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Correlation Between Technological Advances On Employee Performance Using A PRIORI Method (Case Study: PLN City of Binjai)

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Abstract

Technology is a set of tools that can be used or utilized by humans to facilitate various forms of work. Employee performance is the ability to achieve job requirements, where a work target can be completed in a timely manner or does not exceed the time limit provided so that the goal will be in accordance with company morals and ethics. This study aims to determine the correlation of technological progress on employee performance. In this study using RapidMiner as a test of 230 data on employees of PLN Binjai City. By using the Apriori algorithm method with a minimum support value of 10% and confidence of 50%, 44 association rules are obtained in the entire set and there are 2 rules in 4 itemsets. From the test results, the best rule with the highest value is obtained, namely if the data is T7, A3, F7 then SB, which means if using Ms.Word and Ms.Excel and Ms.PPT, using FSO Mobile and PLN Mobile, using Computers and Printers and Fax Machines then employee performance is Very Good with a support value of 30% and a confidence value of 96%.

Keywords: Apriori, Correlation, Data Mining, Employee Performance, Technological Advances.

1. Introduction

Technology is a set of tools that can be used or utilized by humans to facilitate various forms of work. The use of technology in the world of work includes electronic work processes, information processing, data processing, and management systems.[1]. Employee performance is the ability to achieve job requirements, where a work target can be completed at the right time or not exceeding the time limit provided so that the goals will be in accordance with company morals and ethics. Employee performance is influenced by several factors, including the ability of employees to operate technology[2]. In the midst of today's rapid technological developments, almost all individuals or workforce are required to know and understand the technological developments around them. Understanding the use of technology where one works is very important. A worker must have the ability to apply technology where he works to maximize his performance.[3]. Based on the description above, it is necessary to conduct research on the correlation between technological advances on the performance of PLN employees in Binjai City. This is based on observations that have been made that there are several employees who have poor performance because they do not keep up with technological advances in their offices.

2. Research Methods

2.1. Data Mining

Data mining is an analysis step of data sets that are generally large in size to obtain relationships between these data and summarize them in a form that is easy to understand and use.[4]. The resulting relationships and summaries are generally in the form of models or patterns. The process of data mining uses statistical, mathematical, artificial intelligence and machine learning techniques to extract and identify useful information and related knowledge from various related databases. So the main purpose of data mining is to find and explore existing knowledge and data or information.[5]

2.2. A priori algorithm

The a priori algorithm is used to find frequent itemsets that meet the minimum support and then get a rule that meets the minimum confidence of the frequent itemsets. The a priori algorithm determines the possible candidates by paying attention to the minimum support and minimum confidence[6].

Support value is the percentage of the item combination in the database and Confidence value, namely the strength of the relationship between items in associative rules formed by the association method in data mining[7]. The formula for finding the support value is as follows:

$$Support\ (A, B) = P(A \cap B) = \frac{\sum \textbf{Transaction contains A and B}}{\sum Total\ Transactions} \text{ X } 100\% \quad (1)$$

The formula for finding the Confidence value is as follows:

$$Confidence = P(B \mid A) = \frac{\sum \textbf{Transaction contains A and B}}{\sum Total\ Transaction\ contain\ A} \text{ X } 100\% \quad (2)$$

2.3. The Apriori Method Stage

1. Forming Itemset candidates, k-itemset candidates are formed from the combination of (k-1)- Itemset obtained from the previous iteration. One feature of the Apriori algorithm is the pruning of k-itemset candidates whose subset contains k-1 items not included in a high-frequency pattern with k-1 length.
2. Calculating the support of each k-itemset candidate. Support of each k-itemset candidate is obtained by scanning the database to calculate the number of transactions that contain all items in the k-itemset candidate. This is also a feature of the a priori algorithm where calculations are required by scanning the entire database as long as the longest k-itemset.
3. Sets the high frequency pattern. High-frequency patterns that contain k items or k-itemsets are determined from k-itemset candidates whose support is greater than the minimum support.
4. If no new high-frequency pattern is found, then the whole process is stopped. If not, then k is added to one and returns to part one[8].

