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Rough Set Method For Measuring The Performance Of Institute Of Administration And Health Lecturers Setih Setio (IAKSS) Muara Bungo

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Abstract
Lecturers are an important resource in educational organizations. The quality of lecturers needs attention because it determines the quality of the teaching and learning process. Data mining has developed rapidly and adds value to the information stored in it databases. One data mining algorithm that is quite simple is Rough Set. Lecturer performance measurement can be done using the rough set method. Aspects or attributes assessed using the rough set method consist of: teaching and learning processes, guidance and consultation, research and community service, and other tasks outside the main task. Research on lecturer performance was conducted at IAKSS. The rough set method can be used to produce output in the form of lecturer achievements. The aim of applying the rough set method is to assist management in finding out possible lecturer achievements based on lecturer data that has been stored so far. The benefit obtained is that it can be determined early on the lecturer's possible achievements based on the knowledge obtained through the rough set method.

Keywords: *Performance, Data Mining, Rough Set*

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I. Introduction

Data mining is a field that is growing rapidly along with the development of information technology which involves the use of large and small scale databases (Saura, 2021). Information stored in databases becomes useless over time. Data mining can increase the added value of a database (Shao et al., 2020). We can dig into information stored in databases that have accumulated over a long period of time to obtain additional information. Many algorithms implement data mining. One algorithm that is quite simple and easy to implement is the Rough Set algorithm(In et al., 2020)(Istianingsih & Defit, 2021).

The Rough Set algorithm can be used to analyze lecturer performance (Bangun et al., 2020). Lecturers are an important resource in supporting the teaching and learning process(Hartama & Hartono, 2016). The quality of lecturers really determines the quality of the teaching and learning process. Research on lecturer performance was conducted at IAKSS. Aspects or attributes assessed using the rough set method consist of: teaching and learning processes, guidance and consultation, research and community service, and other tasks outside the main task(Sofyani et al., 2019). The rough set method can be used to produce output in the form of lecturer achievements. The aim of applying the rough set method is to assist management in finding out possible lecturer achievements based on lecturer data that has been stored so far (Memon et al., 2017). The benefit obtained is that it can be determined early on the possible achievements of prospective lecturers based on the knowledge obtained through the rough set method.

II. Research methodology

The research procedure uses the stages of Knowledge Discovery in Database (KDD). The stages include: Selection (Selecting relevant data), Preprocessing (removing noise and data inconsistencies; combining data sourced from many sources), Transformation (Transforming data into a form suitable for the data mining process), Data Mining (Selecting a data algorithm mining in accordance with data patterns; Extraction of

patterns from data), Interpretation/Evaluation (interpreting patterns into knowledge by eliminating redundant and irrelevant patterns) (In et al., 2020). The existing KDD process can be seen in Figure 1.

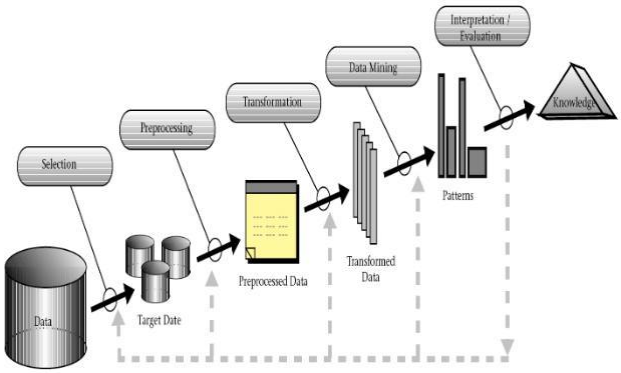

Figure 1. Process in KDD

III. Discussion

Data Mining

Data mining is the process of finding interesting knowledge, patterns and information from large data sets through descriptive, understanding and prediction processes using a model or algorithm (Zaki and Meira, 2014). Data mining is a process that uses statistical, mathematical, artificial intelligence, and machine learning techniques to extract and identify useful information and related knowledge from large databases (Putra et al., 2018).

Data mining is one of the important stages in the Knowledge Discover in Database (KDD) process. The terminology of KDD and data mining is different. KDD is the entire process of finding useful knowledge from a data set, while data mining is one of the stages in KDD and focuses on efforts to find useful knowledge using algorithms.

Rough Set

Rough Set built by Zdzislaw Pawlak in the early 1980s. The philosophy of this method is that information (knowledge, data) can be associated with objects. In Rough Set, a data set is represented as a table, where the rows are in the table represents objects and columns represent the attributes of these objects(Istianingsih & Defit, 2021).

The stages in using the Rough Set algorithm are as follows:
1. Data Selection (Selection of data to be used)
2. Formation of a Decision System containing condition attributes and decision attributes.
3. Establishment of Equivalence Class, namely by eliminating repeated data.
4. Formation of Discernibility Matrix Modulo D, namely a matrix that contains comparisons between data with different condition attributes and decision attributes.
5. Generate reducts using boolean algebra.
6. Produce rules (knowledge).

Data Selection

The data used is lecturer data in the IAKSS Business Administration Study Program for the 2021-2022 academic year, with attributes: teaching and learning processes, guidance and consultation, research and community service, and other tasks outside the main task.

