YAYASAN AKRAB PEKANBARU
Akrab Juara : Jurnal Ilmu-ilmu Sosial
Volume 10 Nomor 2 Edisi Mei 2025 (342-349)
https://doi.org/10.58487/akrabjuara.v10i2

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IMPLEMENTATION OF THE C4.5 DECISION TREE ALGORITHM ON THE NUTRITIONAL STATUS OF TODDLERS (CASE STUDY: POSYANDU "ABC")

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(Naskah diterima: 1 April 2025, disetujui: 28 April 2025)

Abstract

Malnutrition is a serious health problem in children under five in Indonesia. Posyandu (Integrated Service Post) has an important role in the prevention and control of malnutrition. This study aims to evaluate the role of Posyandu in the prevention and management of malnutrition in toddlers. Posyandu can also make referrals to higher health facilities if cases of malnutrition are found. The purpose of this study will be to test the nutritional status classification model of toddlers at Posyandu "ABC" by utilizing data mining techniques using the Decision Tree method of the C4.5 Algorithm. The results of the study show that the criteria of Age, Weight, Height and Parental Nutrition Knowledge play a role in monitoring the growth and development of toddlers, early detection of malnutrition, and providing nutrition education to mothers under five. Thus, the results of this study can be one of the strategies in preventing and overcoming malnutrition status in toddlers in Indonesia.
Keywords: *Posyandu, Malnutrition, News, Prevention, Countermeasures, DecisionTree, AlgorithmC4.5.*

Abstrak

Gizi buruk merupakan masalah kesehatan yang serius pada balita di Indonesia. Posyandu (Pos Pelayanan Terpadu) memiliki peran penting dalam pencegahan dan penanggulangan gizi buruk. Penelitian ini bertujuan mengevaluasi peran Posyandu dalam pencegahan dan penanggulangan gizi buruk pada balita. Posyandu juga dapat melakukan rujukan ke fasilitas kesehatan yang lebih tinggi jika ditemukan kasus gizi buruk. Tujuan dari penelitian ini akan menguji coba model klasifikasi status gizi balita pada Posyandu "ABC" dengan memanfaatkan teknik data mining menggunakan metode *Decision Tree* Algoritma C4.5. Hasil penelitian menunjukkan bahwa kriteria Umur, Berat Badan, Tinggi Badan serta Pengetahuan gizi Orang Tua berperan dalam pemantauan tumbuh kembang balita, deteksi dini gizi buruk, dan pemberian edukasi gizi kepada ibu balita. Dengan demikian, hasil penelitian ini dapat menjadi salah satu strategi dalam pencegahan dan penanggulangan Status gizi buruk pada balita di Indonesia.
Katakunci: Posyandu, Gizi Buruk, Balita, Pencegahan, Penanggulangan, *DecisionTree*,AlgoritmaC4.5.

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I. INTRODUCTION

Malnutrition is a serious health problem in children under five in Indonesia. According to WHO data, Indonesia still faces significant malnutrition problems, especially in children under the age of five. Poor nutrition can lead to a variety of health problems, such as decreased immunity, impaired growth and development, and even death. Posyandu (Integrated Service Post) is one of the Indonesian government programs that aims to improve maternal and child health. Posyandu provides basic health services, such as child growth and development monitoring, immunization, and maternal health counseling. In the context of malnutrition, Posyandu can play an important role in the prevention and management of malnutrition in toddlers. Posyandu has several activities that can help prevent and overcome malnutrition, such as:

1. Monitoring the growth and development of toddlers
2. Early detection of malnutrition
3. Providing nutrition education to mothers under five
4. Referral to a higher health facility if a case of malnutrition is found

Thus, Posyandu can be one of the strategies in preventing and overcoming malnutrition in toddlers in Indonesia. Therefore, it is necessary to conduct research to evaluate the role of Posyandu in the prevention and management of malnutrition in toddlers.

