



Testing the Web-Based Naive Bayes Classifier Method For Information on Skin Cancer in Humans

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ABSTRACT

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The state of the earth is getting hotter give a lot of influence on the human body. One is a skin cancer, skin cancer caused by sun radiation is too much that it makes the skin cells to mutate. An expert system for finding information on the possibility of skin cancer that occurs as well as providing advice and how to cure this journal pakarpada .The system built with PHP and dataMySQL basis, the method used is Naive Bayes classifier, the method of classification using probability and statistics to predict the opportunities in future. The results of this study is to inform skin cancer with 80.00% accuracy results and provide saranterhadap possibility of skin cancer. Lock said skin cancer, Naive Bayes classifier, skin diseases, PHP, expert systems

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1. Introduction

Expert systems are systems made by adopting human knowledge into a computer so that the computer can solve problems like an expert. The purpose of the expert system is to solve the problem in a particular field. An expert system can make inferences, predict, recommend, monitor, perform the design and planning, debugging, give instructions and control. In the expert systems use a method. The method used in an expert system is a method that can accommodate and analyze variables and elements. In this paper, the authors use the method of Naive Bayes classifier. Naive Bayes classifier is likely simple classification method based applications Bayes theorem, assuming an independent explanatory variables (independent), assuming that the presence of an event does not relate to the absence of other events. Naive Bayes algorithm to predict future opportunities based on the experience in the past so it is known as Bayes' Theorem. The main characteristic of this BayesClassifier Naive assumption is very strong (naive) would be independent of each condition or event.

The skin is the outer layer of the human body which is elastic, complex and sensitive and an important network to protect the entire organ in the human body. As the outermost layer, the first skin exposed to sunlight. Skin cancer is a cancer that grows in the skin tissue, the condition is characterized changes in the skin, such as the appearance of bumps, blemishes, or moles with the shape and size that is not normal. The ozone layer of the earth are dwindling and increasingly polluted environment that makes the case of skin cancer increases. People who are less concerned with the lack of knowledge about the dangers of skin cancer. In this case the necessary role of a dermatologist, can now be overcome with expert systems. This system is limited to skin cancer often occurs.

2. Study of Literature

Research expert system using Naive Bayes classifier method has been widely used before. In the first journal entitled "Bayes Theorem and Forward Chaining Method On Expert System for hypercholesterolemia Determine Drugs". Results of the system can perform these medicines are suitable for patients based on symptoms. Selection of this drug system has a 96.05% accuracy [1]. In the second journal, entitled "Expert System Livestock Cow Disease Diagnosis Method Using Naive Bayes - Certainty Factor". The result shows the accuracy of the results with the cow disease diagnosis accuracy rate reached 92% [3]. In the third journal, entitled "Expert System Diagnosis of Diseases Ear Nose Throat (ENT) Using Android-Based Naive Bayes Method". The result shows an expert system that can diagnose the type of disease and its treatment, with an accuracy of 92% using the data 25 [4]. In keempatyang journal titled "Rule-based Naive Bayes classifier for Heart Disease Risk Prediction and Therapy Recommendation". The





