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IMPLEMENTATION OF BUSINESS INTELLIGENCE TO DETERMINE SCHOLARSHIP RECIPIENTS (CASE STUDY: PAMULANG UNIVERSITY)

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Abstract

Information technology has an important role in various fields of work, including in the academic world, especially to help the selection process of students who are eligible to receive scholarships. This selection does not only depend on one factor, but rather considers several important criteria such as the student's GPA and economic condition. However, with a lot of student data in each batch, the process of retrieving information becomes complex if it is only done with ordinary queries.

To address this problem, Business Intelligence (BI) can be used to effectively manage large amounts of data. BI includes the use of data warehouses and data analysis to facilitate information processing. In this study, the Online Analytical Processing (OLAP) method was applied to analyze data in a multidimensional manner. RapidMiner is also used to help create a decision tree model that can identify students who are eligible for scholarships. With the combination of OLAP and RapidMiner, it is hoped that the decision-making process can be carried out faster and more accurately, making it easier for academics to select scholarship recipients at the university.

Keywords **:** *Business Intelligence, Data Warehouse, OLAP, RapidMiner*

Introduction

By leap The development of information technology, various aspects of work have become easier. Information technology also produces more and more and varied data. The information obtained from this data is an important element in the progress of a government agency or company. The abundance of data in government agencies can slow down the information collection process, which in turn affects the speed of decision-making. These challenges force government agencies and companies to manage and process data quickly and efficiently, in order to produce quality information for the right decisions.

Without proper management, abundant data will become less valuable. Analysis of business activities is a need that cannot be ignored. The speed of data processing and obtaining accurate information for decision-making allows government agencies and companies to handle and prevent events that can harm them.

The use of Business Intelligence (BI) is very important for government agencies, including universities, especially in the process of determining students who are eligible to receive scholarships. The large amount of student data demands good processing by the authorities, so as to produce the right information and decisions.

For example, Pamulang University with an active number of around 89,750 students, including postgraduate programs, has a very large student data. Pamulang University strives to identify students who are eligible to receive scholarships based on the criteria of academic achievement index and economic level. In this case, the data needed includes around 20,000 student data from the 2022 and 2023 batches. From each batch, some students will be selected to receive scholarships based on criteria such as high academic achievement index and economically disadvantaged conditions, such as parents who work as laborers or farmers, or do not have a job.

This study will examine data analysis to determine students who are eligible to receive scholarships using the RapidMiner tool. Government agencies face difficulties in managing large volumes of data if they use only simple tools that are not capable of generating accurate information, which can result in errors in decision-making. Therefore, the use of BI and analysis tools such as RapidMiner is expected to be able to help in efficient data processing and

produce the right decisions for the determination of scholarship recipients at Pamulang University.

Theoretical Foundation

A. Business Intelligence (BI)

The term "intelligence" has been used in artificial intelligence research since the 1950s. However, it wasn't until the 1990s that the term "business intelligence" became popular among businesses and IT. In the 2000s, the term "business analytics" was introduced to refer to the key analytical components in BI.

Business intelligence is a term that includes architecture, tools, databases, analysis tools, applications, and methodologies. By implementing business intelligence technology in the company, data that previously had no economic value can be transformed into valuable information to determine future business strategies.

There are four main components of business intelligence that work synergistically for BI to function well:

1. Data Warehouse:

Data warehouses serve as data sources for business intelligence. It is a dataset that is subject-oriented, unchanging, and has a sufficiently long time span to support management decision-making.

2. Business Analytics:

Business analytics is a collection of tools for manipulating, mining, and analyzing data in a data warehouse.

3. Report and Queries.

It includes all forms of reporting, both static (unchanged) and dynamic according to data changes, as well as different types of queries such as drill downs, multidimensional views, and groupings

4. Data, Text, and Web Mining as well as High-Level Math and Statistics Tools:

Data mining is the process of finding unknown relationships or information in a large database or data warehouse using intelligent tools. Text mining is a semi-automated process for extracting patterns from large amounts of unstructured data. The main difference between text mining and data mining is the source of the data; Data mining uses structured data in a database, while text mining uses unstructured data.

Agencies or companies usually have hundreds or even thousands of data. Manually checking data takes a long time and has a higher risk of errors compared to using business intelligence. BI makes data processing and analysis more organized and fast with the help of data mining tools and applications. With BI, agencies or companies can easily find data that is useful for both them and the wider community. The collected data then becomes a data warehouse. The data in the data warehouse is used to conduct business analytics, which is data analysis according to the needs or goals of the agency or company. With data mining applications, data relevant to business analytics can be obtained.

