



# Diagnosing a Paper Dryer Malfunction in PT.Bamindo Agrapersada Using the Method DecisionTree

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## Abstract

PT. BAMINDO AGRAPERSADA is a private company that processes bamboo into paper and sells it to consumers. In an industrial field, problems often occur to overcome damage to paper drying machines because mechanics are difficult to find and sometimes time is not possible so that operations are hampered while production targets must be completed immediately. Decision Tree which is a tree that is used as a reasoning procedure to get answers to the problems entered. Decision trees provide a way to present algorithms with conditional control statements that include branches in decision-making steps that lead to a favorable outcome. With the Decision Tree, it can minimize damage to the paper drying machine and help solve problems in the PT. BAMINDO AGRAPERSADA industry.

*Keywords: Decission Tree, Paper Dryer Machine, Mechanical.*

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## 1. Introduction

In an industrial field, it is often a problem for the industry to deal with damage to paper drying machines because mechanics are difficult to find and sometimes time is not possible so that operations are hampered while production targets must be completed immediately. Therefore the author raises this problem with the title diagnosing damage to paper drying machines using the decision tree method in order to minimize damage to paper drying machines in the industry. PT. BAMINDO AGRAPERSADA is a private company that processes bamboo into paper and sells it to consumers. Here the author sees a system that is not good at diagnosing paper drying machine damage.

Based on the description above, it is necessary to build a decision support system that can be used as an alternative in diagnosing damage to the right paper drying machine based on the mechanic's assessment criteria. So that workers in the paper printing machine section can minimize damage to paper drying machines in the industry.

Decision Tree or decision tree is a tree that is used as a reasoning procedure to get answers to the problems entered. Decision trees provide a way to represent algorithms with conditional control statements. They include branches that represent decision-making steps that can lead to a favorable outcome. Decision Trees are widely used to solve decision-making cases such as medicine (diagnosis of patient's disease), computer science (data structures), psychology (decision-making theory) and etc.

The application of the Decision Tree method has been carried out by many researchers including the title Implementation of the Decision Tree Method at the Level of Student Achievement at the Anak Bangsa Private Vocational School. With the results Based on data processing using the RapidMiner software, an accuracy value of 71.43% is obtained, meaning that the resulting rules are close to 100% correct. Where the results of the class precision label Achievement are 63.89% and labels Not Achievement are 92.31% [1].

The next researcher is entitled Recommendation System for Poly Objectives at the Bajawa Regional General Hospital Based on the Decision Tree Method. With the results based on the results of system testing that has been done, it can be concluded that the system can provide recommendations for poly destinations based on time of visit, disease description, poly unit name and type of care carried out by the admin of the administrative section of the Bajawa general hospital. Subsequent research can be continued by building applications that include other algorithms as additions and comparisons such as the random-forest-classifier and also using more disease information data, so that the system can provide maximum recommendation results [2].

## 2. Research methodology

The problem solving method is divided into several parts, which can be explained as explained below.

### 2.1. DecisionTree

Decision tree is one way of data processing in predicting the future by building a classification or regression model in the form of a tree structure. This is done by continuing to break down into smaller subsets and at that time a decision tree is gradually developed. The end result of the process is a tree with decision nodes and leaf nodes. A decision node (eg Weather/ Outlook) has two or more branches (eg Sunny, Cloudy and Rainy).

Decision tree is a classification method that uses a tree structure representation (tree) where each node represents attribute, the branch represents the value of the attribute, and the leaves represent the class. The topmost node of the decision tree is called the root [3].

In the decision tree there are 3 types of nodes, namely:

- a. Root Node, is the topmost node, at this node there is no input and can have no output or have more output from one.
- b. Internal Node, is a branching node, at this node there is only one input and has a minimum of two outputs.
- c. Leaf node or terminal node, is the final node, at this node there is only one input and has no output.

### 2.2. Definition of Drying Machine

Cabinet dryer is a drying machine that functions to dry various types of food and non-food raw materials. The hot air generated from the heating source is distributed to all parts of the drying chamber using a blower. The dryer cabinet dryer model is one of the solutions to the drying problem.

## 3. Application of the Decision Tree Method

In accordance with the needs based on data obtained from experts who usually deal with damage to paper drying machines and the weight of each symptom. The paper drying machine damage data is as follows:

**Table 1:** Paper Drying Machine Damage Result Rule

No.	Code	Results
1	H1	Machine Trouble
2	H2	Machine Tool Repair

**Table 1:** Data on Symptoms of Damage to the Paper Dryer Machine

No.	Code	Diagnosing Symptoms
1	G1	Noisy Chain Sound
2	G2	Non-Spinning Chain
3	G3	Off Chain
4	G4	Belting Loosen
5	G5	Broken Belting
6	G6	Non-Rotating Belting
7	G7	Weakening Speed
8	G8	Rusty Machine
9	G9	Machine Not Running

The following are the symptoms and damage to the paper dryer machine as shown in the table below.

