	14%	35%
If buy Honey Soap, it will buy HPAI Herbal Toothpaste	14%	50%
If buy HPAI Herbal Toothpaste, then will buy Propolis Soap	14%	35%
If buy Propolis Soap, it will buy HPAI Herbal Toothpaste	14%	50%
If buy Collagen Soap, it will buy Honey Soap	12%	43%
If buy Honey Soap, it will buy Collagen Soap	12%	43%
If buy Collagen Soap, it will buy Propolis Soap	10%	36%
If buy Propolis Soap, it will buy Collagen Soap	10%	36%
If buy Honey Soap, it will buy Propolis soap	14%	50%
If buy Propolis Soap, it will buy Honey Soap	14%	50%

The minimum confidence value is 50%, then multiplied between support and confidence, the results of the final association rules are shown in the table below this.

Table 5. Final association rules.

Rule Item	Support	Confidence	Support x Confidence
If buy Extra Food, it will buy Synergy Herb Oil	14%	50%	7%
If buy HPAI Herbal Toothpaste, then you will buy Herb Oil Synergy	20%	50%	10%
If buy Extra Food, it will buy HPAI Herbal Toothpaste	16%	57%	9%
If buy Extra Food, it will buy Propolis Soap	14%	50%	7%
If buy Propolis Soap, then will buy Extra Food	14%	50%	7%
If buy Collagen Soap, then will buy HPAI Herbal Toothpaste	16%	57%	9%
If buy Honey Soap, it will buy HPAI Herbal Toothpaste	14%	50%	7%
If buy Propolis Soap, then will buy HPAI Herbal Toothpaste	14%	50%	7%
If buy Honey Soap, it will buy Propolis Soap	14%	50%	7%
If buy Propolis Soap, then will buy Honey Soap	14%	50%	7%

Based on the above calculation, the rule that has the highest support and confidence is 10% with rule If buy HPAI Herbal Toothpaste, then you will buy Herb Oil Synergy.

3.2. Testing result
For testing result data used to obtain associative rules for products purchased by HPAI consumers are from January 2017 to December 2018. The total amount of initial data (data warehouse) is 1633 data.

Table 6. Testing results.

Min Support	Min. Confidence	Rule	Support	Confidence	Support X Confidence
10%	50%	HPAI Herbal Toothpaste, Olive → Synergy Herb Oil	22.6%	89.13%	20.14%
		Synergy Herb Oil, Olive → Herbal HPAI Toothpaste	22.6%	100%	22.6%
		Synergy Herb Oil, HPAI Herbal Toothpaste → Olive	22.6%	92.95%	21%
15%	50%	HPAI Herbal Toothpaste, Olive → Synergy Herb Oil	22.6%	89.13%	20.14%
		Synergy Herb Oil, Olive → Herbal HPAI Toothpaste	22.6%	100%	22.6%
		Synergy Herb Oil, HPAI Herbal Toothpaste → Olive	22.6%	92.95%	21%
20%	50%	HPAI Herbal Toothpaste, Olive → Synergy Herb Oil	22.6%	89.13%	20.14%
		Synergy Herb Oil, Olive → Herbal HPAI Toothpaste	22.6%	100%	22.6%
		Synergy Herb Oil, HPAI Herbal Toothpaste → Olive	22.6%	92.95%	21%
20%	50%	HPAI Herbal Toothpaste → Olive	22.6%	89.13%	20.14%
		Olive→ HPAI Herbal Toothpaste	25.35%	72.13%	18,28%
30%	50%	Found no association results			

This test stops here due to support values of 35%, 40%, and so on will not get the association rules. Based on the above test, with existing datasets, this system can perform apriori calculations with a minimum of $\leq 25\%$ support. From the five tests with 5 minimum values of support used, it can be seen that the best association rule that is formed is if you buy Synergy Herb Oil, Olive then buy Herbal HPAI Toothpaste has 22.6% support and 100% confidence.

4. Conclusion

Based on the results of the study in the previous chapter, the following conclusions can be drawn: From the five tests with 5 minimum values of support used, it can be seen that the best association rule that is formed is if you buy Synergy Herb Oil, Olive then buy Herbal HPAI Toothpaste has 22.6% support and 100% confidence. Thus, the three products must always be available at store.

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