study aims to establish a system in need in Nigeria to treat heart disease that are often experienced by students in Nigeria. This expert system developed with naïve Bayes methods adopted of intelligent systems to input data from the rules of classification rules that have been created such as blood sugar, pain in the chest. This expert system developed with programming language Java, JQuery and MySql [5]. In the fifth journal entitled "Naïve Bayes Expert System Approach for Design of Children Skin Identification Based on Android". The results of this study found a useful application for users so that they can consult such a specialist, know the symptoms that occur in children and find the right treatment for the disease [6]. Journal of the sixth, entitled "Incorporating repeating temporal association rules in Naïve Bayes classifiers for the diagnosis of coronary heart disease". This study makes a classification system that aims to identify heart disease, and to create a classifier systems that aim to identify the type of heart disease using a naïve Bayes. The result illustrates the system relatively high performance of the classifier [7]. In the seventh journal entitled "Implementation of Expert System for Diabetes Diseases using Naïve Bayes and Certainty Factor Methods". In this study discusses the problem of diabetes as one of the most frequently suffered by Indonesian citizens. Based on these problems a research methods expert system making Naive Bayes and certainty factor. The results of this study, the expert system to diagnose diabetes with accuracy up to 100% [8]. In the eighth journal entitled "Prediction of Breast Cancer using Random Forest, Support Vector Machines and Naïve Bayes". This study uses three methods are naïve Bayes, SVM, and Random Forest that aims to treat breast cancer database. The result can diagnose, predict and suggest that value accuracy of 99.42% [9]. In the ninth journal entitled "Dental and Mulut Menggunakan Metode Naive Sistem Pakar Diagnosis Penyakit Bayes - Weighted Product". As a result, this system can help the community to be able to know the diagnosis of dental and oral diseases suffered. The level of accuracy of the system is 93.3% using the 30 test data [11]. Journal tenth titled "Upgrading the Performance of KNN and Naïve Bayes in Diabetes Detection with Genetic Algorithm for Feature Selection". In this study combines various artificial intelligence fiktur like K Nearest Neighbor and naïve Bayes in shaping and classifying healthy or diabetic patients [12]. At the eleventh journal entitled "Stroke Disease Early Sistem Pakar Deteksi Menggunakan Metode Naive Bayes-Certainty Factor". Results from these studies found an android-based expert system with the Java programming language that can detect a stroke with an accuracy rate of 84% [13]. In the twelfth journal entitled "Expert System Diagnosis of Disease in Goats Bayes dan Naive Method Using Certainty Factor". In this study, an expert system that can diagnose diseases of goats as can be done by a veterinary expert. The result shows that the application can diagnose the disease in goats with accuracy up to 86.80% [14]. In the thirteenth journal, entitled "Performance Analysis Of Data Mining Algorithms For Breast Cancer Cell Detection Using Naïve Bayes, Logistic Regression and Decision Tree". Do approach to cancer classification with Naive Bayes method. Logistic Regression, Decision Tree. The results of this approach to find a subset of the smallest feature that can ensure accurate classification of breast cancer [15]. In the fourteenth journal entitled "A System for Diagnosing Hepatitis Based on Hybrid Soft Computing Techniques". This research helps in analyzing health data aimed at helping physicians to predict disease. This study uses a hybrid method used to classify data. The proposed model performance compared to standard classifiers, and the accuracy of the proposed system was found to be better [16]. In the fifteenth journal entitled "A Hybrid Classification System for Heart Disease Diagnosis Based on the RFRS Method". This study aims to help classify the diagnosis of heart disease by using hybrid methods. This system has an accuracy of 92.59% [19]. This research helps in analyzing health data aimed at helping physicians to predict disease. This study uses a hybrid method used to classify data. The proposed model performance compared to standard classifiers, and the accuracy of the proposed system was found to be better [16]. In the fifteenth journal entitled "A Hybrid Classification System for Heart Disease Diagnosis Based on the RFRS Method". This study aims to help classify the diagnosis of heart disease by using hybrid methods. This system has an accuracy of 92.59% [19]. 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3. Research methods

3.1 Stages of Research

This study began with the identification of problem that occurred, and then formulate a problem, then find literature related to the problem and method of solution appropriate to the issues discussed, after analyzing the needs of the system, then designed the application, if it is then it will be entering selanjutnya code- code, then will be tested





using black box method, which evaluates only its external appearance alone (input and output). if successful will be the implementation and testing of the system, otherwise it will be repaired by checking the code. After all the process is finished can end with a conclusion and provision of advice.

