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Determination of the Children Classification with Special Needs in Extraordinary High School in Banjarmasin Using the Naive Bayes

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Abstract

Children with special needs with different physical characteristics are very easy to distinguish. However, in children with special needs with different psychological characteristics, there are difficulties in determining the classification of the child. Children with mental disorders are children who have deviations in the ability to think critically, logically in responding to the world around them. This study determined the classification of children with special needs, the decision support system can analyze using the naive bayes classification (NBC) method. The result showed that Naïve Bayes Classifier algorithm can be used as the basis for the decision-making process by the Special High School Special Education Foundation (SMALB YPLB) Banjarmasin. In this study, it is hoped that using an application based on the Naive Bayesian Classification method can be used as an alternative calculation that is more effective than calculations using the manual method, with the achievement of conformity of the results reaching 80%.

Keywords: *Children with Special Needs; Classification; Naive Bayesian Classification*

Introduction

Children with special needs can be defined as children who have different characteristics, physically, emotionally, or mentally from other children their age (Yang, 2018). The special characteristics that distinguish him from other children, a striking difference occurs in the emotions of children with special needs (Mirza, 2019). The difference in emotional management is mainly because they feel that there is something different about themselves compared to other children (Kalcheva & Nikolov, 2020). The need for attention and weak self-acceptance makes children with special needs often difficult to control their emotions (Wu, 2018). The National Socio-Economic Survey of the Central Statistics Agency in 2016 showed that of the 4.6 million children who were not in school, one million of them were children with special needs (Kalcheva & Nikolov, 2020).

Data from the Ministry of Education and Culture in 2016 and 2017 states that only 10 percent of 1.6 million children with special needs in Indonesia attend SLB (Langarizadeh & Moghbeli, 2016). The large number of children with special needs causes many types of children with special needs. The types of children with special needs (ABK) according to Afin Murtie (2016) ABK consists of physical characteristics and psychological characteristics. Children with special needs with physical characteristics consist of quadriplegic, visually impaired, deaf and speech impaired (Zulfikar et al., 2018). Children with special needs with psychological characteristics consist of mental retardation, autism, hyperactivity and mental retardation (Hartatik et al., 2018). In children with mental disorders are children who have deviations from the ability to think critically, logically in responding to the world around them.

Classification for children with special psychological needs is difficult to classify in detail because they have similar thinking and emotional abilities (Liu et al., 2016). In this case also occurred at the Extraordinary High School Special Education Foundation (SMALB YPLB) Banjarmasin, students with special needs special education (BK) in schools is not a problem, but the lack of teacher competence and the readiness of the school to recognize BK children is a problem encountered in this school (Shinde & Prasad, 2017). This can make it difficult for the school to determine the differences in students' psychological disorders (Putri et al., 2020) so that later in handling the learning process it is necessary to group together the BK students. To assist in determining the classification of BK students, so that they can be grouped according to the condition of student status, it is necessary to have a tool that is a system for determining the classification of BK students' classification decisions. To determine the classification of children with special needs, the decision support system can analyze using the naive bayes classification method. Naive Bayesian Classification (NBC) is a method of probabilistic reasoning. NBC is a classification algorithm that is very effective (getting the right results) and efficient (the reasoning process is carried out using existing inputs in a relatively fast way). The NBC algorithm aims to classify data in certain classes. The classifier's performance is measured by the predictive accuracy value (Hartatik et al., 2018).

Methods

1. Waterfall Method

The system development in this study uses the waterfall method, first introduced by Windows W. Royce in 1970. This method is a simple classic model with a linear system flow, and is still popularly used today.

