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Expert System to Diagnose Internet Addiction Levels using Bayes Theorem Method

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A B S T R A C T

The internet is one of the most popular media today by teenagers. Not a few people are very dependent on the internet so that users are addicted, the symptoms of addiction are given the name Internet Addiction. Internet Addiction is defined as a syndrome characterized by spending an enormous amount of time using the internet and not being able to control its use while online. People who show this syndrome will feel anxious, depressed, or empty when not online on the internet. The low awareness of the public about this addiction disorder is a factor in the increasing number of people, especially teenagers, who underestimate this addiction disorder and are often regarded as something natural because in this era it is indeed a time of wide open technology. Therefore there is a need for technology that helps diagnose internet addiction using the Bayes Theorem Method. In the Bayes theorem method, each symptom weight in this disorder is determined by the probability of the results of a survey or questionnaire that has been done previously as much as 50 data. tendency of individuals who are indicated to be addicted to the internet. Bayes' theorem uses a statistical approach to calculate trade offs between different decisions, using the probabilities and values that accompany a decision. The system test shows that the Bayes theorem method has an accuracy rate of 60% to diagnose the level of internet addiction experienced by teenagers..

Keywords: Bayes Theorem,.Expert System, Internet Addiction.

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1. Main text

The internet is one of the most popular media today by teenagers. The internet has become a passion for teenagers in finding the latest information and establishing relationships with other people elsewhere. The development of internet users in Indonesia from year to year is high, it can be seen from the results of the PUSKAKOM survey in collaboration with APJII, where in 2015 there were 88.1 million people, in 2016 as many as 132.7 million people, and in 2017 as many as 143, 26 million inhabitants. But there are some people who are currently affected by one of the negative effects of their use. Not a few people are very dependent on the internet so that users are addicted

Based on this need a system that can accommodate the knowledge of experts or psychologists in terms of preventing and diagnosing internet addiction, one alternative solution is to create an expert system. Based on previous research conducted by sister Fatina Fachraini Elfa with the title of the thesis "Building an Expert System for Conducting Internet Addiction Diagnosis with Forward Chaining Method", no solution or steps have been given to reduce addiction to the internet and in that study only used simple methods and calculations i.e. it only sums all the symptom values chosen by the user using Forward Chaining. It is expected that in this study the authors can develop the application using the Bayes Theorem Method. Bayes 'theorem is a simple probabilistic technique based on the application of Bayes' rules with a strong assumption of independence. The calculation using Bayes' Theorem in this research is to compare the problems that might occur with problems that have not yet occurred or in other ways to overcome the problem of uncertainty between symptoms and the level of addiction that exists. The advantage of Bayes also is that it has the characteristics of very strong assumptions and independence from each condition. It is hoped that the advantages possessed by the Bayes Theorem will be able to overcome problems in generating diagnoses of internet addiction and provide early treatment solutions to addictions experienced by users.

The purpose of this research is the application of an expert system that is designed to produce a diagnosis for people who have been addicted to the internet, the expert system can help psychologists in dealing with patients who are indicated to be addicted to the internet, and the expert system can produce information solutions that can handle these addictions.

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2. Literature Review

Internet addiction is a psychophysiological disorder which includes tolerance (the use of the same amount will cause a minimal response, the amount must be added so that it can generate the same amount of pleasure), whithrawal symptoms (especially causing termor, anxiety, and mood changes), affective disorders (depression, difficulty adjusting), and disruption of social life (decreased or completely lost, both in terms of quality and quantity)

Internet addiction is defined as a syndrome which is characterized by spending an enormous amount of time using the internet and not being able to control its use while online. People who show this syndrome will feel anxious, depressed, or empty when not online on the internet.

One symptom (symptom) of internet addiction is the excessive use of time for the internet. A person may find it difficult to reduce access to the Internet even if he is threatened with sanctions getting bad grades at school or being expelled from his job. Other symptoms of addiction include lack of sleep, fatigue, worsening grades, poor performance at work, apathy, etc. There is also the possibility of reduced investment in social relations and activities. Someone might lie about how much time they spend online or deny they have a problem. They may become irritable when they are not online, or angry with anyone who asks their time when online on the internet.

2.1. Bayes Theorm

Bayes' theorem is a statistical approach to calculating trade offs between different decisions, using the probabilities and values that accompany a decision making.