II. THEORETICAL STUDIES

The nutritional status of toddlers is one of the health problems in Indonesia. Malnutrition cases are not only a burden for families but also a burden for the state. Toddlers experience a cycle of growth and development that requires greater nutrients than other groups of elements so that toddlers are most likely to suffer from nutritional disorders. The nutritional status of toddlers can be assessed by measuring the human body known as "Anthropometry". Anthropometric measurements can be carried out by measuring weight and height indicators and paying attention to the age and gender of the toddler itself. Many previous studies have used anthropometric measurement references for the assessment of the status. Parental Nutrition (k5) so that there is an update in the research, based on the results of our reset that the Parental Nutrition Knowledge indicator is our concern in the field to prove whether it is influential or not, to help this research we use the Decision Tree algorithm model and the Rapidminer application to process researcher data. The data collection process is to find out the nutritional status of toddlers at the "ABC" posyandu. We conducted interviews with Posyandu members, as well as Suvai directly to get data. If the data is

explored correctly, it can be known as a pattern or knowledge to make decisions. A series of processes of obtaining knowledge or patterns from data sets is called Data Mining [1]– [4]. Data Mining is the mining or discovery of new information by looking for certain patterns or rules from a large amount of data that is expected to overcome these conditions [5]. Data Mining itself has several techniques, one of which is classification. Classification is one of the processes in data mining that aims to find valuable patterns from relatively large to very large data. The C4.5 data mining algorithm is one of the algorithms used to perform classification or segmentation or grouping and is predictive. Algort.

III. RESEARCH METHODS

Data Mining

According to [4] explained that "Data Mining is the selection or "digging" of knowledge from a large amount of data." In contrast to Segall, Guha & Nonis (2008:127) explain "Data mining is called knowledge discovery or finding patterns hidden in data. Data mining is the process of analyzing data from different perspectives and summarizing it into useful information." It can be concluded that data mining is the process of analyzing a lot of data and making a pattern to become useful information. Classification is a data mining functionality that will generate a model to predict the class or category of objects in a database. Classification is a process that consists of two stages, namely the learning stage and the classification stage. At the learning stage, a classification algorithm will build a classification model by analyzing training data.

C4.5 Algorithm

The C4.5 algorithm is an algorithm used to form a decision tree. Meanwhile, the decision tree can be interpreted as a way to predict or clarify a very strong [6]–[8]. A decision tree can divide large datasets into smaller sets of records by applying a set of decision rules. The C4.5 Algorithm formula is divided into 2 formulas, the first of which is a formula to find the gain value.

Rapid Miner Application

Rapid Miner is one of the software for data mining processing. The RapidMiner app is open source. RapidMiner is built using the java language so it can work on all operating systems. The work done by RapidMiner text mining revolves around text analysis, extracting patterns from large data sets and combining them with statistical methods, artificial intelligence, and databases. The purpose of this text analysis is to obtain the highest quality information from the processed text.

IV. RESEARCH RESULTS

The research at Posyandu "ABC" uses 5 criteria, including: Age (k1), JK (k2), Weight (k3), Height (k4), and Parental Nutrition Awareness (k5) we used data from Posyandu "ABC" as many as 69 nutritional data for toddlers and processed using Microsoft Excel software.

