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Analysis of Room Allocation Based on Age in Nursing Homes Using the C4.5 Decision Tree Method

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ABSTRACT

This study analyzes the effectiveness of the C4.5 Decision Tree algorithm in managing room allocation in nursing homes based on the residents' ages. Using a dataset of 333 entries, which includes age and room names, the study aims to determine the most suitable room placements. The analysis process involves preprocessing the data to simplify the dataset, followed by the application of the C4.5 Decision Tree model using the RapidMiner platform. The results indicate that the algorithm effectively classifies residents into room names such as Jambu, Nenas, Jeruk, and others based on their age. These findings provide insights into how age influences room placement in nursing homes and enable more optimal facility management. The study also recommends considering additional factors in further analyses to enhance the accuracy of resident placement.

Keyword : Decision Tree, C4.5, Data Mining.

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1. INTRODUCTION

Technology is one of the rapidly evolving aspects in modern times (Mubaroq & Ilham, 2023). In this context, Data Mining is crucial as a process for uncovering hidden information from data, which is part of Knowledge Discovery in Database (KDD), with the aim of finding useful information within a database (Sri Utami et al., 2023). One significant Data Mining technique is classification, used to predict the class of an item based on its attribute features (Hermawan et al., 2023).

The C4.5 algorithm, also known as a decision tree, is one of the frequently used algorithms in Data Mining classification techniques (Tasia et al., 2023). In this context, a nursing home is a place where elderly individuals gather, either voluntarily or as assigned by family members, to have their needs managed. A nursing home functions as a temporary residence for the elderly to enjoy their later years safely and comfortably while receiving adequate facilities (Wahyuni et al., 2022).

With only age and room data, applying classification techniques using the C4.5 algorithm can help determine the optimal room allocation for the elderly. By analyzing age data, a nursing home can organize the placement of elderly individuals into rooms that match their needs and preferences. This can enhance comfort and the effectiveness of facility use, ensuring that each individual receives appropriate attention according to their condition.

2. RESEARCH METHOD

a. Data Classification: Data is classified based on age and room names (Jambu, Anggur, Apel, Duku, Durian, Nenas, Jeruk, Langsat, Semangka, Mangga, Pepaya).
b. Data Collection: This is one of the steps in reaching a solution by re-recording the necessary data as a foundation for problem-solving, which facilitates the subsequent steps in the resolution process (Pangestu et al., 2023). The data collected is the List of Social Welfare Residents of UPTD Elderly Social Service Kisaran, Jl. Perintis Km. 8 Simpang Tiga Lemang, Kec. Simpang Empat, Kab. Asahan. The data spans from January to April 2024.
c. Data Preprocessing: Preprocessing is an important stage before conducting data mining (Muhadi & Octaviano, 2023).

d. Model and Analysis: The classification model used is the Decision Tree C4.5, and the model is analyzed using RapidMiner. RapidMiner is a data science software platform used for data analysis and as a data mining engine (Limet & Rijal, 2023).

3. RESULTS AND DISCUSSION

A. Data Collection

	Name WBS	Wife/Husband's Name	Number of Cl	Age	Gender	Date of Entry	Room	No. KTP	No. KK	Origin Location
313	Toga Sinambela	-	-	60	Male	08/04/2024	Jeruk	'402171058(	402021012(	Kisaran
314	Misnan	-	-	63	Male	08/04/2024	Jeruk	-	-	Tanjungbalai
315	Sudirman	-	-	72	Male	08/04/2024	Jeruk	-	-	Tanjungbalai
316	Irianto	-	-	85	Male	08/04/2024	Jeruk	-	-	Pinangsori
317	Albiner Simamora	-	-	60	Male	08/04/2024	Jeruk	-	-	Asahan
318	Rahmawati	-	-	75	Male	15/04/2024	Langsat	-	-	Kisaran Barat
319	Roliyah	-	2	80	Male	15/04/2024	Langsat	'402711241(	402121107(	Kisaran
320	Naffiah	-	-	74	Female	15/04/2024	Langsat		-	Tanjung Balai
321	Gustina Wati Sitorus	-	-	64	Female	15/04/2024	Langsat	'830521159(	-	Tanjung Balai
322	Tomoh Sihombing	-	-	64	Female	17/04/2024	Mangga	-	-	Medan
323	Ayub Silalahi	-	-	60	Female	17/04/2024	Mangga	-	-	Tanjung Balai
324	Saman Ilyas	Darmawati	1	74	Male	17/04/2024	Mangga	'4012811480002		Rantau Prapat
325	Baharuddin	-	-	68	Male	17/04/2024	Mangga	'4051412070004		Pinangsori
326	Siti Fatimah	Alm.Amin Panjaitan	-	61	Male	25/04/2024	Nenas	'920450859(	920051107(	Tanjungbalai
327	Rubiah	Alm.Sukarno	3	66	Male	25/04/2024	Nenas	-	-	Tanjungbalai
328	Mariati Purba	-	-	60	Female	25/04/2024	Nenas	-	-	Kisaran
329	Ade Rospita Nasution	-	-	60	Female	25/04/2024	Nenas	-	-	Tanjungbalai
330	Mahfuri Siregar	-	-	87	Female	25/04/2024	Nenas	-	-	Siantar
331	Suwarni	-	-	64	Female	25/04/2024	Pepaya	'922711258(	922020720(	Medan
332	Meri Sianturi	-	-	65	Female	25/04/2024	Pepaya	'107500358(	-	Tanjungbalai
333	Ernawati Lingga	-	-	60	Female	25/04/2024	Pepaya	-	-	Siantar