3. Bayes' theorem is used to calculate the uncertainty of data into definite data by including the percentage. Bayes' theorem is more applied to matters relating to a statistical diagnosis that relates to the probability and likelihood of illness and related symptoms. The Bayes formula can be stated as follows.

$$P|(H|E)= \frac{P(E \mid H).P(H)}{P(E)} \quad (1)$$

where :

P(H|E) = hypothesis probability *H* true if given *evidence E*

P(E|H) = probability of emergence *evidence E*, if known hypotheses *H* was true.

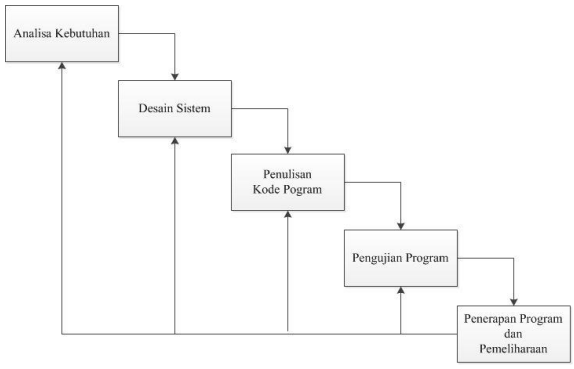
P(H) = hypothesis probability *H* without looking *evidence*.

P(E) = probability *evidence E*

2.2. *Expert System Components*

The expert system is composed of two main parts, namely: the development environment and the consultation environment. The expert system has several main components, namely: the user interface, the expert system database, the knowledge acquisition facility and the inference mechanism. In addition there is one component that is in several expert systems, namely the explanation facility (explanation facility).

3. Methods

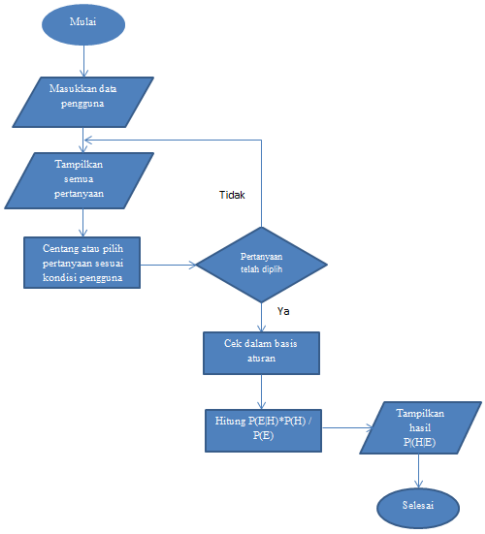


Picture 1. Waterfall Flow Chart

4. Design

4.1. Flowvhart

The following is a flowchart of the system



Picture 2. Flowchart System

Picture 2. Flowchart System

In the system design that is described by the flowchart, Bayes theorem method runs after the question is answered or selected by the user. Bayes' theorem will process answers to user questions by using probability calculations which will then determine the level of internet addiction experienced by the user.

4.2. Internet Addiction Data

The following is a list of symptoms of internet addiction based on those taken from references

Table 1. An example of a table.

No	Question	Code
1	Keep thinking of going online / internet even when you're offline	P1
2	It is necessary to spend more and more time online to achieve satisfaction	P2
3	Time online / internet now increased to 6 hours outside of school	P3
4	Still happy even though you can't get online / internet	P4
5	If there is a problem, prefer to rest than surf the internet	P5
6	Find it easy to stop old online / internet activities	P6
7	Life is still fun even without the internet	P7
8	Feeling anxious when offline, and those feelings disappear when you go back online	P8
9	Feeling dizzy when you can't surf the internet / online	P9
10	I will stop browsing before doing the assignment	P10
11	Prefer spending time to surf the internet / online alone rather than go with other people	P11
12	I can't sleep because I can't surf	P12
13	I am sure that I will be able to stop the old internet activities	P13
14	Most of my time is spent browsing	P14
15	I will get angry if I am not given permission to surf	P15
16	Although I have been determined not to surf the internet for a long time, but the desire to surf the internet has made me return for a long time	P16
17	Worried if my life without the internet would become empty and boring	P17
18	Still happy even though my internet time is reduced	P18
19	Often late doing work because of the excitement of the internet / online	P19
20	Stay on the internet even though my eyes are tired	P20
21	Before the task is complete, I will not surf the internet	P21
22	Prefer friend invitations to play or activities together rather than the internet	P22
23	It doesn't matter even though I can't surf	P23
24	Often do not do the task because of busy internet	P24
25	Could not concentrate with the lesson because I was busy surfing the internet	P25
26	Online or internet activities disrupt my social life	P26
27	I can stop the internet habit for a long time because it can be detrimental to me	P27
28	I often muttered to myself "I'll be off soon (stop)" surf	P28
29	Sleep better if you have not previously surfed	P29
30	The body feels fresher when it is not internet	P30

In the system design that is described by the flowchart, Bayes theorem method runs after the question is answered or selected by the user. Bayes' theorem will process answers to user questions by using probability calculations which will then determine the level of internet addiction experienced by the user.