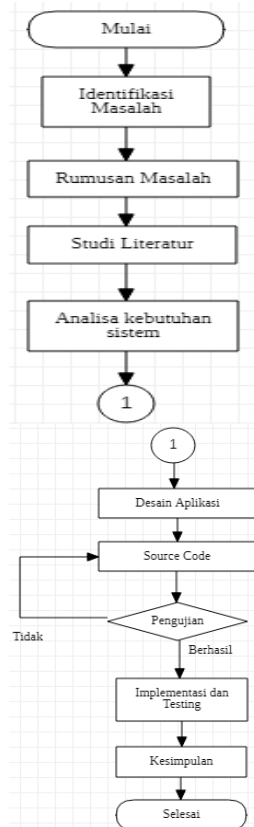


Fig 1. flowchart Research

3.2 Expert system

An expert system is a computer-based system that uses knowledge, facts and reasoning system in solving the problems that usually can only be solved by a pakardalam the field. Knowledge of experts in this system is used as a base by an expert system to answer questions (consultation).

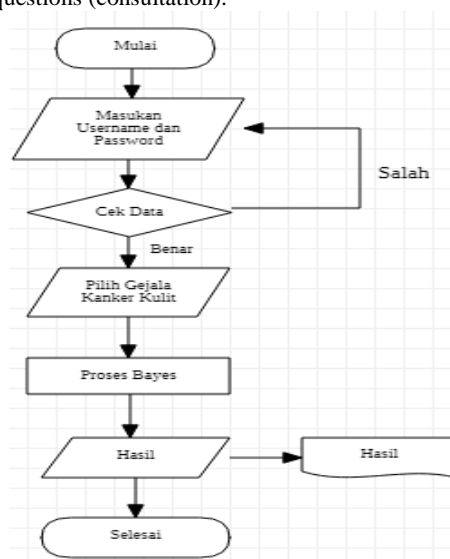


Fig 2. Flowchart Expert Systems Applications





In Figure 2 is a flowchart expert system. This flowchart explaining how the flow of the course of this expert system applications, ranging from login using the username and password as admin or user. The system will check if any of the bias is not entered, if correct will be directed kehalaman home. Then proceed to enter the testing menu of symptoms experienced by the user. These symptoms will then be processed using a Naive Bayes calculations to determine the percentage chances of developing skin cancer and the user can print the results berkenaan possibility kerkulit information.

3.3 Use Case Diagram

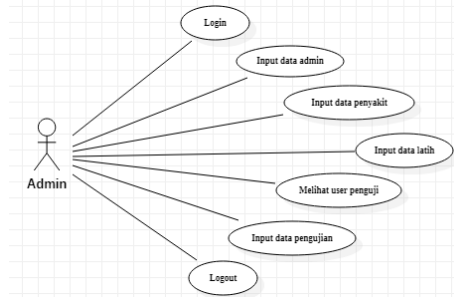


Fig 3. Use Case Diagram Admin

Use case diagram used to describe the interaction of actors with the system. In figure 3 shows the use case diagram admin. Admin can log in, enter data a new admin admin or delete data, or deleting data input illness, training data input, see the user testers, test data input, and logout.

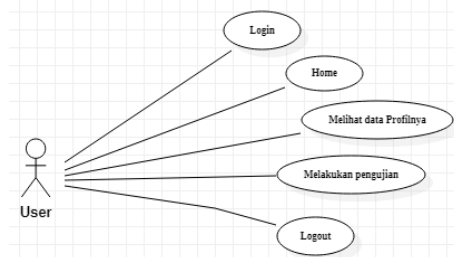


Fig 4. Use Case Diagram User

Figure 4 above illustrates user interaction with the system. Users can log in, mangakses the home page, look at the data for skin cancer, perform testing, and logout.

