

ANALYSIS OF MEDICINE SALES CLASSIFICATION USING DECISION TREE METHOD

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Abstract

Medicine sales are an important aspect in the pharmaceutical industry that requires effective analytical strategies to improve business performance and understand consumer patterns. This research aims to analyze medicine sales using Decision Tree method. The Decision Tree method is used to identify patterns and main factors that influence medicine sales. Decision trees will help in understanding the hierarchy of these factors and provide a clear view of the relationships between variables. These clusters can help in determining market segmentation and more specific sales strategies. The medicine sales data used in this research involves variables such as type of medicine, price, time of sale, and promotions carried out. The results of this analysis are expected to provide in-depth insight into sales trends, consumer preferences, and key factors that can increase the efficiency and effectiveness of medicine marketing strategies. By implementing this approach, it is hoped that pharmaceutical companies can make more informed decisions, minimize risks, and improve overall medicine sales performance. This research also contributes to the development of sales analysis methodology in the context of the pharmaceutical industry. The results of the Apply Model Decision Tree algorithm, obtained a true positive cash classification accuracy value of 75%, true positive Credit 66.67% and true positive Qris 100% class precision with an overall accuracy value of 80%. The level of accuracy between decision tree predictions and data testing is very high. This proves it that the Decision Tree Algorithm is suitable as a model for classification in this research

Keywords: Medicine Sales, Classification, Decision Tree, RapidMiner

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1. INTRODUCTION

The development of technology at this time is very rapid and is widely used to help various human activities, especially technology related to information systems which can make work easier in various ways [1]. Not only is technology developing, it is also changing very quickly. New technology is always being discovered to improve or even replace previous technology. The development of information technology itself is widely used for various purposes such as helping in work efficiency, helping in solving problems, and helping in creating new things [2].

In this modern era, the pharmaceutical industry plays an important role in providing various medicines and health products to meet people's needs [3]. As

technology develops and market complexity increases, medicine sales analysis has become a crucial aspect for understanding consumer trends, optimizing stock, and increasing operational efficiency [4].

Sales is an integrated activity to develop directed strategic plans to efforts to satisfy the needs and desires of buyers/consumers, the purpose of which is to get sales profit or gain is generated. Or a transaction activity carried out by 2 or more people using a tool valid payment [5].

Pemuda Pharmacy operates in the health sector which is located on Pemuda Street in Mataram City. Where when the medicine sales process occurs, the Pemuda Pharmacy is a pharmacy that is developing in helping society by providing solutions to various diseases that circulate in everyday life. Pharmacies are

no longer foreign to the ears of Indonesian people, because their existence is getting closer and closer around us. If in the past we only found one or two pharmacies in a certain area, now we can see many pharmacies. This is because pharmacies have an increasingly necessary function as community medicine centers. In the business world which is always dynamic and full of competition, players in the same field must always be active in thinking about ways to continue to develop the scale of the business [6].

One approach that has emerged in analyzing medicine sales is using the classification method with Decision Tree and clustering method with K-Means. Decision Tree is a predictive model based on decision trees, while K-Means is a clustering algorithm that helps group data into similar groups. The combination of these two methods can provide deep insight into student achievement analysis that may be difficult to detect manually [7].

The background to the need for classifying medicine sales using the decision tree method is that the first is to be able to group data, where a decision tree is one method that can be used to group data based on certain criteria [8]. In medicine sales, this method can be used to classify medicine sales into groups based on relevant features, such as disease symptoms, type of medicine, or other factors that can influence purchasing decisions. Then secondly, there is a risk analysis, namely a decision tree, which can help identify the risks associated with medicine sales. By creating a clear decision tree, stakeholders can visually see how these risks relate to factors that influence medicine sales. This can help in making better decisions to manage these risks. The third is sales prediction, where the decision tree method can also be used to predict future medicine sales based on historical data. By using relevant factors, such as seasonality, purchasing trends, and promotional effectiveness, we can identify patterns and trends that may influence future medicine sales. This can help in planning and making business decisions. And the last thing is understanding the factors that influence sales, because decision trees can also help in understanding what factors contribute to increasing or decreasing medicine sales. By analyzing the relationship between these factors and sales results, we can identify the most important variables and focus on increasing medicine sales [9].