In the journal on the implementation of business intelligence to determine scholarship recipients, the first step taken was to collect data on Pamulang University students from 2022 to 2023 as a data warehouse. Then, business analytics is carried out on the data warehouse to determine the criteria for students who are eligible to receive scholarships. Next, reports and queries are generated with the help of a data mining application, in this case using RapidMiner.

B. RapidMiner

Today, RapidMiner is one of the popular solutions for data mining and predictive analytics. RapidMiner has a variety of advantages, including:

1. It is freely available as an open-source application, but it also provides a commercial license suitable for closed-source applications.

2. It is mature with the development of users and a large community of developers, as well as relatively lower development costs compared to other data mining solutions.

3. It is suitable for research purposes, with an intuitive, well-structured, and user-friendly graphical user interface.

4. Able to access many databases and read a wide range of file formats, as well as having more than 250 learning algorithms and many built-in operators for data mining, RapidMiner was developed in 2001 in the artificial intelligence unit of the Technical University of Dortmund by Ralf Klinkenberg, Simon Fischer, and Ingo Mierswa. The project was originally named Yet Another Learning Environment (YALE).

Results and Discussion

In this chapter, we will describe the results of the research and the discussion of the results, namely how the processing of student data is carried out until an output is obtained in the form of a decision tree for determine who is eligible to receive the scholarship.

A. Data Processing Steps

In this application, the data to be processed includes Student Identification Number (NIM), parental work,

and Cumulative Grade Point Average (GPA). This system will process data from all students of Pamulang University batch 2022 to batch 2023

B. Criteria for Students Receiving Scholarships
The criteria for students who are eligible to receive scholarships according to this system are as follows:

1. Not a final year student.
2. Parents' jobs as laborers, farmers, or no jobs.
3. Have a Cumulative Grade Point Average (GPA) of more than 2.75.
4. Not currently receiving scholarships from other institutions.

C. Data Execution Process
The process of executing data using RapidMiner involves the following steps:

1. Input/Read Data: Starts by entering or reading the data to be processed, where the data is generally an Excel file.
2. Import Configuration Wizard: Using The Import Configuration Wizard feature to select and configure the data to be processed.
3. Data Validation: Performs validation to ensure that the imported data is correct and ready for further processing.

D. Data Process Results
The results of this data processing include:
1. Decision Tree:
In the early stages, the data was categorized based on parental occupation. Students who meet the parents' employment criteria will continue the selection process based on GPA. The end result of this process is a decision tree which classifies students according to the set criteria, as shown in Figure 1.

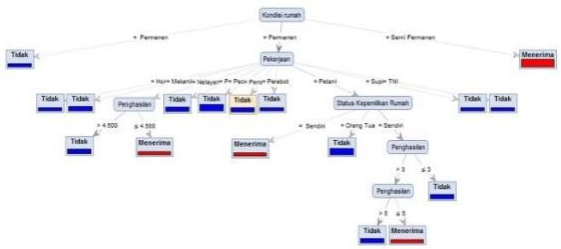


Figure 1 Decision Tree

2. Total Number of Students:
The number of students eligible to receive the scholarship is calculated based on the decision tree. Figure 2 provides detailed information about students who meet the criteria for scholarships. Figure 1 only shows whether students fall into the eligible category or not, while Figure 2 shows the number of students who passed the category through
screening criteria and providing detailed information about students who are eligible to receive scholarships.

Tree

```
C5 > 15662.500: buruk {baik=0, buruk=2}
C5 ≤ 15662.500
|   C5 > 14248.500: buruk {baik=1, buruk=3}
|   C5 ≤ 14248.500
|   |   C5 > 430.500
|   |   |   C5 > 451
|   |   |   |   C5 > 634
|   |   |   |   |   C5 > 663
|   |   |   |   |   |   C1 = A11
|   |   |   |   |   |   |   C13 > 65.500: baik {baik=4, buruk=0}
|   |   |   |   |   |   |   C13 ≤ 65.500: buruk {baik=67, buruk=74}
|   |   |   |   |   |   C1 = A12
|   |   |   |   |   |   |   C5 > 12391.500: buruk {baik=0, buruk=3}
|   |   |   |   |   |   |   C5 ≤ 12391.500
|   |   |   |   |   |   |   |   C16 > 3.500: buruk {baik=0, buruk=2}
|   |   |   |   |   |   |   |   C16 ≤ 3.500: baik {baik=65, buruk=52}
|   |   |   |   |   |   C1 = A13
|   |   |   |   |   |   |   C5 > 1036.500: baik {baik=27, buruk=6}
|   |   |   |   |   |   |   C5 ≤ 1036.500: buruk {baik=1, buruk=3}
|   |   |   |   |   |   C1 = A14
|   |   |   |   |   |   |   C5 > 11232.500: buruk {baik=1, buruk=2}
|   |   |   |   |   |   |   C5 ≤ 11232.500: baik {baik=206, buruk=26}
|   |   |   |   |   C5 ≤ 663: buruk {baik=0, buruk=2}
|   |   |   |   C5 ≤ 634: baik {baik=9, buruk=0}
|   |   |   C5 ≤ 451: buruk {baik=0, buruk=3}
|   |   C5 ≤ 430.500: baik {baik=9, buruk=0}
```

