Mental Health Analysis at the University of Dipa Makassar using Naïve Bayes Classifier

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Article Info	ABSTRACT
	Maintaining the stability of our mental health as a student and keeping it healthy is one of the most important things to live a healthy mindset to become academically advanced. A good healthy mentality shall produce a positive mindset so that the body can function better emotionally, psychologically, or socially and it will affect the way of thinking. The purpose of this research is to classify mental disorders that are felt by the university students at Dipa Makassar. The results of the classification of mental disorders were carried out on 50 students at the university. 38 students were Identified as having mental disorders while the other 12 students were Unidentified as having mental disorders. Data testing performed on RapidMiner resulted in an accuracy rate of 100%. With this research, it is possible to classify mental disorders felt by the students of Dipa Makassar University.

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1. INTRODUCTION

Mental health includes our emotional, psychological, and social mechanisms. It affects how we think, feel, and act on how we react to handle stress. Mental health helps us in making healthy choices during our formative years and during every important stage of life. According to medical experts, mental and physical states are equal components of all-inclusive health. *Depression* could increase the risk of many types of physical health problems, such as *diabetes*, *stroke* even *heart disorder* [1].

The understanding of mental health cannot be separated from an understanding of health and physical illness. Various research has revealed a relationship between the physical and mental health of each individual, where individuals with medical complaints indicate a psychological problem to some extent of mental disorders. Conversely, individuals with mental disorders also indicate a disturbance in physical function [2]. Dealing with mental health, especially as a college student living our day-to-day life on campus, it is very important to acknowledge the need to maintain good and stable mental health. We will be forced to conduct ourselves according to our environmental society. Especially on campus, which requires a higher level of awareness on how to adapt to higher academic surroundings. Recent surveys, on many college students, report that many had suffered from mental difficulties and the issue has negatively impacted their academic

performance over the last 12 months [3]. A concept called "The Person in Environment" explains that the existence of an individual in an environment will influence each other. The presence of individuals will produce dynamic conditions for the environment, and also the environment directly or indirectly affect individuals and will have an impact on changes in certain individuals. This explains how someone who suffers from mental health disorders is the result failure individual in adapting to the surrounding environment [4].

There are many types of mental disorders that general in Indonesia and 5 of them are the most common which are *Anxiety Disorder*, *personality disorder*, *psychotic disorder*, *mood disorder*, and *Post-Traumatic Stress Disorder* (PTSD) [5]. All of these disorder has their characteristics. Due to the lack of means that can classify students of Dipa Makassar university based on their symptoms of mental disorders, this study will rely on the method of Naive Bayes to classify these characteristics. To find out a better level of accuracy, this study will be using data testing on the RapidMiner application.

As for related research previously conducted by other authors presenting methods for classifying electrocardiogram data (ECG) into four emotional states based on stress levels using the one-against-all and naive Bayes algorithms of support vector machines. The stress classification criteria are determined by calculating the R-S peak averages, R-R intervals, and Q-T intervals of the ECG data to improve the accuracy of stress classifications[6]. Next strive to get a clear and accurate picture. The reason to follow the different approaches is for accurate information to work better and reduce the number of suicides. The final result was 87.38 percent, i.e. using the Support Vector Machine (SVM)[7], research diagnoses mental illness using ML algorithms and suggests how ML techniques can be used and applied in practice[8]. A study that collected data from 466 subjects by performing neuropsychological tests. The author focuses on the diagnosis of DA for neuropsychological tests using Naive Bayes, identifying factors of mental health problems in selected college students. The study aims to classify students into different categories of mental health problems, namely stress, depression, and anxiety, using machine learning algorithms[10]. Predicting the onset and course of mood and anxiety disorders is clinically important but still difficult comparing the predictive performance of traditional logistical regression, basic probabilistic machine learning (ML), and automatic ML. (Auto-sklearn)[11]. Classification and analysis related to mental health during the pandemic using tweets shared by users in Indonesia and then comparing the algorithms of Naïve Bayes, SVM, Logistic Regression, and Random Forest[12], The information collected from the survey was analyzed using Bayes' classification and the results were concluded using visualization tools. Based on the output, the socio-economic and physical stress factors have been coded and prioritized. Often mentioned stressors should be reduced to help students excel in academic achievement and activate social activity, thereby reducing individual health problems such as migraine headaches, wearing glasses, and so on[13]. Then the detection of cyberbullying will use ML algorithms namely Naïve Bayes and Decision Tree, as well as comparing which of them are better for detection. As social media shows, it's seen that people express their feelings through the platform rather than seeking professional help, Naïve Bayes classification, Logistic Regression Model, Random Forest Classification, and Vector Machine Support classification are used for classification[15]. Implementation classification algorithms like Decision Tree, Random Forest and Naïve Bayes. The target population is the working class, that is, people over the age of 18. Once the model is built, the model will be integrated into the website so that it can predict the outcome according to the details given by the user[16]. Penelitian mengenai data mining juga banyak dilakukan pada pengelompokan kunjungan wisatawan mancanegara dengan menerapkan K-Means dan SVM[17]. *Research that deals with the design of web-based application systems for dementia diagnostics, which are made using the PHP programming language, as well as storage or database using MySQL. The application aims to enable a patient to identify about dementia. The way this application works is almost the same as consulting a specialist or a doctor. To diagnose the type of dementia a patient is experiencing is by using methods or forward chaining algorithms*[18].