Overall, the use of the decision tree method in medicine sales classification can help in grouping data, analyzing risk, predicting sales, and understanding the factors that influence medicine sales. With this

information, companies can make better decisions in managing medicine sales and plan effective marketing strategies [10].

Analysis of medicine sales using the Decision Tree method can help identify factors that influence purchasing decisions, such as type of medicine, brand, price and promotion [11]. Meanwhile, K-Means can help group consumers with similar preferences, enabling the development of more focused marketing strategies.

This research aims to extract valuable information from medicine sales data through the application of the Decision Tree and K-Means methods. In this way, pharmaceutical companies can optimize marketing strategies, increase customer satisfaction, and respond to market changes more effectively.

Through this analysis, it is hoped that new insights will emerge that can make a positive contribution to decision making in the pharmaceutical industry, helping companies to remain competitive and provide better services to the community.

2. LITERATURE REVIEW

Data mining is the process of employing learning techniques to analyze and extract knowledge automatically. The stages of data mining are as follows: data selection, preprocessing, transformation, data mining, and evaluation [12].

The data mining stage process starts with data cleaning, the purpose of which is to remove inconsistent data and noise [13]. Next is data integration, where data is combined from several sources. After that, data transformation means the data is changed into a form suitable for mining. The next process is the application of data mining techniques, namely the process of extracting patterns from existing data. Then an evaluation of the patterns found is carried out where the process of interpreting the patterns becomes knowledge that can be used to support decision making [14]. And the last one is the presentation of knowledge, namely using visualization techniques. This stage is part of the knowledge search process which includes checking whether the patterns or information found contradict previously existing facts or hypotheses [15].

The preprocessing stage is carried out so that it is clean from noise, has smaller dimensions, is more structured so that it can be processed further [16]. In preprocessing data normalization was also carried out.

Transformation is changing the format of stored data into a standard data format that suits the application used. This research changes the Excel data

format to .csv so that it can be processed using Rapidminer 9.10. Some of the techniques available in data mining are classification, clustering, association rule discovery, sequential pattern, regression, and deviation detection [17].

Classification of medicine sales in pharmacies is a data mining process that aims to categorize or group medicine sales based on several relevant variables or attributes [18]. The goal of this classification is to identify certain patterns or characteristics in medicine sales data that can help pharmacies make better decisions [19].

The classification process for medicine sales in pharmacies involves the following steps:

1. Data Selection: First of all, relevant medicine sales data must be collected and selected. This data may include information such as medicine type, medicine name, date of sale, price, number of sales, and other attributes deemed important.
2. Data Preprocessing: The collected data must then be processed to clean and prepare it before analysis. This can involve removing missing or irrelevant data, filling in missing values, and changing the data format if necessary.
3. Feature Selection: After the data is processed, the next step is to select the features or attributes that will be used in classification analysis [20].

Decision analysis or Decision Analysis (DA) is simply defined as the process of selecting the alternative that best suits the stated objectives. In the literature, decision analysis is described as a deep systematic procedure transforming decision-making problems that are still opaque into a clear decision with a transparent sequence of steps [21].

The use of decision analysis in assessing project feasibility provides a clear picture better view the opportunities they have, evaluate potential risks, provide overview of what information is needed and assess readiness to do the job the. In the context of decision making, Decision Analysis should be seen as a communication between a decision maker and a decision facilitator with a purpose provide insight, so that the results of decision analysis are expected to provide an overview best of the options you have [22].

The existence of uncertainty factors both included and outside the boundaries, It is possible that the best results from Decision Analysis may not be linear towards project success. To reduce the consequences of inaccurate analysis results, it is necessary decision analysis process in stages with changes in new information held as the project progresses [23].