In order to assess and analyze lecturer performance, it is based on a number of assessment components such as:
1. Teaching and learning process (Max. 50%)
2. Guidance and consultation (Max. 20%)
3. Research and community service (Max. 20%)
4. Other tasks outside the main task (Max. 10%)

The existing assessment components in the teaching and learning process can be seen in Table 1.

Table 1. Components of Teaching and Learning Process Assessment

	Criteria Assessed	Weight
a.	Fulfill the number of face to face meetings according to the requirements	10%
	scheduled, including being present and finishing on time	
b.	Create exam questions, answers and correct them correctly	10%
	time	
c.	Supervise exams according to scheduling and assignments	5%
	main	
d.	Testing work internships and theses in accordance with	5%
	scheduling	
e.	Results of feedback / assessments from students regarding	20%
	teaching and learning process	

The assessment components that include guidance and consultation can be seen in Table 2.

Table 2. Guidance and Consultation Assessment Components

	Criteria Assessed	Weight
a.	Providing work internship / KP / Thesis guidance	10%
b.	Become an academic advisor (guardian lecturer)	10%

The assessment components that include research and community service can be seen in Table 3.

Table 3. Components of Research and Community Service Assessment

No	Criteria Assessed	Weight
a.	Create scientific work: research, papers, books, diktats, articles in journals/magazines/newspapers, etc	10%
b.	Carrying out community service: social service, providing counseling/training, including developing students	10%

Table 4. Assessment components for other tasks outside the main task

	Criteria Assessed	Weight
a.	Serve as a committee member	5%
b.	Attend activities held by universities: seminars, training, symposia, work meetings, ceremonies, etc	5%

Data Transformation

The total assessment results are then put into a form category with conditions:

<50 is said to be Less = 1

$51 \leq X \leq 70$ is categorized as Fair = 2

$71 \leq X \leq 80$ is categorized as Good = 3

$81 \leq X \leq 100$ is categorized as Very Good = 4

Formation of Decision Systems

The Decision System for analyzing lecturer performance consists of:

1. Condition Attributes: teaching and learning process, guidance and consultation, research and community service, and other tasks outside the main task.
2. Decision Attribute: Lecturer Achievements

The existing Decision System can be seen in Table 5, with an example of 10 (ten) data that will be used.

Table 5. Decision Systems

Name Lecturer	Mark PBM	Mark BK	Mark PPM	Mark TL	Amount Mark	Decision
A	45	15	16	10	86	Very good
B	39	10	15	8	75	Good

C	38	9	10	7	67	Enough
D	40	15	15	10	78	Very good
E	40	10	15	7	72	Good
F	38	20	5	10	70	Good
G	35	15	5	10	65	Enough
H	42	8	20	5	70	Good
I	43	7	10	10	72	Good
J	35	12	15	10	75	Good

Establishment of Equivalence Class

Before we create an equivalent class, the first step is to carry out a transformation back to attribute A (teaching and learning process), attribute B (guidance and consultation), attribute C (research and community service), and attribute D (other tasks outside of the assignment). main).

Attribute A is grouped into 4 groups, namely:
0≤X≤35=1

36≤X≤40=2
41≤X≤45=3
46≤X≤50=4

Attribute B is grouped into 4 groups, namely:

0≤X≤8=1
9≤X≤12=2
13≤X≤16=3

17≤X≤20=4

For attribute C, it is grouped into 4 groups, namely:
0≤X≤5=1

6≤X≤10=2
11≤X≤15=3

16≤X≤20=4

Attribute D is grouped into 4 groups, namely:
0≤X≤2=1
3≤X≤5=2

6≤X≤8=3
9≤X≤10=4

So the results of forming the decision system can be seen in Table 6.

Table 6. Formation of the Decision System after 2nd transformation

Name Lecturer	Mark PBM	Mark BK	Mark PPM	Mark TL	**Amount Mark**	**Decision**
A	3	3	4	4	**4**	**4**
B	2	2	3	3	**3**	**3**
C	2	2	2	3	**2**	**2**
D	2	3	3	4	**4**	**4**
E	2	2	3	3	**3**	**3**
F	2	4	1	4	**3**	**3**
G	2	3	1	4	**2**	**2**
H	3	1	4	2	**3**	**3**
I	3	1	2	4	**3**	**3**
J	1	2	3	4	**3**	**3**

The Equivalence Class is formed by eliminating data that has similarities, so in the Equivalence Class the data is reduced to 1 (one) record. The results of the formation of the Equivalence Class can be seen in Table 7.

Table 7. Equivalence Class

	A	B	C	D	K
EC1	3	3	4	4	4
EC2	2	2	3	3	3
EC3	2	2	3	2	3
EC4	2	3	3	4	4
EC5	2	4	1	4	3
EC6	2	3	1	4	2
EC7	3	1	4	2	3
EC8	3	1	2	4	3
EC9	1	2	3	4	3

Information:

Attribute A (teaching and learning process), attribute B (guidance and consultation), attribute C (research and community service), and attribute D (other tasks outside the main task).