3. Results And Discussion

3.1. Research methods

Research methodology is a scientific method used in an effort to find or obtain data for a specific purpose or use. With the existence of a research methodology, it can provide an understanding of how the research process takes place, with a research methodology, researchers can determine what methods will be used in research and provide an understanding of what steps must be taken in collecting and analyzing data.
The following is the application of research methodology in this research process:

1. Research Preparation; At this stage the writer determines the background of the problem, defines the problem boundaries so that this research remains focused on research that will help the writer in the next stage.
2. Formulate Problems and Goals; The author will formulate the problem and what goals are in accordance with the background in order to produce results that are in accordance with what is expected and can be useful for users.
3. Data collection; Data collection was carried out in this study, namely by direct observation, literature study, namely understanding the literature in the form of books, journals, and other references related to related issues, as well as by distributing questionnaires to pln binjai employees regarding the implementation of progress technology and employee performance.
4. Data processing; At this stage, the data that has been collected will be processed to find correlations using an a priori algorithm using the Rapid Miner software.
5. Conclusion; In the final stage, a conclusion will be obtained in the form of a statement containing the results of this study.

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3.2. Research Supporting Data

The research supporting data used are parents' employment and education data on student behavior obtained from PLN employees in Binjai City by distributing questionnaires. The data obtained can be seen in Table 1 below.

Table 1 : Student Data

No	Name	Information Technology used	The Office Mobile Application used	Office facilities used	Employee performance
1	Dilla	Ms. Word & Ms. Excel & Ms. PPT	FSO Mobile & PLN Mobile	Computers&Printers& Fax Machines	Very good

2	Ricky	Ms. Word & Ms. PPT	FSO Mobile & PLN Mobile	Computers&Printers	Good
3	Diko	Ms. word	PLN Mobile	Computers&Printers	Good
4	Mia	Ms. Word & Ms. PPT	FSO Mobile & PLN Mobile	Computers&Printers	Very good
5	Rusli	Ms. Word & Ms. excel	FSO Mobile	Computers&Printers&Fax Machines	Good
6	Alpine	Ms. Word & Ms. Excel & Ms. PPT	FSO Mobile & PLN Mobile	Computers&Printers&Fax Machines	Very good
7	Revelation	Ms. Word & Ms. PPT	Not both	Computer	Not good
8	dedi	Ms. word	PLN Mobile	Computers&Printers	Good
9	Yona	Ms. word	PLN Mobile	Computers&Printers	Good
10	Nanda	Ms. Word & Ms. Excel & Ms. PPT	FSO Mobile & PLN Mobile	Computers&Printers&Fax Machines	Very good
11	Diah	Ms. Word & Ms. Excel & Ms. PPT	Not both	Computers&Printers	Very good
12	Rista	Ms. Word & Ms. excel	PLN Mobile	Computers&Printers&Fax Machines	Very good
13	Dimas	Ms. Word & Ms. PPT	FSO Mobile & PLN Mobile	Computers&Printers	Good
14	Rozy	Ms. Word & Ms. Excel & Ms. PPT	FSO Mobile & PLN Mobile	Computers&Printers&Fax Machines	Very good
15	Come on	Ms. Word & Ms. Excel & Ms. PPT	PLN Mobile	Computers&Printers	Good
16	Haiqal	Ms. word	PLN Mobile	Computers&Printers	Good
17	Nabila	Ms. Word & Ms. PPT	FSO Mobile & PLN Mobile	Computers&Printers	Good
18	Mitha	Ms. Word & Ms. excel	PLN Mobile	Computer	Very good
19	Yaza	Ms. Word & Ms. Excel & Ms. PPT	FSO Mobile & PLN Mobile	Computers&Printers&Fax Machines	Very good
20	great	Ms. word & Ms. PPT	Not both	Computer	Not good

3.3. Application of the Method

This study uses the a priori method as a problem-solving method, namely to analyze the correlation of technological progress on the performance of PLN employees in Binjai City. The process of the associative method with the a priori algorithm is as shown in the flowchart below:

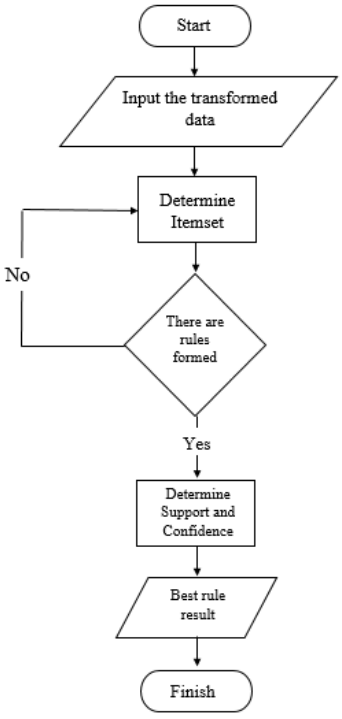


Fig. 1: A priori flowchart

Description as follows:

1. Start
2. *Inputs*data is entering data that has been transformed.
3. Determine the Itemset that may be formed.
4. If there is a rule that is formed, then calculate and determine the value of support and confidence, if not then specify the Itemset again.
5. After getting the best rule results, then it's done.