The Decision Tree algorithm is one of the algorithms for data mining methods that is often applied as a solution to classifying a problem [24]. Decision Tree is also a classification in data mining.

Making the Decision Tree itself uses a supervised machine learning method, namely a learning process where new data is classified based on existing training samples. Decision Tree consists of root, internal nodes and leaves. The concepts that are often used to determine the root, internal nodes and also leaves in a Decision Tree are also the entropy concept and the Gini concept [25].

The process of a decision tree is to change the form of table data into a tree model. The tree model will produce rules and be simplified [26].



Figure 1. Decision Tree concept

To analyze the classification of medicine sales in pharmacies using the decision tree method, there are several steps, namely preparing data, where prepare medicine sales data that has been previously selected and processed. Make sure the data is in the appropriate format and there are no missing values [27]. Then divide the data, namely dividing the data into two subsets, namely training data and testing data. Training data will be used to build a decision tree model, while testing data will be used to test model performance. The next step is feature selection, namely selecting relevant features to be used in the analysis. For example, type of medicine, price, and other attributes that are considered important in medicine sales classification. And the last thing is to build a Decision Tree model by using a decision tree algorithm (such as ID3, C4.5, or CART) to build a decision tree model based on training data. This algorithm will select the best attribute as the root node and perform separation based on the value of that attribute [28].

The decision tree classification process involves a series of steps to build a model that can predict the class or target value from the given data. Here are the general steps in the process:

1. Data Selection: The first step in the decision tree classification process is to select suitable data for model training. This data consists of the attributes or features used to make decisions (e.g., age, gender, income) as well as labels that correspond to

- each instance of the data (e.g., precise categories, such as "yes" or "no," "has a disease") or not").
2. **Data Division:** Data is usually divided into two subsets: training data and testing data. Training data is used to build a decision tree model, while testing data is used to test how well the model can predict the correct class or target value.
 3. **Attribute Selection:** Next, the decision tree model must choose which attributes are most important for dividing the data. This can be done using methods such as Information Gain, Gini Index, or Gain Ratio. The goal is to choose the attributes that best separate the data into different classes.
 4. **Decision Tree Construction:** Once appropriate attributes are selected, a decision tree is constructed by dividing the data based on the values of the selected attributes. This process is carried out recursively until each branch of the tree produces a homogeneous subset of data or until it reaches a certain stopping criterion.
 5. **Recursion Termination:** Recursion in decision tree construction should be stopped when one of the following conditions is met:
 - All data instances on a branch have the same target value.
 - There are no more attributes left to share.
 - Reaches the predetermined maximum depth level.
 - The number of data samples is below the minimum threshold.
 6. **Pruning:** Once the decision tree is built, it can be pruned to avoid overfitting. Pruning involves removing insignificant or redundant parts of the tree, resulting in a more general model and better generalization.
 7. **Model Evaluation:** Once the decision tree is built, the model must be evaluated using separate test data. This evaluation can be done using various metrics, such as accuracy, precision, recall, and F1-score, to assess how well the model can correctly predict the target class or value.
 8. **Tuning Parameters:** Some parameters in building a decision tree model, such as the maximum depth of the tree or the minimum threshold for splitting, may need to be adjusted to improve model performance.

9. **Prediction:** Once a decision tree model is evaluated and deemed adequate, it can be used to predict target classes or values from new, previously unseen data.

Decision Tree can be applied for learn classification and predict patterns from data and describe the relationship between attribute variables x and target variables y in the form of a tree. Decision Tree is a structure that resembles a flowchart where each internal node is a test of an attribute variable, each branch is the result of the test, while the outer node, namely the leaf, is the label.