2.   RESEARCH METHOD

This study used a qualitative approach where the researchers distributed a questionnaire using google form via online to 50 student correspondents from Dipa Makassar University by presenting questions about symptoms that they may or may not have experienced in the past. To obtain quality data of empirical results, especially on the mental health of the students of Dipa Makassar University.

2.1. Data Mining

Data Mining or Knowledge Discovery in Database (KDD) is a process of finding valuable knowledge from well-organized Big Data in a transactional database [19] [20].

Data Mining is a sequential process to explore the form of information which has so far been unknown manually from a database. Information that generated by catching and recognizing the important pattern or by seeking data that is contained in the database [21].

2.2. Naïve Bayes Method

Naïve Bayes is a method that calculates conditional probabilities. Naïve Bayes predicts the future probabilities based on previous data on the same matter, so it is known as Bayes Theorem, Bayes Theorem is used in a wide variety of classification tasks. Data mining can also be interpreted as a series of activities to find a unique pattern out of a big amount of data, then the data is stored inside a database warehouse[22] [23]. Conditional probability is a measure of the probability of an event occurring given that another event has the essence of assumption, presumption, assertion, or evidence that occurred [24]. In using the Naïve Bayes method, the advantage that can be obtained is that the method only requires a small amount of training data to determine the required parameter estimates in the classification process [25].

Classification is a data mining functionality that produces a model to predict the class or category of objects in the database. Classification is a process consisting of two stages, namely the learning stage and the classification stage. At the learning stage, an algorithm classification will build a classification model by analyzing training data [26].

Here stated Bayes Theorem in general :

$$P(Mi \mid N) = \frac{P(N|Mi).P(Mi)}{P(N)} \qquad (1)$$

Where :
N   = Data with yet unknown class
Mi   = The data hypothesis of N
$P(Mi \mid N)$ = The probability of the Mi hypothesis is based on the condition N (posterior probability)
$P(Mi)$ = Hypothesis probability of Mi (prior probability)
$P(N \mid Mi)$ = The probability of N based on the condition of hypothesis Mi
$P(N)$ = Probability of N

On its development, P(N) can be omitted because the value is fixed so that when compared to each category, this value can be written off because the attribute assumption is not always related (conditionally independent) so [27]:

$$P(N/Mi) = \prod_{k=1}^{n} P(N_k|Mi)$$
$$= P(N_1/Mi) \: x \: P(N_2/Mi)x \: ... \: xP(N_n/Mi) \qquad (2)$$

If P(N) can be known through the calculation above, so class (label) from sample data N is class (label) which has P(N|Mi) x P(Mi) maximum.

$$Posterior = \frac{likelihood \: x \: prior \: probability}{Evidence} \qquad (3)$$

2.3. RapidMiner

RapidMiner is a software that is used as a learning tool in data mining studies. This platform was developed by a company dedicated to handling big data for business commercials, research, education, training, prototyping, and application development as well as supporting all steps of machine learning processes including data preparation, result visualization, validation, and

optimization. RapidMiner was developed with an open-core model [28]. RapidMiner consists of up to 100 learning solutions for classification, grouping, and regression analysis. RapidMiner supports 22 file formats, like .xls, .csv, etc [29]. RapidMiner is written using Java programming language to carry out its function. It basically uses a process XML-File that is generated by the user and contains a sequence of tasks represented by the operator. There are more than 500 operators included in the RapidMiner application. RapidMiner was first named Yet Another Learning Environment or YALE for short. In 2007 it changed its name to RapidMiner [30].

RapidMiner emphasizes *Artificial Intelligence* (AI) in companies through an open scalable data science platform. RapidMiner is built for analysis teams, and integrates all kinds of data science cycles, from data preparation to learning machines to the deployment of predictive models.