3.4 Naive Bayes classifier

Naive Bayes classifier is a classification method using probability and statistics methods proposed by the English scientist Thomas Bayes. Naive Bayes algorithm to predict future opportunities based on the experience in the past. The main characteristic of the Naive Bayes classifier is a strong assumption would be the independence of each state / incident. The initial steps are:

- Count the number of categories for each class / variable in each training
- Calculate the probability in each category
- Determine the frequency of each word in each category.

classification:

- Calculate for each category
- Specify the Category with the maximum value

The probability formula is:

$$P(C|X) = \frac{P(x|c) P(c)}{P(x)}$$

information :

x = data with unknown classes

c = Data hypothesis is a specific class

P (C | X) = probability hypothesis based on conditions (posteriori probability)

P (c) = hypothesis probability (prior probability)

P (x | c) = probability based on conditions on the hypothesis

P (x) = probability c

3.5 Knowledge base

Table 1.
Data Disease

Code	Disease name
P01	Basal Cell Carcinoma (BCC)





P02	Squamous Cell Carcinoma (SCC)
P03	Melanoma (MM)

The collection of data obtained through observation book Dermatology and Venereal seventh printing, Faculty of Medicine, University of Indonesia, 2018. Journal entitled "SKIN CANCER" Udayana University Medical Faculty. This article from the "SMART PATIENT WEBSITE" with the title of Skin Cancer and from ALODOKTER and Halodoc obtained three skin cancers, 38 symptoms, 89 training data, the data rules 3 and 20 test data.

table 2,
Data Symptoms

KodeGejala	Name Symptom
G1	Terdapat benjolan kecil mengkilap seperti mutiara di kulit.
G2	Benjolan dapat berupa tahi lalat berwarna daging atau seperti jerawat.
G3	Benjolan bisa bercak merah atau merah muda bersisik.
G4	Benjolan rapuh dan mudah berdarah
G5	Benjolan berkerak.
G6	Bercak bersisik berwarna coklat atau hitam yang membesar.
G7	Lesi seperti luka goresan, berwarna putih, lembut, tanpa tepi luka yang jelas.
G8	Luka terbuka yang tidak kunjung sembuh atau kambuhan.
G9	Benjolan yang terdapat pembuluh darah di dalamnya.
G10	Benjolan tidak terasa sakit.
G11	Terdapat nodul atau benjolan menyerupai papiloma (kutil).
G12	Nodul berwarna coklat atau hitam.
G13	Nodul tidak berambut.
G14	Gejala dapat muncul pada payudara.
G15	Benjolan kecil berbentuk kubah pada kulit.
G16	Benjolan kasar.
G17	Benjolan kemerahan.
G18	Luka pada permukaan kulit dengan tepi meninggi dan berwarna kuning kemerahan.
G19	Benjolan akan tumbuh, mengeras dan berdarah.
G20	Pada mulut muncul luka atau bercak putih.
G21	Lesi atau benjolan berbentuk datar dan bersisik seperti kerak.
G22	Benjolan atau luka berwarna pucat dan tidak mengkilap.
G23	Tahi lalat yang terasagatal dan nyeri yang tak kunjung hilang.
G24	Nodul atau benjolan keras dengan tepi yang tidak jelas atau tidak rata.
G25	Gejala dapat muncul pada kepala, telinga, atau bibir.
G26	Gejala dapat muncul pada kelamin atau anus.
G27	Tahi lalat berbentuk asimetris (tidak beraturan).
G28	Terjadi perubahan warna pada tahi lalat.
G29	Ukuran tahi lalat membesar.
G30	Kulit di sekitar tahi lalat kemerahan dan bengkak.
G31	Sesak nafas.
G32	Tahi lalat memiliki lebih dari satu warna.
G33	Diameter tahi lalat lebih besar dari 6mm.
G34	Bintik kecoklatan besardan bintik lebih gelap.
G35	Kemunculan tahi lalat baru.
G36	benjolan menyakitkan yang gatal dan rasa terbakar.
G37	Terjadi perubahan bentuk pada tahi lalat.
G38	Tahi lalat berdarah.