Figure 2 Summing Up the Sum

1. Accuracy:

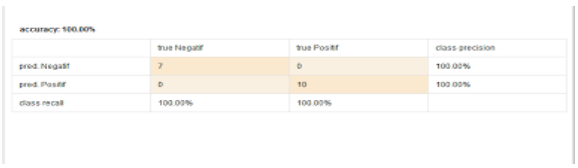
Accuracy describes how close the predicted value is to the actual value. Figure 3 shows the accuracy of the prediction results against the actual data.

	true Negatif	true Positif	class precision
pred. Negatif	84	53	61.31%
pred. Positif	4	9	69.23%
class recall	95.45%	14.52%	

Figure 3 Accuracy of Results

2. Precision/Confidence:

Precision or confidence is the proportion of cases that are predicted to be positive and also really positive in actual data. In this study, precision is used to measure the degree of accuracy between the information requested and the answers provided by the system. The level of precision is shown in Figure 4.



accuracy: 100.00%

	true Negatif	true Positif	class precision
pred. Negatif	7	0	100.00%
pred. Positif	0	10	100.00%
class recall	100.00%	100.00%	

Figure 4 Precision Results

3. Recall/ Senstivity

Recall or sensitivity measures the proportion of cases that are actually positive and correctly predicted as positive. In this study, recall was used to show the success rate of the system in rediscovering relevant

information. The results of the recall are shown in Figure 5.

Figure 5 Recall

4. Area Under Curve (AUC)

The Area Under Curve (AUC) is used to assess the differences in the performance of the methods applied in the analysis [7]. AUC is divided into three types, namely:

A. AUC Optimistic: Measures the performance of a method based on the most ideal or optimistic scenario.

B. Pessimistic AUC: Measures the performance of a method in a more conservative or pessimistic scenario.

C. AUC Neutral: Assesses the performance of a method under normal conditions without an optimistic or pessimistic bias.

AUC is calculated using the Receiver Operating Characteristic (ROC) curve, which describes the relationship between false positives (FP) and true positives (TP) values.

Figure 6 AUC Pessimistic

Figure 6 shows the AUC Optimistic, which reflects how well the method meets the criteria specified in the optimistic scenario.

Figure 7 AUC Optimistic

Pessimistic AUC is a calculation used to assess differences in the performance of methods in producing values that do not match the specified criteria. Figure 7 shows AUC

pessimistic, which reflects a scenario in which

The performance method is judged to be less than ideal or pessimistic.

Neutral AUC is a calculation used to assess the difference in the performance of a method in producing a comparison between values that are appropriate and that do not match the set criteria. Figure 8 shows the AUC Neutral, which gives an idea of the method's performance under normal conditions without an optimistic or pessimistic bias.

Figure 8 AUC Neutral

Conclusions and Recommendations

Based on the results of the research that has been conducted, it can be concluded as follows:

1. The determination of scholarship recipients at Pamulang University is carried out by analyzing student data that has met certain criteria, namely based on the Cumulative Achievement Index (GPA)

and the work of parents, such as laborers, farmers, or parents who do not have jobs.

2. The data execution process is then classified using the RapidMiner tool based on predetermined criteria. The outputs from data processing using RapidMiner include:

a. Decision Tree: Displays different forms of decision trees that users can choose from according to their interests.

b. Total Number of Students: Calculates the number of students who are eligible for the scholarship based on the decision tree.

c. Accuracy: Measures how close the predicted value is to the actual value.

d. Precision/Confidence: Shows the proportion of cases that are predicted to be positive and really positive in the actual data.

e. Recall: Measures the success rate of the system in rediscovering relevant information.

f. Area Under Curve (AUC): Includes AUC Optimistic, AUC Pessimistic, and AUC Neutral, which are used to assess the performance of a method under various conditions.

g. Ease of Data Analysis: Pamulang University can more easily analyze the data of eligible students

h. receive scholarships with the help of the RapidMiner tool, which manages the data according to the set criteria.

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