3. RESULTS AND ANALYSIS
3.1 Data Classification

Based on the information found on the internet regarding mental health, it can be concluded that out of 5 mental disorders, sufferers experienced at least 2 characteristics each. Types of mental disorders are shown in Table 1 below.

Table 1. Disorder Table

Code	Disorder
G1	*Anxiety Disorder*
G2	*Post-Traumatic Stress Disorder* (PTSD)
G3	*Mood Disorder*
G4	*Psychotic Disorder*
G5	*Personality Disorder*

The characteristics of mental disorders are shown in Table 2 below.

Table 2. Characteristics table

Code	Characteristic
Ch1	Anxiety that occurs every day and persists for up to 6 months
Ch2	Fatigue, tension, nauseous, headache, difficulty in concentrating, insomnia/trouble sleeping when anxiety occurs
Ch3	Experiencing sudden changes in behavior or emotions without knowing why
Ch4	Have u ever avoided places, activities, or people that remind you of past traumatic events?
Ch5	Overly confident when about to do something or activities
Ch6	Sometimes experiencing excessive feelings of sadness and growing feelings of depression
Ch7	Sometimes feeling disoriented because you trust something easily for no apparent reason
Ch8	Thinking that you can feel, see, or hear something that you are aware that it is not a normal thing to experience
Ch9	Difficulty in building social relationships with other people
Ch10	Feeling that you are lacking in giving sympathy/empathy to friends or relatives

Each disorder has several characteristics that are felt by each person. Therefore, the relation between the disorder and its characteristics is shown in Table 3 below.

Table 3. Relation Table

No	Disorder	Characteristic
1	G1	Ch1, Ch2
2	G2	Ch3, Ch4
3	G3	Ch5, Ch6

| 4 | G4 | Ch7, Ch8 |
| 5 | G5 | Ch9, Ch10 |

For the answers to each question in the questionnaire which was distributed to 50 respondents, we converted the values as shown in Table 4.

Table 4. Value Conversion

Answer	Value
Yes	1
No	0

The training data and test data used for classification are 14 training data and 1 testing data, then this training data will be processed using the Naïve Bayes Classifier method. The training data used is shown in Table 5 below.

Table 5. Training Data

Respondent	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch8	Ch8	Ch9	Ch10	Category
1	1	1	0	0	0	0	0	0	0	0	Identified
2	0	0	1	1	0	0	0	0	0	0	Identified
3	0	0	0	0	1	1	0	0	0	0	Identified
4	0	0	0	0	0	0	1	1	0	0	Identified
5	0	0	0	0	0	0	0	0	1	1	Identified
6	1	0	0	0	0	0	0	0	0	0	Unidentified
7	0	0	1	0	0	0	0	0	0	0	Unidentified
8	0	0	0	0	1	0	1	0	0	0	Unidentified
9	0	0	0	0	0	0	1	0	0	0	Unidentified
10	0	1	0	1	1	0	0	0	0	0	Unidentified
11	0	0	0	1	1	0	0	0	1	0	Unidentified
12	0	1	1	0	0	1	1	0	0	1	Unidentified
13	0	0	0	1	1	1	1	0	0	0	Identified
14	0	0	0	0	1	0	0	1	0	0	Unidentified

Calculations with Naïve Bayes to test the data in Table 6 are as follows:

Table 6. Testing Data

Respondent	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8	Ch9	Ch10	Category
4	0	0	0	0	0	0	0	0	1	1	Identified

3.2 Determine the value of n_c for every class

The first step is to find the value of n_c for each disorder based on the characteristic experienced by the respondent.

1. Category: "Identified"
   n   = 1   p = 1/2 = 0,5

        m   = 14
        9. nc = 1   10. nc = 1
2. Category: "Unidentified"
        n   = 1   p = 1/5 = 0,5
        m   = 14
        1. nc = 0   5. nc = 0
        2. nc = 0   6. nc = 0
        3. nc = 0   7. nc = 0
        4. nc = 0   8. nc = 0

3.3 Calculating the value of P($ai|vj$) and P(vj)

At this stage, the probability calculation for each disorder is carried out based on the characteristics felt by the respondent.