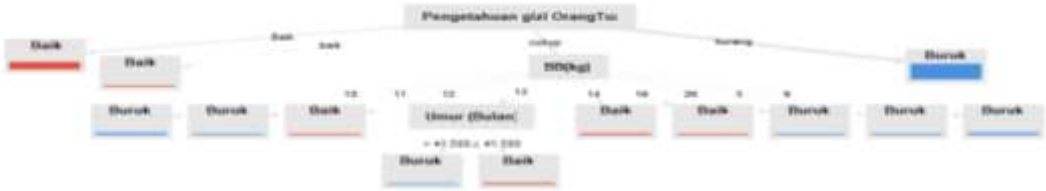
Tabel1. Data Penelitian

Umur (Bulan)	JK	BB(kg)	TB(cm)	Pengetahuan giziOrangTua	Status Gizi
27	L	9	80	kurang	Buruk
15	P	24	110	kurang	Buruk
44	P	15	114	Baik	Baik
28	P	9	85	cukup	Buruk
19	L	14	105	Baik	Baik
15	P	14	100	cukup	Baik
23	L	8,5	80	kurang	Buruk
6	P	7	68	kurang	Buruk
12	L	13,2	95	cukup	Baik
24	L	12	112	Baik	Baik
12	P	13	93	cukup	Baik
22	L	11	110	Baik	Baik
34	L	10	109	kurang	Buruk
18	P	11	88	kurang	Buruk
21	L	10	87	Baik	Baik
6	P	8	72	kurang	Buruk
3	P	6	68	kurang	Buruk
2	L	3	53	cukup	Buruk
40	P	13	115	cukup	Baik
27	P	11	104	kurang	Buruk
43	L	16	115	cukup	Baik
30	L	9	85	cukup	Buruk
9	P	13	113	baik	Baik
17	P	10	105	kurang	Buruk
28	P	8	85	kurang	Buruk
22	L	25	119	kurang	Buruk
15	L	16	120	Baik	Baik
10	P	11	87	kurang	Buruk
13	P	14	100	Baik	Baik
17	L	15	100	Baik	Baik
36	P	10	110	cukup	Buruk
18	P	9	87	kurang	Buruk
21	L	9	85	kurang	Buruk
7	L	8	73	kurang	Buruk

5	L	7	68	kurang	Buruk
2	P	5	56	kurang	Buruk
43	P	13	113	cukup	Buruk
29	L	11	102	cukup	Buruk
26	P	10	88	cukup	Buruk
33	P	26	121	cukup	Buruk
17	L	11	90	kurang	Buruk
12	L	24	119	kurang	Buruk
14	P	10	116	cukup	Buruk
30	L	8	88	kurang	Buruk
18	L	8	102	Baik	Baik
14	L	14	100	Baik	Baik
21	P	13	88	kurang	Buruk
7	L	11	75	kurang	Buruk
12	P	13	90	cukup	Baik
23	L	12	112	Baik	Baik
17	L	9	86	kurang	Buruk
8	L	7	75	kurang	Buruk
35	P	11	110	kurang	Buruk
17	P	10	87	kurang	Buruk
20	L	9	85	kurang	Buruk
7	P	9	73	kurang	Buruk
5	P	7	65	kurang	Buruk
2	L	3	53	kurang	Buruk
43	P	14	115	cukup	Baik
31	L	11	102	kurang	Buruk
13	P	20	115	kurang	Buruk
17	L	9	117	cukup	Buruk
27	L	8	86	kurang	Buruk
15	P	8	100	Baik	Baik
16	P	14	110	Baik	Baik
25	L	14	85	kurang	Buruk
6	P	10	78	kurang	Buruk
10	L	12	100	cukup	Baik
24	L	12	112	Baik	Baik

Then the data is processed to be analyzed using the RapidMiner application, the attributes are selected first, then determine the attributes to be used as Labels, in this case the Nutritional Status attribute is used as a label. The next step is to put the source data in the RapidMiner area then select the Decision Tree algorithm model then connect the select Run button to see the DecisionTree results then the decision tree is formed as shown below:

Gambar1.*DecisionTree*



The Decision Tree above produces rules that will be implemented in the program. The resulting rules are as follows:

Tree

```
Pengetahuan gizi OrangTua = Baik: Baik (Buruk=0, Baik=14)
Pengetahuan gizi OrangTua = baik: Baik (Buruk=0, Baik=1)
Pengetahuan gizi OrangTua = cukup
|   BB(kg) = 10: Buruk (Buruk=3, Baik=0)
|   BB(kg) = 11: Buruk (Buruk=1, Baik=0)
|   BB(kg) = 12: Baik (Buruk=0, Baik=1)
|   BB(kg) = 13
|   |   Umur (Bulan) > 41.500: Buruk (Buruk=1, Baik=0)
|   |   Umur (Bulan) ≤ 41.500: Baik (Buruk=0, Baik=2)
|   BB(kg) = 14: Baik (Buruk=0, Baik=2)
|   BB(kg) = 16: Baik (Buruk=0, Baik=1)
|   BB(kg) = 26: Buruk (Buruk=1, Baik=0)
|   BB(kg) = 3: Buruk (Buruk=1, Baik=0)
|   BB(kg) = 9: Buruk (Buruk=3, Baik=0)
Pengetahuan gizi OrangTua = kurang: Buruk (Buruk=31, Baik=0)
```