For manual calculations there are several steps of the a priori method, namely as follows:

1. High Frequency Pattern Analysis
   At this stage, look for item combinations that meet the minimum requirements of the support value in the database
2. Formation of Association Rules
   After all the high frequencies are found, then we look for the association rules that satisfy Confidence by calculating associative rules.
   To analyze the correlation between technological advances on the performance of PLN employees in Binjai City, the authors took 20 employee data, which will be described as follows:

Table 2 : Data Representation

No	Variable	Sub Variable	Code
1.	Information Technology used	1. Ms. word	T1
		2. Ms. Excel	T2
		3. Ms. PPT	T3
		4. Ms. word & Ms. excel	T4
		5. Ms. word & Ms. PPT	T5
		6. Ms. Excel & Ms. PPT	T6
		7. Ms. Word & Ms. Excel & Ms. PPT	T7
2.	The Office Mobile Application used	1. FSO Mobile	A1
		2. PLN Mobile	A2
		3. FSO Mobile & PLN Mobile	A3
		4. Not both	A4
3.	Office facilities used	1. Computer	F1
		2. Printers	F2
		3. Fax machine	F3
		4. Computers&Printers	F4
		5. Computers & Fax Machines	F5
		6. Printers & Fax Machines	F6
		7. Computers&Printers&Machines	F7
4.	Employee performance	1. Very good	SB
		2. Good	B
		3. Not good	BK

From the data above, data transformation is carried out and forms a data matrix to determine the number of items that appear in the data. The matrix form of the data above is as shown in the table below.

Table 3: Student Data Transformation

	Information Technology used							**Comprehensive Office Mobile Application**				**Office facilities used**							**Employee performance**		
No	T1	T2	T3	T4	T5	T6	T7	A1	A2	A3	A4	F1	F2	F3	F4	F5	F6	F7	SB	B	KB
1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0
2	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0
3	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0
4	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0
5	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0
6	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0
7	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1
8	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0
9	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0
10	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0
11	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0
12	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0
13	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0
14	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0
15	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	1	0
16	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0
17	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0
18	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0

19	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0
20	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1
Total	4	0	0	3	6	0	7	1	7	9	3	3	0	0	10	0	0	7	9	9	2

3. Defineθ(Frequent)
   Suppose we defineθ= 3, then we can determine the frequent Itemset. From the table above it is known the totalθfor data k > 1, there are some that are greater thanθ
4. Set Item Sets
   Then F1 for the employee data table whose value is greater thanθ ieT1, T4, T5, T7, A2, A3, A4, F1, F4, F7, SB, B,while items likeT2, T3, T6, A1, F2, F3, F5, F6, KBnot included because it only appears <2 data
5. Test Setsθ
   To find out the relationship or correlation between items is determined by 2 factors, namely support and confidence, which is obtained by the following formula:

support= Supporting Value

$$\boldsymbol{Support = \frac{\sum \text{items used}}{\sum \text{sum of all transactions}} \times 100\%} \quad (3)$$

Confidence= certainty value

$$\boldsymbol{Confidence = \frac{\sum \text{items used at once}}{\sum \text{Number of transactions in the antecent section}} \times 100\%} \quad (4)$$

The rule for 4 Itemset consists of 3 rules which are implemented in the following table:

Table 4: 4 Itemset Association Rules

If antecedent then consequent	***support***	***Confidence***
If data T1 A2 F4 ➔ B	4/20 * 100% = 20%	4/4* 100% = 100%
If data T5 A3 F4 ➔ B	3/20 * 100% = 15%	3/4* 100% = 75%
If data T7 A3 F7 ➔ SB	5/20 * 100% = 25%	5/5* 100% = 100%

And after the Support and Confidence values are obtained, a multiplication between Support and Confidence is performed

Table 5: 4 Itemset Association Rules

If antecedent then consequent	***support***	***Confidence***	**S*C**
If data T1 A2 F4 ➔ B	20%	100%	20%
If data T5 A3 F4 ➔ B	15%	75%	11.25%
If data T7 A3 F7 ➔ SB	25%	100%	20%

And after multiplying Support and Confidence, the Best Rule for 4 Itemsets is obtained, which is as shown in the table below.