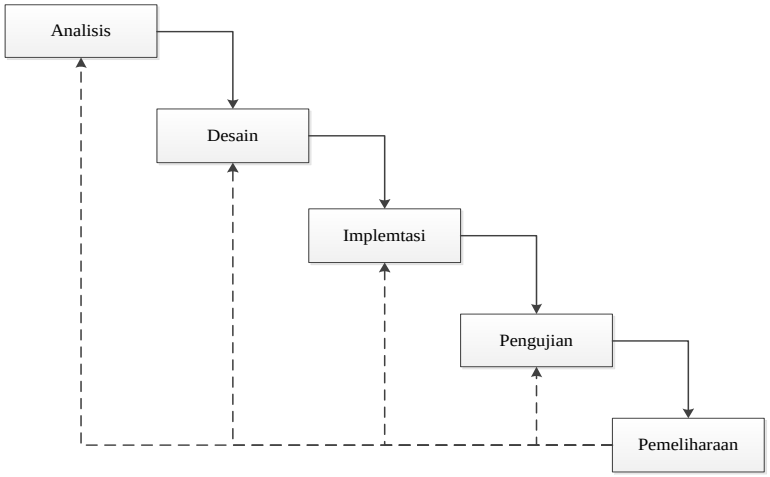

Figure 1 Waterfall Method

Description:

a. Analysis

The analysis stage is the stage used to determine the need for a decision support system in classifying children with special needs. Analysis was also carried out for the purpose of using the Naive Bayesian Classification (NBC) method in classifying children with special needs, such as analyzing the value of the classification variable for children with special needs to be continued on the Naive Bayesian Classification (NBC) algorithm. Analysis is also used to determine functional and non-functional requirements.

b. Design

At the design stage, system planning is carried out based on the results of the analysis. The design consists of from database design and interface design. This stage also aims to provide an overview of the system workflow. The database design will be done conceptually, logically and physically. Interface design is done to design a user-friendly display.

c. Implementation

The results of the Naive Bayesian Classification (NBC) algorithm for the classification of children with special needs will be implemented into a decision support system. The decision support system will provide output in the form of a classification of children with special needs based on the Naive Bayesian Classification (NBC) algorithm. So that the system can help related parties determine decisions in the process of handling children with special needs based on the results of the classification.

d. Test

The test was carried out as a validation stage for the results of the Naive Bayesian Classification (NBC) algorithm for the classification of children with special needs. In addition, testing is also carried out to avoid and find errors in the decision support system, so that improvements and refinements can be made.

e. Maintenance

The maintenance phase is carried out specifically for the system. So, the system that is installed and used can run well for continuous use. Maintenance includes correction of various errors that were not found in the previous stages, improvements to the implementation of the system unit and the development of system services.

2. Observed Variables

The variables used in determining the status of children with special needs for mental retardation, autism, and hyperactivity at the Extraordinary High School Special Education Foundation (SMALB YPLB) Banjarmasin consist of 4 variables, namely social behavior (K1), ways of speaking and communicating (K2), process sensory (K3), and thinking skills (K4). As for each variable has its own sub-variables. In detail the sub-variables for each variable are as follows:

Table 1. Social Behavior Sub Criteria (K1)

No	Sub Variabel	Sub Variable Name
1	SK11	It's hard to share with others
2	SK12	Difficulty understanding shared social goals.
3	SK13	Difficulty socializing and emotionalconnection/attachment with other people.
4	SK14	Difficult to join social groups/play together, cooperate, etc.
5	SK15	Behaving awkwardly, unnaturally, and difficult to understand by their peers.

Tabel 2. Sub Criteria of Language and Communication (K2)

No	Sub Variabel	Sub Variable Name
1	SK21	Choice of words used in speaking.
2	SK22	Able to understand other people's speech.
3	SK23	Able to understand other people's writing.
4	SK24	Can understand the intentions and goals of others who are conveyed nonverbally.
5	SK25	Can use non-verbal communication methods, such as body language, facial expressions, and voice initiation

Tabel 3. Sensory Process (K3)

No	Sub Variabel	Sub Variable Name
1	SK31	Have sensory disturbances such as sensory disturbances of smell, taste, and touch
2	SK32	Has modulation disorders such as difficulty distinguishing high and low.
3	SK33	It is difficult to combine sight and hearing in interpreting one event.
4	SK34	Make inappropriate movements
5	SK35	Difficulty adapting to new situations or things.