1. Category: "Identified"

$P(9|Idd)$ $= \frac{1+14.0,5}{1+14} = 0,53$

$P(10|Idd)$ $= \frac{1+14.0,5}{1+14} = 0,53$

$P(Idd)$ $= \frac{6}{14} = 0,42$

2. Category: "Unidentified"

$P(1|Udd)$ $= \frac{0+14.0,5}{1+14} = 0,467$

$P(2|Udd)$ $= \frac{0+14.0,5}{1+14} = 0,467$

$P(3|Udd)$ $= \frac{0+14.0,5}{1+14} = 0,467$

$P(4|Udd)$ $= \frac{0+14.0,5}{1+14} = 0,467$

$P(5|Udd)$ $= \frac{0+14.0,5}{1+14} = 0,467$

$P(6|Udd)$ $= \frac{0+14.0,5}{1+14} = 0,467$

$P(7|Udd)$ $= \frac{0+14.0,5}{1+14} = 0,467$

$P(8|Udd)$ $= \frac{0+14.0,5}{1+14} = 0,467$

$P(Udd)$ $= \frac{8}{14} = 0,57$

3.4 Calculating the value of P($ai|vj$) x P(vj) for each v

Next method is to calculate by multiplying the probability value of each disorder by each characteristic.

1. Category: "Identified"
    $= P(Idd) \ x \ [P(9|Idd) \ x \ P(10|Idd)]$
    $= 0,42 \ x \ [0,53 \ x \ 0,53]$
    $= 0,117978$

2. Category: "Unidentified"
    $= P(Udd) \ x \ [P(1|Udd) \ x \ P(2|Udd) \ x \ P(3|Udd) \ x \ P(4|Udd) \ x \ P(5|Udd) \ x \ P(6|Udd) \ x \ P(7|Udd) \ x \ P(8|Udd)]$
    $= \ 0,57 \ x \ [0,467 \ x \ 0,467 \ x \ 0,467 \ x \ 0,467 \ x \ 0,467 \ x \ 0,467 \ x \ 0,467 \ x \ 0,467]$
    $= 0,001289$

Table 7. Table V from every class

Category	v-value
Identified	0,117978
Unidentified	0,001289

Based on the table above, it can be seen that the largest value of v is 0,001289 then the characteristics experienced by respondent 4 will be categorized as Identified for having mental disorders

3.5 Testing using RapidMiner Application

The following is the process of testing the RapidMiner application by taking data from questionnaires that have been collected as Testing Data, and Training Data that was collected randomly.

The process of this test can be seen in Figure 1 below.
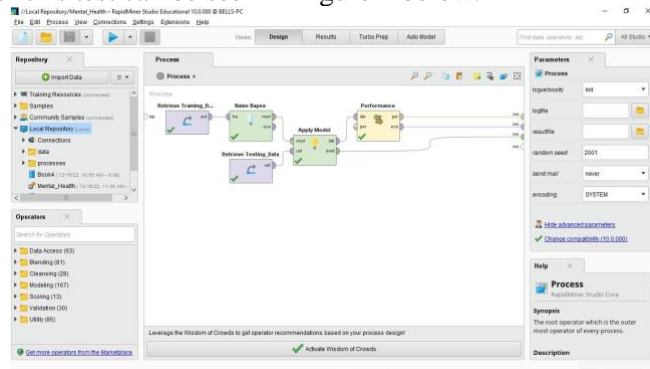
Figure 1. Design Process

The result of the Accuracy Level through a comparison of Training Data and Testing Data is 100%. The level of accuracy can be seen in Figure 2 below.
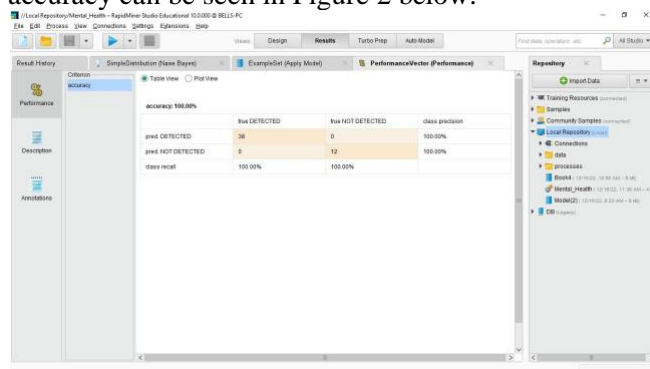

Figure 2. Accuracy Level

4. CONCLUSION

conclusions is classification of Mental Health using Naïve Bayes which was studied on 50 students at Dipa Makassar University, 38 students were identified as having mental disorders while the other 12 students were Unidentified as having mental disorders. The level of accuracy of Naïve Bayes in testing 50 data is 100%. This study can be a means to classify Dipa Makassar University students based on the characteristics they feel.

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