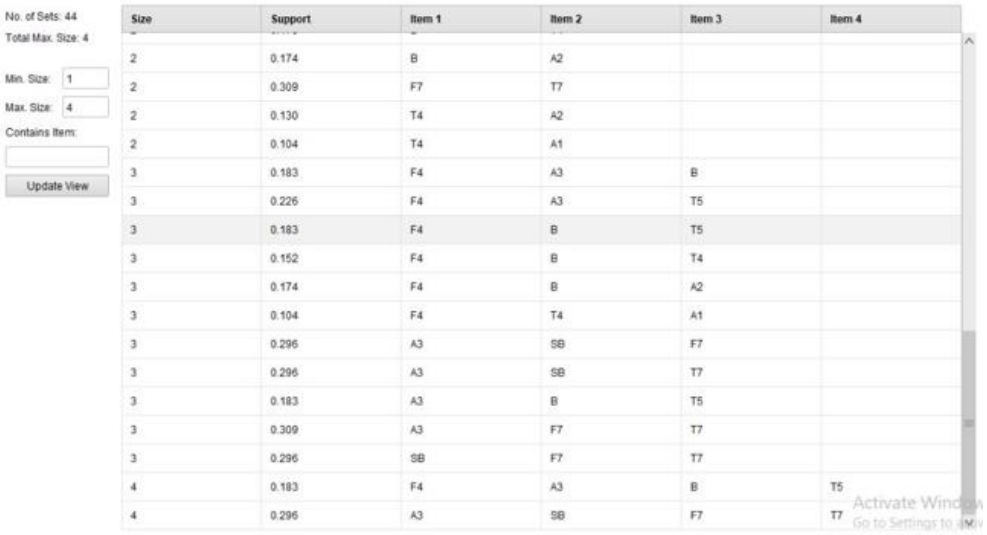
Table 6 : Best Rules

If antecedent then consequent	***support***	***Confidence***	**S*C**
If data T7 A3 F7 ➔ SB	25%	100%	25%

If you use Ms.Word and Ms.Excel and Ms.PPT, use FSO Mobile and PLN Mobile, use Computers and Printers and Fax Machines, the employee's performance is very good

4. Testing

At the testing stage, researchers conducted experiments on all data using the RapidMiner application using a minimum support value of 10% and a minimum confidence value of 50%. The test results can be seen in the following table:



Size	Support	Item 1	Item 2	Item 3	Item 4
2	0.174	B	A2		
2	0.309	F7	T7		
2	0.130	T4	A2		
2	0.104	T4	A1		
3	0.183	F4	A3	B	
3	0.226	F4	A3	T5	
3	0.183	F4	B	T5	
3	0.152	F4	B	T4	
3	0.174	F4	B	A2	
3	0.104	F4	T4	A1	
3	0.296	A3	SB	F7	
3	0.296	A3	SB	T7	
3	0.183	A3	B	T5	
3	0.309	A3	F7	T7	
3	0.296	SB	F7	T7	
4	0.183	F4	A3	B	T5
4	0.296	A3	SB	F7	T7

Fig. 2: Test results on rapidminer

No.	Premises	Conclusion	Support	Confidence
10	A3	SB	0.348	0.640
11	SB	A3, F7	0.296	0.642
12	SB	A3, T7	0.296	0.642
13	SB	F7, T7	0.296	0.642
14	SB	A3, F7, T7	0.296	0.642
15	T4	B	0.178	0.661
16	T5	B	0.183	0.677
17	T5	F4, B	0.183	0.677
18	T5	A3, B	0.183	0.677
19	T5	F4, A3, B	0.183	0.677
20	SB	F7	0.317	0.689
21	SB	T7	0.317	0.689
22	A2	B	0.174	0.714
23	A2	F4, B	0.174	0.714
24	T4	F4	0.200	0.742
25	F4	B	0.422	0.752

Fig. 3: Test results with support and confidence values

From this figure, the formation of association rules or rules is generated with the provision of a minimum support value of 10% and a minimum confidence value of 50% for as many as 44 rules. One of the rules that has the highest confidence value is, if the data is T7, A3, F7 then SB. Which means if you use Ms.Word and Ms.Excel and Ms.PPT, use FSO Mobile and PLN Mobile, use computers and printers and fax machines, the employee's performance is very good

5. Conclusions

As for some conclusions that the author can give from writing this thesis research, among others, are as follows.

1. By using the a priori algorithm method can find a correlation between technological advances on employee performance.
2. From the results of tests carried out using the RapidMiner application with data on 230 data from PLN employees in Binjai City, with a minimum support value of 10% and a minimum confidence of 50%, it results in 44 association rules in all itemsets and 2 association rules in 4 itemsets.
3. From the results of tests carried out using the RapidMiner application with data on 230 PLN employee data in Binjai City, it produces the best rule if the data is T7, A3, F7 then SB, which means if you use Ms.Word and Ms.Excel and Ms.PPT, use FSO Mobile and PLN Mobile, using computers and printers and fax machines, the employee performance is very good with a support value of 30% and a confidence value of 96%.

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