Fig 1. Data Collection

In Figure 1, the data collection consists of 333 rows, including the header, and includes the following columns: Name WBS, Wife/Husband's Name, Number of Children, Age, Gender, Date of Entry, Room, ID Number, Family Card Number, and Origin Location.

B. Data Processing

	Age	Room
313	60	Jeruk
314	63	Jeruk
315	72	Jeruk
316	85	Jeruk
317	60	Langsat
318	75	Langsat
319	80	Langsat
320	74	Langsat
321	64	Langsat
322	64	Langsat
323	60	Mangga
324	74	Mangga
325	68	Mangga
326	61	Nenas
327	66	Nenas
328	60	Nenas
329	60	Nenas
330	87	Nenas
331	64	Nenas
332	65	Nenas
333	60	Pepaya

Fig 2. Data Preprocessing

In Figure 2, after preprocessing, the dataset remains at 333 rows, including the header, but the number of columns is reduced to only Age and Room.

B. Model and Analysis

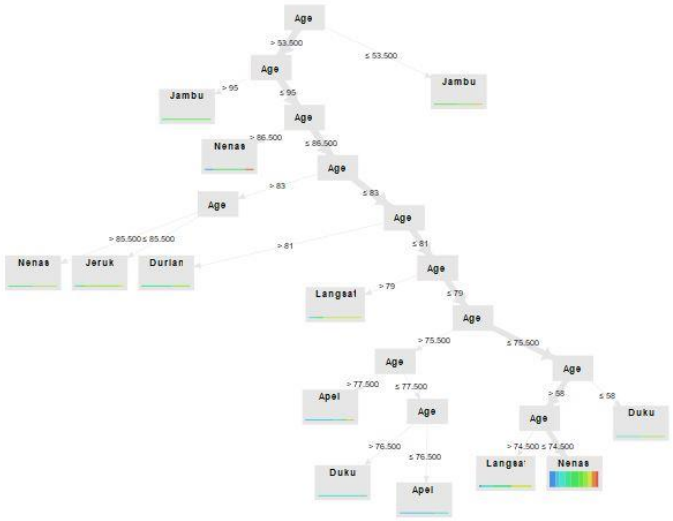

Fig 3. Model Decision Tree

In Figure 3, the Decision Tree model is used to classify data based on age. The process begins at the root node with Age > 53.500. For ages exceeding 53.500, the tree splits at Age > 95, resulting in a classification of Jambu. If the age is less than or equal to 95, the tree evaluates Age > 86.500, leading to a classification of Nenas. For ages less than or equal to 86.500, the tree further splits at Age > 83. If Age > 85.500, the classification is Nenas; if less than or equal to 85.500, it is classified as Jeruk. For ages less than or equal to 83, the tree splits at Age > 81, resulting in Durian. Ages less than or equal to 81 are further divided at Age > 79, classifying these ages as Langsat. For ages less than or equal to 79, the next split occurs at Age > 75.500. If Age > 77.500, it is classified as Apel; if less than or equal to 77.500, the classification is Duku if Age > 76.500 and Apel if Age ≤ 76.500. For ages less than or equal to 75.500, the tree splits at Age > 58, classifying as Langsat if Age > 74.500, or Nenas if less than or equal to 74.500. For Age ≤ 58, the classification is Duku. Finally, for ages less than or equal to 53.500, the classification is Jambu.