In Table 2 below is a symptom data 38 diseases that occur when having the possibility of skin cancer.

Table 3.
rule

Disease	If
P01	G1, G2, G3, G4, G5, G6, G7, G8, G9, G10, G11, G12, G13, G14
P02	G2, G3, G4, G5, G15, G16, G17, G18, G19, G20, G21, G22, G23, G24, G25, G26.
P03	G4, G6, G23, G24, G27, G28, G29, G30, G31, G32, G33, G34, G35, G36, G37, G38.

Table 3 illustrates the rule or rules that will be used to inform the application of the possibility of the disease according to symptoms experienced by the user.

Table 4.
Train Data symptom 1 - gejala19





G1	$P(G1 = \text{Yes} \mid X = \text{KSB}) = 14/28 = 0.5$
	$P(G1 = \text{Yes} \mid X = \text{KSS}) = 0/30 = 0$
	$P(G1 = \text{Yes} \mid X = \text{MM}) = 0/31 = 0$

On the table there is the calculation in the eight symptoms 1. based on standardization of skin cancer, the results are still in stage 0 for appearing on the epidermis (outer skin).

Table 9.
Counting G2

Flesh Colored Bumps Or As Acne	
G2	$P(G2 = \text{Yes} \mid X = \text{KSB}) = 14/28 = 0.5$
	$P(G2 = \text{Yes} \mid X = \text{KSS}) = 15/30 = 0.5$
	$P(G2 = \text{Yes} \mid X = \text{MM}) = 0/31 = 0$

On the table there are eight on the calculation results based on standardization 2. The symptoms of skin cancer, the results are still in stage 0 for appearing on the epidermis (outer skin).

Table 10.
Counting G3

Bumps Red Or Pink Scaly	
G3	$P(G2 = \text{Yes} \mid X = \text{KSB}) = 14/28 = 0.5$
	$P(G2 = \text{Yes} \mid X = \text{KSS}) = 15/30 = 0.5$
	$P(G2 = \text{Yes} \mid X = \text{MM}) = 0/31 = 0$

On the table there are eight on the calculation results based on standards 3. symptoms of skin cancer, the results are still in stage 0 for appearing on the epidermis (outer skin).

Table 11.
Counting G4

Bloody lump	
G4	$P(G2 = \text{Yes} \mid X = \text{KSB}) = 14/28 = 0.5$
	$P(G2 = \text{Yes} \mid X = \text{KSS}) = 15/30 = 0.5$
	$P(G2 = \text{Yes} \mid X = \text{MM}) = 16/31 = 0.5161$

On the table there are eight on the calculation results based on standards 4. symptoms of skin cancer, the results are still in stage 0 for appearing on the epidermis (outer skin).

Table 12.
Counting G5

lump Crusty	
G5	$P(G2 = \text{Yes} \mid X = \text{KSB}) = 14/28 = 0.5$
	$P(G2 = \text{Yes} \mid X = \text{KSS}) = 15/30 = 0.5$
	$P(G2 = \text{Yes} \mid X = \text{MM}) = 0/31 = 0$

On the table there are eight symptoms 5. The calculation results based on standards of skin cancer, the results are still in stage 0 for appearing on the epidermis (outer skin).

*Information :

KSB = Basal Cell Carcinoma

KSS = Squamous Cell Carcinoma

MM = Melanoma

Because there are 38 symptoms, here the authors simply enter the calculation 5 symptoms. Multiply all calculation results Basal Cell Carcinoma, Squamous Cell Carcinoma, and Melanoma. After that, as the table below compare

Table 13.
Comparison of the results of the calculation

Symptoms code	Category Diseases		
	KSB	KSS	MM
G1	0.5	0	0
G2	0.5	0.5	0
G3	0.5	0.5	0
G4	0.5	0.5	0.516129032
G5	0.5	0.5	0
G6	0.5	0	0.516129032
G7	0.5	0	0
G8	0.5	0	0
G9	0.5	0	0
G10	0.5	0	0