**Table 2:** A combination of symptoms of damage to the paper dryer machine

No.	Condition	Code	H01	H02
1	Chain	G1	✓	
		G2		✓
		G3	✓	
2	Belting	G4	✓	
		G5		✓
		G6	✓	
3	Dynamo Drayer	G 7	✓	
		G 8	✓	
		G 9		✓

**Table 4:** Data on Damage Classification of Paper Drying Machines with Mixed Feature Types

nodes	Attribute	Damage Criteria	Total	Disturbance	Repair	Entropy	gains
			14	6	8	0.9852	
1	Chain						0.2916
		Noisy Chain Sound	5	3	2	0.9710	
		Non-Spinning Chain	4	0	4	0	
		Off Chain	5	3	2	0.9710	
2	Belting						0.4749
		Belting Loosen	4	4	0	0	
		Non-Rotating Belting	6	1	5	0.6500	
		Broken Belting	4	1	3	0.8113	
3	Dynamo Drayer						0.3249
		Weakening Speed	4	3	1	0.8113	
		Rusty Machine	6	3	3	1.0000	
		Machine Not Running	4	0	4	0	

$$E(\text{all}) = - \left( p(\text{ya} | \text{semua}) \times \log_2 p(\text{ya} | \text{semua}) + p(\text{tidak} | \text{semua}) \times \log_2 p(\text{tidak} | \text{semua}) \right)$$

Entropy(Total)

$$= - \left( \left( \frac{6}{14} \right) \times \log_2 \left( \frac{6}{14} \right) + \left( \frac{8}{14} \right) \times \log_2 \left( \frac{5}{14} \right) \right)$$

$$= 0.9852$$

Entropy( Noisy Chain Sound )

$$= - \left( \left( \frac{3}{5} \right) \times \log_2 \left( \frac{3}{5} \right) + \left( \frac{2}{5} \right) \times \log_2 \left( \frac{2}{5} \right) \right)$$

$$= 0.9710$$

Entropy(Unturned Chain)

$$= - \left( \left( \frac{0}{4} \right) \times \log_2 \left( \frac{0}{4} \right) + \left( \frac{4}{4} \right) \times \log_2 \left( \frac{4}{4} \right) \right)$$

$$= 0$$

Entropy(Loaded Chain)

$$= - \left( \left( \frac{3}{5} \right) \times \log_2 \left( \frac{3}{5} \right) + \left( \frac{2}{5} \right) \times \log_2 \left( \frac{2}{5} \right) \right)$$

$$= 0.9710$$

Gain(Total,Chain)

$$= 0.9852 \left( \frac{5}{14} \times 0.9710 \right) + \left( \frac{4}{14} \times 0 \right) + \left( \frac{5}{14} \times 0.9710 \right)$$

$$= 0.2916$$

Entropy( Belting Loosening )

$$= - \left( \left( \frac{4}{4} \right) \times \log_2 \left( \frac{4}{4} \right) + \left( \frac{0}{4} \right) \times \log_2 \left( \frac{0}{4} \right) \right)$$

$$= 0$$

Entropy(Belting Does Not Rotate)

$$= - \left( \left( \frac{1}{6} \right) \times \log_2 \left( \frac{1}{6} \right) + \left( \frac{5}{6} \right) \times \log_2 \left( \frac{5}{6} \right) \right)$$

$$= 0.6500$$

Entropy(Broken Belting)

$$= - \left( \left( \frac{1}{4} \right) \times \log_2 \left( \frac{1}{4} \right) + \left( \frac{3}{4} \right) \times \log_2 \left( \frac{3}{4} \right) \right)$$

$$= 0.8113$$

Gain(Total, Belting)

$$= 0.9852 \left( \frac{4}{14} \times 0 \right) + \left( \frac{6}{14} \times 0.6500 \right) + \left( \frac{4}{14} \times 0.8113 \right)$$

$$= 0.4749$$

Entropy ( Weakening Speed )

$$= - \left( \left( \frac{3}{4} \right) \times \log_2 \left( \frac{3}{4} \right) + \left( \frac{1}{4} \right) \times \log_2 \left( \frac{1}{4} \right) \right)$$

$$= 0.8113$$

Entropy ( Rusty Machine )

$$= - \left( \left( \frac{3}{6} \right) \times \log_2 \left( \frac{3}{6} \right) + \left( \frac{3}{6} \right) \times \log_2 \left( \frac{3}{6} \right) \right)$$

$$= 1$$

Entropy ( Machine Not Running )

$$= - \left( \left( \frac{0}{4} \right) \times \log_2 \left( \frac{0}{4} \right) + \left( \frac{4}{4} \right) \times \log_2 \left( \frac{4}{4} \right) \right)$$

$$= 0$$

$$\begin{aligned} &\text{Gain}(\text{Total, Dynamo Drayer}) \\ &= 0.9852((4/14 \times 0.8113) + (6/14 \times 1) + (4/14 \times 0)) \\ &= 0.3249 \end{aligned}$$

### 3.1. Root Decision Tree

After obtaining the entropy and gain calculation results, as well as the rules or rules, the decision tree that is formed can be seen as shown below :



Figure 1: Decision Tree Decision Tree

### 3.2. Outline of Results

To make it easier for users to understand the process flow of the system to be built, it is necessary to make an overview of the results. An overview of the results is made in the form of an interface design (interface). The better the interface design is made, the better the system will be built. The following is an interface design for making a system for diagnosing paper drying machine damage using the Decision Tree method.

## 4. Conclusion

With the existence of a system to diagnose damage to the paper drying machine at PT. BAMINDO AGRAPERSADA can, then several conclusions can be drawn, including the following:

1. Helping PT. BAMINDO AGRAPERSADA in minimizing damage in the field of printing machines.
2. Assist and facilitate mechanics in repairing damage that is appropriate and according to their abilities.
3. Helping PT. BAMINDO AGRAPERSADA in carrying out operations so that production targets can be achieved according to planning.

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