4.3. Sample case

In the calculation of the Bayes theorem method there is data processed including student / patient data, type data, rule data, and symptom data. Student / patient data used in this example calculation are 40 training data obtained during observation from a total of 50 data and the remaining 10 data are used for test data. The following is an example of Bayes theorem calculation method: A student wants to do a diagnosis of his uncontrolled internet activity problem which causes his school grades to drop. Then student A diagnoses internet addiction in the counseling room at his school. The student answers the questions in the application in his school's counseling room. The student chose several symptoms including:

a. I still think about online / internet even when I'm offline (G1)
b. I am still happy even though I can't get online / internet (G4)
c. If I have a problem, I prefer to rest rather than surf (G5)
d. I find it easy to stop old online / internet activities (G6)
e. My life is still fun even without the internet (G7)
f. I feel dizzy if I can't surf the internet / online (G9)
g. I will stop browsing before doing my work (G10)
h. I am sure I will be able to quit the old internet activities (G13)
i. Before my assignment is complete, I will not surf the internet (G21)
j. I prefer to invite friends to play or activities together rather than the internet (G22)
k. I don't care if I can't surf (G23)
l. I can stop my internet habits for a long time because it can be detrimental to me (G27)
m. I often mumble in my heart "I'll be off soon (stop)" internet (G28)
n. I sleep better if I have not been online (G29)

After that the symptoms chosen by the students are processed using Bayes theorem method.

a. Below is the result of type probability obtained from the calculation of the number of events of the Addiction Type i (Pi) from the results of the diagnosis of addiction disorder students divided by the number of students.

Tabel 2. Type Probability Results

Id_Tipe	amount	symptom obability to the patient (P(H))
P1 (Light)	14	0,35
P2 (middle)	20	0,5
P3 (weight)	4	0,1
P4 (not addicted)	2	0,05
	40	

b. After that the question / symptom is determined with the answer "Yes" chosen by the student. Then from each question the rule probability is determined. The probability of a rule is obtained from the number of questions / symptoms in each type divided by the probability of the type that was previously calculated. Below is the result of the probability rules of each type that have been calculated.

Tabel 3. Probability Rules of Selected Symptoms

Prob	Light	middle	heavy	not addicted
G1	0,2857	0,5	0,5	0
G4	0,8571	0,9	0,75	1
G5	0,9286	0,8	0,75	1
G6	1	0,6	0,5	1
G7	1	0,85	0,25	1
G9	0	0,05	0,25	0
G10	0,9286	0,95	0,75	1
G13	1	0,8	0,5	1
G14	0,0714	0,2	0,5	0
G18	1	0,95	0,5	1
G19	0,1429	0,35	0,75	0
G21	0,8571	0,95	0,75	1
G22	1	0,9	0,5	1
G23	0,8571	0,85	0,5	1
G27	0,9286	0,75	0,75	1
G28	0,6429	0,75	0,75	0,5
G29	0,7857	0,6	0,75	1

c. Each probability crossed by eachprobablity type.

Tabel 4. Results of Multiplication Probability of Rules from Selected Symptoms and Types

Prob	Light	middle	heavy	not addicted	Prob
G1	0,099995	0,25	0,05	0	0,399995
G4	0,299985	0,45	0,075	0,05	0,874985
G5	0,32501	0,4	0,075	0,05	0,85001
G6	0,35	0,3	0,05	0,05	0,75
G7	0,35	0,425	0,025	0,05	0,85
G9	0	0,025	0,025	0	0,05
G10	0,32501	0,475	0,075	0,05	0,92501
G13	0,35	0,4	0,05	0,05	0,85
G14	0,02499	0,1	0,05	0	0,17499
G18	0,35	0,475	0,05	0,05	0,925
G19	0,050015	0,175	0,075	0	0,300015
G21	0,299985	0,475	0,075	0,05	0,899985
G22	0,35	0,45	0,05	0,05	0,9
G23	0,299985	0,425	0,05	0,05	0,824985
G27	0,32501	0,375	0,075	0,05	0,82501
G28	0,225015	0,375	0,075	0,025	0,700015
G29	0,274995	0,3	0,075	0,05	0,699995

d. The results of each multiplication above are then divided by the sum of the results of each question / symptom.