Formation of Discernibility Matrix Modulo D

*Discernibility Matrix Modulo D*is a matrix that contains comparisons between data with different condition attributes and decision attributes. Data with attributes

different conditions, but the same decision attributes are still considered the same. The Discernibility Matrix Modulo D can be seen in Table 8.

Table 8. Discernibility Matrix Modulo D

	EC1	EC2	EC3	EC4	EC5	EC6	EC7	EC8	EC9
EC1	X	ABCD	ABCD	X	ABC	AC	BD	BC	ABC
EC2	ABCD	X	C	BD	X	BCD	X	X	X
EC3	ABCD	C	X	BCD	BCD	X	ABCD	ABD	ACD
EC4	X	BD	BCD	X	BC	C	ABCD	ABC	ABC
EC5	ABC	X	BCD	BC	X	B	X	X	X
EC6	AC	BCD	X	C	B	X	ABCD	ABC	ABC
EC7	BD	X	ABCD	ABCD	X	ABCD	X	X	X
EC8	BC	X	ABD	ABC	X	ABC	X	X	X
EC9	ABC	X	ACD	ABC	X	ABC	X	X	X

Generating Reducts Using Boolean Algebra

Several Boolean theorems used in the Rough Set algorithm can be seen in Table 9.

Table 9. Basic Principles of Boolean Algebra

Boolean Theorems	Reduction
Commutative Law	A + B = B + A A*B = B*A
Associative Law	(A+B)+C = A+(B+C) (A*B)*C = A*(B*C)

Distributive Law	A*(B+C) = A*B + A . C A + (B+C) = (A+B) *(A+C)
Negation Law	(A') = A' (A')' = A
Absorption law	A+A . B = A A*(A+B) = A
Identity Law	A + A = A A*A = A 0 +A = A ---- 1*A = A 1+A = 1 ----0*A = 0 A' + A = 1 A'*A = 0 A+A*B-A+B A*(A + B) = A*B
De Morgan's	(A + B)' = A'*B' (A*B)' = A' + B'

The resulting reduct can be seen in Table 10.

Table 10. Resulting Reduct

Class	CNF of Boolean Function	Prime Implicant	Reducts
EC1	(A+B+C+D) * (A+B+C+D) * (A+B+C) * (A+C) * (B+D) * (B+C) * (A+B+C)	AB+BC+CD	{A,B}, {B,C}, {C,D}
EC2	A+B+C+D) * C * (B+D) *(B+C+D)	C * (B+D) = CB+CD	{B,C}, {C,D}
EC3	(A+B+C+D) * C * (B+C+D) * (B+C+D) * (A+B+C+D) * (A+B+D) * (A+C+D)	BC+CD+ AC	{B,C}, {C,D}, {A,C}
EC4	(B+D) * (B+C+D) * (B+C) * C * (A+B+C+D) * (A+B+C) * (A+B+C)	BC+CD	{B,C}, {C,D}
EC5	(A+B+C) * (B+C+D) * (B+C) * B	B	B
EC6	(A+C) * (B+C+D) * C * B * (A+B+C+D) * (A+B+C) * (A+B+C)	BC	{B,C}

Generating Rules

The rules generated based on Reduct consist of a combination of attributes as follows.

1. {A} = Teaching and Learning Process (PBM)
2. {B} = Guidance and Consultation (BK)
3. {C} = Research and Community Service (PPM)
4. {D} = Other tasks outside the main task (TL)
5. {A,B} = PBM and BK
6. {A,C} = PBM and PPM
7. {B,C} = BK and PPM
8. {B,D} = BK and TL
9. {C,D} = PPM and TL

So the resulting rule is based on class equivalence by comparing it with the existing attribute combination, so that the following results are obtained.

A. {A} = {Teaching and Learning Process}

1. If the Teaching and Learning Process has a value of = 1 then the decision has a value of = 1
2. If the Teaching and Learning Process has a value of = 2 then the decision has a value of = 2, 3, or 4
3. If the Teaching and Learning Process is worth = 3 then the decision is worth = 3 or 4

B. {B} = {Guidance and Consultation)

1. If Guidance and Consultation = 1 then the decision is worth = 3
2. If Guidance and Consultation = 2 then the decision is worth = 2 or 3
3. If Guidance and Consultation = 3 then the decision is worth = 2 or 4
4. If Guidance and Consultation = 4 then the decision is worth = 3

The decisions in the previous rule represent the possible achievements of the lecturer. The formation of rules for other attribute combinations is the same.

The application of data mining is increasingly developing at this time. One data mining concept that is quite simple is the rough set algorithm. The rough set algorithm which has the condition attributes: Teaching and learning processes, guidance and consultation, research and community service, and other tasks outside the main task can be used to analyze lecturer performance so that it can assist IAKSS in determining lecturer performance.

IV. Conclusion

Based on the results of the study conducted by researchers, the following conclusions can be obtained.

1. The Rough Set algorithm, which is the simplest data mining method, can be used in analyzing lecturer performance.
2. Attributes: Teaching and Learning Process (PBM), Guidance and Consultation (BK), Research and Community Service (PPM), and other tasks outside the main task (TL) can be used in the lecturer performance analysis process.

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