Table 1. Decision Tree Model Description

Tree
Age > 53.500 | Age > 95: Jambu {Anggur=0, Apel=0, Duku=0, Durian=0, Nenas=1, Jambu=4, Jeruk=0, Langsat=0, Semangka=0, Mangga=0, Pepaya=0} | Age ≤ 95 | | Age > 86.500: Nenas {Anggur=1, Apel=0, Duku=0, Durian=0, Nenas=4, Jambu=0, Jeruk=0, Langsat=0, Semangka=0, Mangga=0, Pepaya=1} | | Age ≤ 86.500 | | | Age > 83 | | | | Age > 85.500: Nenas {Anggur=0, Apel=0, Duku=0, Durian=0, Nenas=1, Jambu=0, Jeruk=1, Langsat=0, Semangka=0, Mangga=0, Pepaya=0} | | | | Age ≤ 85.500: Jeruk {Anggur=0, Apel=0, Duku=1, Durian=0, Nenas=0, Jambu=1, Jeruk=6, Langsat=1, Semangka=0, Mangga=0, Pepaya=0} | | | Age ≤ 83 | | | | Age > 81: Durian {Anggur=0, Apel=0, Duku=0, Durian=5, Nenas=0, Jambu=0, Jeruk=3, Langsat=0, Semangka=0, Mangga=0, Pepaya=0} | | | | Age ≤ 81 | | | | | Age > 79: Langsat {Anggur=0, Apel=0, Duku=1, Durian=0, Nenas=1, Jambu=0, Jeruk=0, Langsat=5, Semangka=0, Mangga=0, Pepaya=0}

| | | | | | Age ≤ 79
| | | | | | | Age > 75.500
| | | | | | | Age > 77.500: Apel {Anggur=0, Apel=4, Duku=1, Durian=1, Nenas=0, Jambu=0, Jeruk=0, Langsat=0, Semangka=1, Mangga=0, Pepaya=0}
| | | | | | | Age ≤ 77.500
| | | | | | | | Age > 76.500: Duku {Anggur=0, Apel=0, Duku=6, Durian=1, Nenas=0, Jambu=0, Jeruk=0, Langsat=0, Semangka=0, Mangga=0, Pepaya=0}
| | | | | | | | Age ≤ 76.500: Apel {Anggur=0, Apel=5, Duku=2, Durian=0, Nenas=0, Jambu=0, Jeruk=0, Langsat=0, Semangka=0, Mangga=0, Pepaya=0}
| | | | | | Age ≤ 75.500
| | | | | | | Age > 58
| | | | | | | | Age > 74.500: Langsat {Anggur=1, Apel=0, Duku=4, Durian=6, Nenas=1, Jambu=0, Jeruk=1, Langsat=7, Semangka=0, Mangga=0, Pepaya=0}
| | | | | | | | Age ≤ 74.500: Nenas {Anggur=31, Apel=19, Duku=28, Durian=29, Nenas=42, Jambu=20, Jeruk=27, Langsat=17, Semangka=0, Mangga=21, Pepaya=12}
| | | | | | | Age ≤ 58: Duku {Anggur=0, Apel=0, Duku=1, Durian=0, Nenas=0, Jambu=0, Jeruk=1, Langsat=0, Semangka=0, Mangga=0, Pepaya=0}
Age ≤ 53.500: Jambu {Anggur=0, Apel=0, Duku=0, Durian=0, Nenas=0, Jambu=3, Jeruk=2, Langsat=0, Semangka=1, Mangga=0, Pepaya=0}

In Table 1, Decision Tree Model Description, data is segmented based on age to determine the type of room. Starting with ages over 53.500 years, if the age is greater than 95 years, the data identifies the "Jambu Room" with a specific distribution. For ages less than or equal to 95 years, the data is divided at ages over 86.500 years, which identifies the "Nenas Room." If the age is less than or equal to 86.500 years, the next split at ages over 83 years indicates the "Nenas Room." For ages less than or equal to 83 years, further division at ages over 81 years identifies the "Durian Room." For ages less than or equal to 81 years, the data is split at ages over 79 years, indicating the "Langsat Room." Ages less than or equal to 79 years are further divided at ages over 75.500 years, identifying the "Apel Room." Next, ages less than or equal to 75.500 years are divided at ages over 58 years, indicating the "Langsat Room." Ages less than or equal to 74.500 years identify the "Nenas Room," while ages less than or equal to 58 years indicate the "Duku Room." Finally, ages less than or equal to 53.500 years identify the "Jambu Room." This decision tree demonstrates how age influences the distribution of room types within the dataset.

4. CONCLUSION

The analysis of room allocation in nursing homes using the Decision Tree C4.5 method indicates that this model is effective for classifying residents based on their age into various room categories such as Jambu, Nenas, Jeruk, and others. This result allows nursing homes to place residents in rooms that align with their needs and preferences, thereby enhancing comfort and the efficiency of facility use. Utilizing this model can assist nursing homes in managing room allocation more optimally. Further research could consider additional factors that might influence resident placement.

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