Gambar2.*Rule*

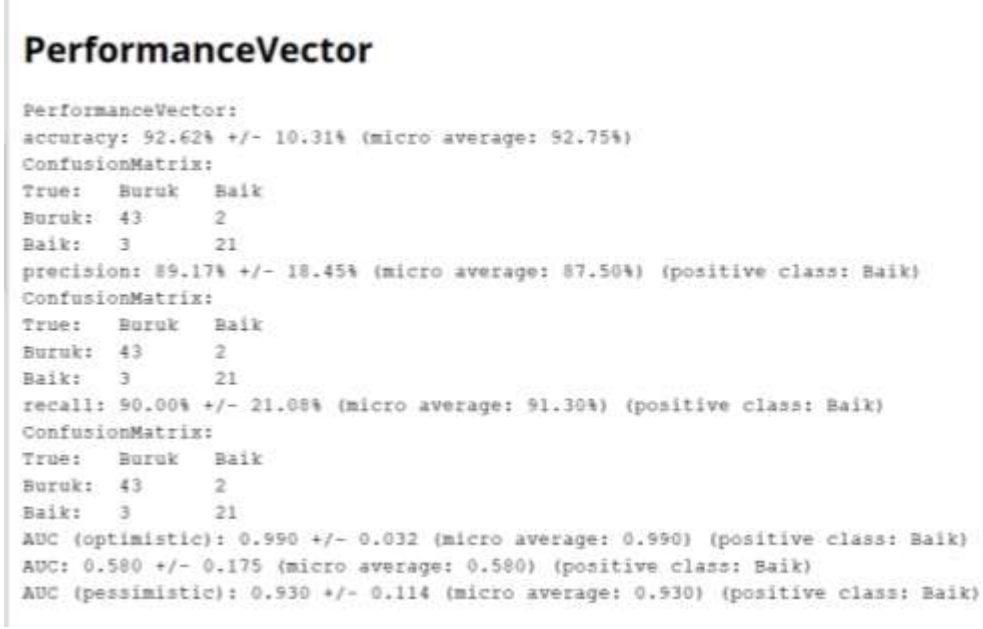
Based on figure 2, it can be concluded that of the 5 attributes of assessment of the nutritional status of toddlers at the "ABC" posyandu, the attributes include: Age (k1), JK (k2), Weight (k3), Height (k4), and Parental nutritional knowledge (k5). The Weight Attribute (k3) and the Parental Nutrition Knowledge Attribute (k5) are the attributes that have the most influence on the nutritional status of toddlers.

accuracy: 92.62% +/- 10.31% (micro average: 92.75%)

	true Buruk	true Baik	class precision
pred. Buruk	43	2	95.56%
pred. Baik	3	21	87.50%
class recall	93.48%	91.30%	

Fig. 3.Accuracy

This can also be explained by the test of the correctness of the data used, with an Accuracy value of 92.62%. this proves that the C4.5 method can be used to assess the nutritional status of toddlers.



PerformanceVector

```
PerformanceVector:
accuracy: 92.62% +/- 10.31% (micro average: 92.75%)
ConfusionMatrix:
True:   Buruk   Baik
Buruk:  43      2
Baik:   3       21
precision: 89.17% +/- 18.45% (micro average: 87.50%) (positive class: Baik)
ConfusionMatrix:
True:   Buruk   Baik
Buruk:  43      2
Baik:   3       21
recall: 90.00% +/- 21.08% (micro average: 91.30%) (positive class: Baik)
ConfusionMatrix:
True:   Buruk   Baik
Buruk:  43      2
Baik:   3       21
AUC (optimistic): 0.990 +/- 0.032 (micro average: 0.990) (positive class: Baik)
AUC: 0.580 +/- 0.175 (micro average: 0.580) (positive class: Baik)
AUC (pessimistic): 0.930 +/- 0.114 (micro average: 0.930) (positive class: Baik)
```

Figure4. Performances

V. CONCLUSION

Based on the results of the discussion and analysis of this study, it can be concluded that the C4.5 algorithm can be applied in determining the nutritional status of toddlers in posyandu "ABC" From 5 (five) attributes, including: Age (k1), JK (k2), Weight (k3), Height (k4), and Parental nutritional knowledge (k5). The Weight Attribute (k3) and the Parental Nutrition Knowledge Attribute (k5) are the attributes that have the most influence on the nutritional status of toddlers.

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