Tabel 5. Share Results

Devide	Light	Middle	weight	Not addicted
G1	0,249991	0,625008	0,125002	0
G4	0,342846	0,514295	0,085716	0,057144
G5	0,38236	0,470583	0,088234	0,058823
G6	0,466667	0,4	0,066667	0,066667
G7	0,411765	0,5	0,029412	0,058824
G9	0	0,5	0,5	0
G10	0,351358	0,513508	0,08108	0,054053
G13	0,411765	0,470588	0,058824	0,058824
G14	0,142808	0,571461	0,285731	0
G18	0,378378	0,513514	0,054054	0,054054
G19	0,166708	0,583304	0,249988	0
G21	0,333322	0,527787	0,083335	0,055556
G22	0,388889	0,5	0,055556	0,055556
G23	0,363625	0,515161	0,060607	0,060607
G27	0,393947	0,45454	0,090908	0,060605
G28	0,321443	0,535703	0,107141	0,035714
G29	0,392853	0,428574	0,107144	0,071429

e. Then add up the results for each type.

Tabel 6. Addition Results

Amount	5,498725	8,624025	2,129396	0,747855

f. Add up all the results obtained.

Tabel 8. Total Sum Results

Total	17

g. Final result count bycalculation point e with pint f

Tabel 8. Final Results Calculation

The final result	0,323454	0,507296	0,125259	0,043991

In table 9 above Bayes calculation, the Bayes calculation process starts from the multiplication of type probabilities with rule probabilities, then the multiplication calculations are added up to produce a total rule probability. Furthermore, the results of the calculation of the first multiplication process are divided by the total probability of the rules in each type. From the process then added up and divided with each total

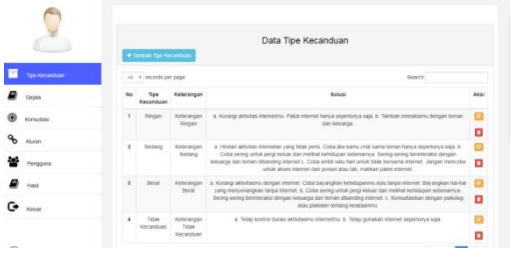
Tabel 8. Bayes Calculation

Id_Tipe	Amount	Probability of symptoms towards patients (P(H))
P1 (ringan)	14	0,35
P2 (sedang)	20	0,5
P3 (berat)	4	0,1
P4 (tidak kecanduan)	2	0,05
	40	

addition in each type. After getting the results of the sum and distribution, then classified with the maximum probability, where the highest probability that will be the result of an internet addiction diagnosis. Can be seen in the example calculation above, it can be concluded that the maximum probability is in the Type of Addiction Medium (P2). Diagnosis results: Student A experiences a type of moderate addiction with a maximum bayes value of 0.507296

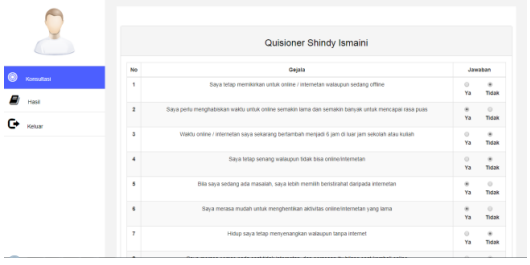
4.4. Implementation

In making this internet addiction expert system the writer makes it with web-based. In this web use 2 pages, namely the admin page and user page.



Picture 3. Admin page

The admin page consists of tab symptoms, consultation, rules, users, and results. The admin page manages data used on user pages.



Picture 4. User Page

The user page provides facilities for users to consult about their condition whether addicted or not. The user must answer 30 questions and the results will come out in the form of a percentage or number.

5. Conclusion

From several trials obtained from this study, it can be concluded several things as follows:

- By using Bayes theorem method on the internet addiction diagnosis expert system, it can provide the results of internet addiction diagnoses through student / user data processing, type data, type probability data, symptom data and rule probability data obtained from questionnaire data conducted at SMAN 1 Gate.
- The level of accuracy or percentage of system calculations using the Bayes Theorem using 40 training data and 10 test data from the symptom data 40% of the system diagnosis results are the same or in accordance with the results of the diagnosis of psychologists.
- The level of accuracy or percentage calculation of the system using the Bayes theorem using 17 training data and 12 test data which is the same as testing 1 with each number of addiction type numbers made the same except not addicted to the symptom data that is 60% the diagnosis of the system is the same or in accordance with the results psychologist expert diagnosis.
- From the results of the speed test it can be concluded that the increase in the speed of diagnosis in the expert system is about 150% faster than manual examination to the expert without using the expert system

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