Decision trees have several advantages compared to other classification methods, especially in the context of interpretability, ability to handle diverse data, and ease of use. Here are several reasons why decision trees can be considered better than other classification methods:

1. **Interpretability:** Decision trees are easy to understand and interpret by humans. This model represents a simple and intuitive set of decision rules, which can be explained directly. This makes it useful in a variety of contexts, including in the medical, business, and legal fields, where model interpretability is critical.
2. **Ability to Handle Data Non-Linearity:** Decision trees do not rely on assumptions about data distribution or linear relationships between features and labels. This makes it effective in dealing with problems where the relationship between features and labels is non-linear or complex.
3. **Ability to Handle Mixed Data:** Decision trees can handle data that has a combination of numeric and categorical attributes well without requiring additional transformations. This makes it very flexible and can be used in various types of classification problems.
4. **Easy to Use:** Decision trees are relatively easy to implement and use. They do not require deep mathematical knowledge or complicated data preparation like some other classification methods. This makes it a good choice for beginners in data analysis.
5. **Detection of Important Attributes:** Decision trees can provide information about which attributes are most important in making classification decisions.

This can help in understanding the most relevant features in the data.

6. Insensitive to Scale: Decision trees are not affected by scale differences between their features. This means there is no need to normalize or standardize the data before using the model, which can save time and effort.
7. Easy to Adjust: Decision trees can be easily adjusted using pruning techniques to prevent overfitting or by adjusting model parameters such as tree depth. This gives users greater control in designing models that suit their needs.

3. RESEARCH METHODOLOGY

The research method in analyzing medicine sales using the Decision Tree method involves several systematic steps.

3.1 Datasets

Data set for research methods analysis of medicine sales using the Decision Tree method. This data set describes several attributes that may influence medicine sales, such as type of medicine, medicine code, and payment method. Samples can be seen in Table 1.

Table 1. Sample Dataset

No	Attribute	Description	Type
1	Medicine code	Coding used to identify and differentiate medicines uniquely	Polynomial s
2	Type of medication	Classification or categorization of medicines based on certain characteristics, such as therapeutic properties, mechanism of action, or treatment targets.	Polynomial s

3	Payment	The method or system used to carry out n financial transactions in exchange of goods or services.	Polynomial s
4	Medicine name	includes explanation or information about the name given to something substance or the formulation used for treatment or prevention disease.	Polynomial s
5	Amount Medicine	How much many units or quantities medicines available on some time in inventory warehouse of an entity, such as pharmacy.	Integer
6	Price Medicine Unit	Represents price per unit of medicine sold in the pharmacy.	Real
7	Total price medicine	Is the total price of the medicine is sold in the pharmacy.	Real

3.2 Data Processing

Data processing in the medicine sales analysis research method using the Decision Tree method involves a series of stages to ensure the resulting data is optimal for analysis.

3.3 Experimentation and Method Testing

At this stage, experiments were carried out in implementing the Decision Tree algorithm testing. There are 3 operator components in this test, namely; Decision Tree for produces a decision tree used for classification of training data, Apply Model to display the ExampleSet model, performance to display the level of accuracy of testing data. The next stage is evaluation and validation.

4. RESULT AND DISCUSSION

Implementing Decision Tree algorithm testing and dividing the dataset into training data and testing data.

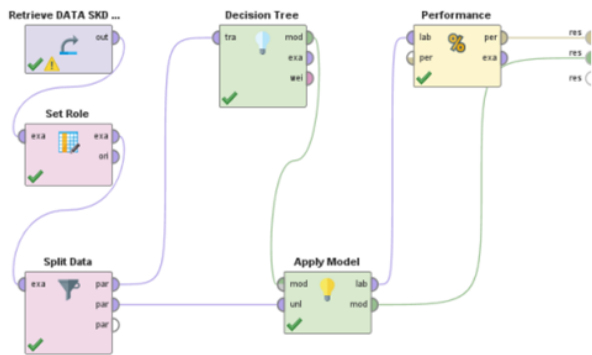


Figure 2. Process Models

Model designed in RapidMiner uses several operators namely Set Role, Split Data, Decision Tree, Apply Model, and Performance. Following Decision Tree algorithm model in RapidMiner is in Figure 2. On Figure 2 contains several operators such as Retrieve Data operator which is data which is used for the Data Mining process. The Set Role operator is used for change the role of one or more attributes where the changed attribute is the attribute 'Remarks' with Target Role being label.