Tabel 4. Thinking Ability (K4)

No	Sub Variabel	Sub Variable Name
1	SK41	It is difficult to apply verbal commands to planning for maximum results, especially at school.
2	SK42	Difficulty imitating proper behavior from other people/media.
3	SK43	Has difficulty with age-appropriate concrete thinking, does not understand the expected goals in a particular job.
4	SK44	Having problems in achieving focus / attention on an object / object..
5	SK45	It is difficult to interpret the concept of 'Done' so that he likes himself when doing something.

Results and Discussion

1. Calculation System Design

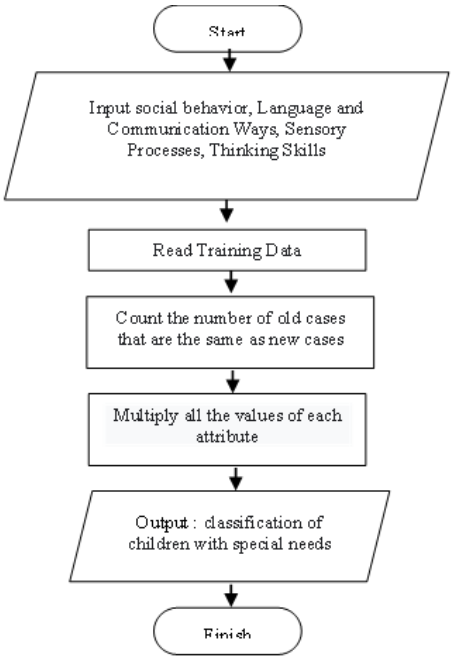

Fig 2. Application Flowchart

a. Analysis and Results of Data Processing

In this method, all attributes will contribute to decision making, with the same weight attribute being important and each attribute independent of each other. If given k attributes that are independent (independence), the probability value can be given as follows (Kusumadewi, 2009).

$$P(X_1, \ldots., X_k|C) = P(X_1|C)x \ldots. xP(X_k|C)$$

if the i-th attribute is discrete, then P(Xi|C) is estimated as the relative frequency of the sample having the value Xi as the i-th attribute in class C. However, if the i-th attribute is continuous, then P(Xi|C) is estimated using the Gaussian density function (Kusumadewi, 2009).

$$f(x) = \frac{1}{\sqrt{2\pi\sigma}} e^{\frac{1(x-\mu)^2}{2\sigma^2}}$$

Description:

$$\sigma = Standar\ Deviasi$$

$$\mu = Avarage$$

$$x = New\ Data$$

Naive Bayesian Classification will be implemented for the classification of children with special needs. So that in the classification of children with special needs, criteria are needed, namely social behavior, ways of language and communication, sensory processes, and thinking skills. In the case for the

classification of children with special needs with 10 initial samples (10 children with special needs in SMALB YPLB Banjarmasin) based on the variables that have been determined as follows:

Table 5. Sample Classification of Children with Needs

No	Social Behavior l (%)	How to speak and communicate (%)	Sensory Process (%)	Thinking Ability(%)	ABK Classification
1.	20	40	20	20	Autism
2.	40	40	40	40	Hyperactive
3.	20	20	40	40	Autism
4.	40	40	20	40	Hyperactive
5.	0	20	20	0	Mentally disabled
6.	40	20	20	20	Autism
7.	20	40	40	40	Hyperactive
8.	20	0	20	20	Mentally disabled
9.	0	20	20	0	Mentally disabled
10	0	20	0	20	Mentally disabled

The value of social behavior is obtained from the assessment of the table of social behavior variables by taking the value of none (X). The value of the way of speaking and communicating is obtained from the assessment of the variable table of language and communication by taking the value of Less (X). The value of the sensory process is obtained from the assessment of the sensory process variable table by taking the value of none (X). The value of thinking ability is obtained from the assessment of the thinking ability variable table by taking the value of none (X).