Symptoms code	Category Diseases		
	KSB	KSS	MM
G11	0.5	0	0
G12	0.5	0	0
G13	0.5	0	0
G14	0.5	0	0
G15	1	0.5	0
G16	1	0.466667	0
G17	1	0.466667	0
G18	1	0.466667	0
G19	1	0.466667	0
G20	1	0.466667	0
G21	1	0.466667	0
G22	1	0.466667	0
G23	1	0.466667	0.516129032
G24	1	0.466667	0.516129032
G25	1	0.466667	0
G26	1	0.5	0
G27	1	0	0.516129
G28	1	0	0.516129
G29	1	0	0.516129
G30	1	0	0.516129
G31	1	0	0.516129
G32	1	0	0.516129
G33	1	0	0.516129
G34	1	0	0.516129
G35	1	0	0.516129
G36	1	0	0.516129
G37	1	0	0.516129
G38	1	0	0.516129
number of Class	0.314606742	0.337078652	0.348314607
result	0.000019202071	0	0

From the calculations in Table 13 showed the calculation of any symptoms in any disease that is multiplied by the number of classes. Highest Probability value is in P (X = Basal Cell Carcinoma). So from the example of training data obtained likelihood of skin cancer are Basal Cell Kasinoma (BCC) with a value of 0.000019202071

4. Results and Testing

1) Display Interface

A. Display Admin and User Login



Fig 5. Login page

In Figure 5 is a login page. It is used to login admin or user to enter into the application. On this page there is a menu forgotten passwords or create a new account.

B. Page Home



Fig 6. Home page

Figure 6 shows the user's home page, on this page there are several menus, including profiles, to change the user data, menu consultation, archive menu logout menu





C. Page Testing

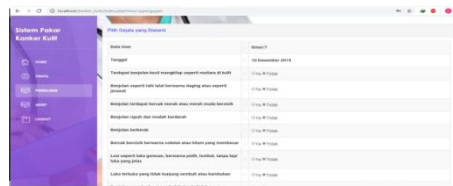


Fig 7. Weather Testing

In figure 7 is a user consultation page views. For consultation, the user selects symptoms. Then the system will do the calculations for mementukan presesntase chances of developing skin cancer.

D. possibility of skin cancer information page

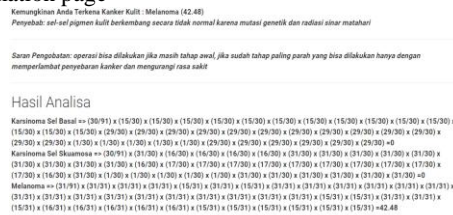


Fig 8. Weather Testing

In the Figure 8 is the result of the analysis of the likelihood of skin cancer along with pertitungan Naive Bayes

2. Testing of accuracy

The test aims to determine the level of accuracy of the suitability of the application with information about the possible result of the disease suffered by the user. Calculations using the Rapid Miner

Fig 9. Test Data

From the above calculation expert system information likelihood of skin cancer has a 80.00% accuracy value of 20 test data, with perhtiungan = $\frac{\text{Jumlah Data Uji Benar}}{\text{Jumlah Total Data Uji}} \times 100\% = \frac{16}{20} \times 100\% = 80\%$

5. Conclusion

Berdasarkanhasilpenelitian this it can be concluded that the system is an expert on skin cancer with Naive Bayes methods only provide information about skin cancer and to help physicians make decisions role of skin cancer and skin cancer treatment recommendations. This expert system only provides information about skin cancer and to help physicians make decisions role kulit.Denganmetodenaive cancer disease bayesinformasi possibility of skin cancer userdan bedasarkanpengujianakurasibahwaaplikasi dapatdiketahui berdasarkanprobabilitasdarigejalajejala experienced that in bangunmemilikinilaiakurasisebesar 80.00%.

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