The Split Data operator is used for divide data into partitions with ratio 0.7 and 0.3. The Decision Tree operator is used to create a Decision Tree model which is the model in the research. The Apply Model operator is used for apply the Decision Tree model to datasets. The Performance operator is used for performance evaluation of the model applied. Performance evaluation used namely Accuracy, Classification Error, Kappa, Recall, and Precision.

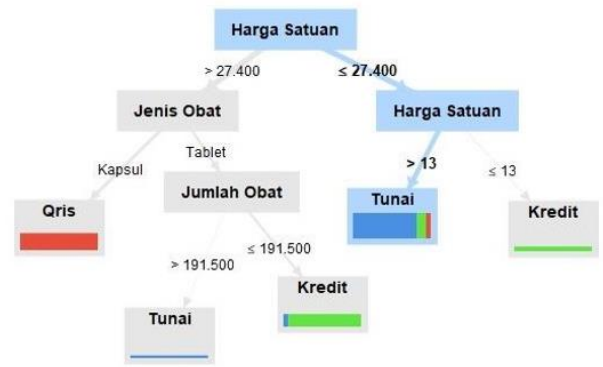


Figure 3. Decision Trees

Model Tree is a tree structure resulting from medicine sales data processing using the Decision Tree Algorithm in RapidMiner. In the tree structure, you can see the division of classes into Tunai, Kredit, and Qris, based on the values of Harga Satuan, Jenis Obat, and Jumlah Obat. From the Tree model, a description of the classification results is obtained. The following tree model of the Decision Tree algorithm in RapidMiner can be seen in Figure 3 and the classification results in Table 2. In Figure 3 is the tree model obtained from the process carried out in RapidMiner. The root of the tree model is Unit Price, while the Leaves are Qris, Tunai and Kredit.

accuracy: 80.00%

	true Tunai	true Kredit	true Qris	class precision
pred Tunai	6	2	0	75.00%
pred Kredit	2	4	0	66.67%
pred Qris	0	0	6	100.00%
class recall	75.00%	66.67%	100.00%	

Figure 4. Accuracy Results

After obtaining the decision rules from the Decision Tree algorithm decision tree, the testing process will measure the extent to which the success of the model obtained can be used as a prediction with evaluation and validation using the Confusion matrix. Confusion Matrix obtained from Decision Tree algorithm calculations.

The results of the Apply Model Decision Tree algorithm, obtained a true positive cash classification accuracy value of 75%, true positive Credit 66.67% and true positive Qris 100% class precision with an overall accuracy value of 80%. The level of accuracy between decision tree predictions and data testing.

This proves it that the Decision Tree Algorithm is suitable as a model for classification in this research. This research can be developed by implementing data algorithms other mining and perform performance comparisons between algorithms used. By comparing these performances, various performances can be seen data mining algorithm.

5. CONCLUSION AND SUGGESTION

The stages in this research consist of data collection, Decision Tree, rules, and analysis of classification results. Decision trees are able to group data based on certain criteria, predict drug sales, and identify factors that influence drug sales. For the results of the Apply Model Decision Tree algorithm, obtained a true positive cash classification accuracy value of 75%, true positive Credit 66.67% and true positive Qris 100% class precision with an overall accuracy value of 80%. The level of accuracy between decision tree predictions and data testing. Based on the results, the accuracy value of 80% proves that using the decision tree algorithm method is suitable as a model for classification in this research.

Analysis of medicine sales using the classification method, especially using Decision Tree, provides in-depth insight into sales patterns, influencing factors, and different consumer groups. Through the use of classification methods such as Decision Tree, organizations can utilize data analysis to increase operational efficiency, improve service to consumers, and achieve more optimal business goals in the medicine sales industry. This proves it that the Decision Tree Algorithm is suitable as a model for classification in this research.

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