If a new input is given, for example the 11th input data is the value of social behavior = 40, the value of language and communication = 20, the value of sensory processing = 20, and the value of thinking ability = 40. For the 11th data can be analyzed using Naive Bayesian Classification to determine the classification. The steps to analyze the 11th data using Naive Bayesian Classification are as follows:

2. Calculate the mean and standard deviation of continuous values (such as social behavior, language and communication, sensory processing, and thinking skills).

a. Social Behavior

Table 6. Mean and Standard Deviation of Social Behavior Variables in Each Category

No	Mentally disabled	Autism	Hyperactive
1	0	20	40
2	20	20	40
3	0	40	20
4	0		
Mean	5	26,7	33,3
Dev. Standart	10	11,5	11,5

b. How to speak and communicate

Table 7. Mean and Standard Deviation of Language and Communication Variables in Each Category

No	Mentally disabled	Autism	Hyperactive
1	20	40	40
2	0	20	40
3	20	20	40
4	20		
Mean	15	26,7	40
Dev. Standart	10	11,5	0

c. Sensory Process

Table 8. Mean and Standard Deviation of Sensory Process Variables in Each Category

No	Mentally disabled	Autism	Hyperactive
1	20	20	40
2	20	40	20
3	20	20	40
4	0		
Mean	15	26,7	33,3
Dev. Standart	10	11,5	11,5

d. Thinking Ability

Table 9. Mean and Standard Deviation of Thinking Ability Variable in Each Category

No	Mentally disabled	Autism	Hyperactive
1	0	20	40
2	20	40	40
3	0	20	40
4	20		
Mean	10	26,7	40
Dev. Standart	11.5	11,5	0

3. Calculate the probabilities for the discrete variables and the probabilities for each category itself

Table 9. Probability for Each Category in Abk Classification

	Number of ABK Classification			Probability of ABK Classification		
	Mentally disabled	**Autism**	**Hyperactive**	**Mentally disabled**	**Autism**	**Hyperactive**
Amount	**4**	**3**	**3**	**0.4**	**0.3**	**0.3**

4. Calculating the probability of the 11th data with the value of social behavior = 40, the value of language and communication = 20, the value of sensory processing = 20, and the value of thinking skills = 40.

a. Value of social behavior = 40

$$f(Social\ Behavior = 40|ABK\ Classification = Tunagrahita)$$

$$= \frac{1}{\sqrt{2\pi}(10)} e^{\frac{-(40-2)^2}{2(10)^2}}$$

$$= 8{,}73\ x\ 10^{-5}$$

$$f(Social\ Behavior = 40|ABK\ Classification = Autis)$$

$$= \frac{1}{\sqrt{2\pi}(11{,}5)} e^{\frac{-(40-26{,}7)^2}{2(11{,}5)^2}}$$

$$= 1{,}77\ x\ 10^{-2}$$

$$f(Social\ Behavior = 40|ABK\ Classification = Hyperactive)$$

$$= \frac{1}{\sqrt{2\pi}(11{,}5)} e^{\frac{-(40-22{,}3)^2}{2(11{,}5)^2}}$$

$$= 2{,}93\ x\ 10^{-2}$$

b. Language and Communication Method = 20

$$f(Language\ and\ Communication = 20|ABK\ Classification = Tunagrahita)$$

$$= \frac{1}{\sqrt{2\pi}(10)} e^{\frac{-(20-15)^2}{2(10)^2}}$$

$$= 3{,}52\ x\ 10^{-2}$$

$$f(Language\ and\ Communication = 20|ABK\ Classification = Autis)$$

$$= \frac{1}{\sqrt{2\pi}(11{,}5)} e^{\frac{-(20-26{,}7)^2}{2(11{,}5)^2}}$$

$$= 2{,}93\ x\ 10^{-2}$$

$$f(Language\ and\ Communication = 20|ABK\ Classification = Hiperaktif)$$

$$= \frac{1}{\sqrt{2\pi}(0)} e^{\frac{-(20-40)^2}{2(0)^2}}$$

$$= 0$$

c. Sensory Process = 20

$$f(Sensory\ Process = 20|ABK\ Classification = Tunagrahita)$$

$$= \frac{1}{\sqrt{2\pi}(10)} e^{\frac{-(20-15)^2}{2(10)^2}}$$

$= 3{,}52\ x\ 10^{-2}$

$f(Sensory\ Process = 20|ABK\ Classification = Autis)$

$= \frac{1}{\sqrt{2\pi}(11{,}5)} e^{\frac{-(20-26{,}7)^2}{2(11{,}5)^2}}$

$= 2{,}93\ x\ 10^{-2}$

$f(Sensory\ Process = 20|ABK\ Classification = Hiperaktif)$

$= \frac{1}{\sqrt{2\pi}(11{,}5)} e^{\frac{-(20-33{,}3)^2}{2(11{,}5)^2}}$

$= 1{,}77\ x\ 10^{-2}$

d. Thinking Ability = 40

$f(Thinking\ Ability = 40|ABK\ Classification = Tunagrahita)$

$= \frac{1}{\sqrt{2\pi}(11{,}5)} e^{\frac{-(40-10)^2}{2(11{,}5)^2}}$

$= 1{,}18\ x\ 10^{-3}$

$f(Thinking\ Ability = 40|ABK\ Classification = Autis)$

$= \frac{1}{\sqrt{2\pi}(11{,}5)} e^{\frac{-(40-26{,}7)^2}{2(11{,}5)^2}}$

$= 1{,}77\ x\ 10^{-2}$

$f(Thinking\ Ability = 40|ABK\ Classification = Hiperaktif)$

$= \frac{1}{\sqrt{2\pi}(0)} e^{\frac{-(40-40)^2}{2(0)^2}}$

$= 0$

5. Calculating Likelihood for the classification of each category

e. Likelihood Mentally disabled

$Likelihood = (8{,}73\ x\ 10^{-5}) x (3{,}52\ x\ 10^{-2}) x (3{,}52\ x\ 10^{-2}) x (1{,}18\ x\ 10^{-3})$

$Likelihood = 5{,}12\ x\ 10^{-11}$

f. Likelihood Autism

$Likelihood = (1{,}77\ x\ 10^{-2}) x (2{,}93\ x\ 10^{-2}) x (2{,}93\ x\ 10^{-2}) x (1{,}77\ x\ 10^{-2})$

$Likelihood = 8{,}08\ x\ 10^{-8}$

g. Likelihood Hyperactive

$Likelihood = (2{,}93\ x\ 10^{-2}) x (0) x (1{,}77\ x\ 10^{-2}) x (0)$

$Likelihood = 0$

6. Calculating the probability value can be calculated by normalizing the likelihood.

a. Probabilitas Mentally disabled

$$Probabilitas = \frac{5{,}12\ x\ 10^{-11}}{(5{,}12\ x\ 10^{-11}) + (8{,}08\ x\ 10^{-8}) + (0)} = 0{,}0006$$

b. Probabilitas Autism

$$Probabilitas = \frac{8{,}08\ x\ 10^{-8}}{(5{,}12\ x\ 10^{-11}) + (8{,}08\ x\ 10^{-8}) + (0)} = 0{,}99$$

c. Probabilitas Hyperactive

$$Probabilitas = \frac{0}{(5{,}12\ x\ 10^{-11}) + (8{,}08\ x\ 10^{-8}) + (0)} = 0$$

From these results, it can be seen that the highest probability value is in the autistic classification, so it can be concluded that the 11th data with the value of social behavior = 40, the value of language and communication = 20, the value of sensory processing = 20, and the value of thinking ability = 40 are included in the classification. Children with Autistic Special Needs.

Conclusion

After doing all the analysis, design, implementation, and evaluation of the system, the following conclusions can be drawn: The Naïve Bayes Classifier algorithm can be used as the basis for the decision-making process by the Special High School Special Education Foundation (SMALB YPLB) Banjarmasin. Development of calculation applications by using the Naïve Bayes Classifier method, it can be used as an alternative calculation that is more effective than calculations using the manual method, with the achievement of conformity of the results reaching 80%.

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