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# SKIN DISEASE DETECTION EXPERT SYSTEM USING NAIVE BAYES CLASSIFIER METHOD

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**Abstract**: The skin is an elastic wrapping that protects the body from environmental influences, the skin is the organ that is located on the outside and limits it from the human environment. Skin diseases can be caused by fungi, viruses, germs, animal parasites, bacterial infections and others. To identify skin diseases, we usually have to see a doctor, but we still experience problems in dealing with disease identification. This is sometimes influenced by the community, sometimes they feel embarrassed to consult their skin disease to a doctor because the signs of skin disease have started to appear, consultation fees and drugs are relatively expensive. Current technological developments are able to process knowledge with artificial intelligence techniques. Due to the many symptoms of disease nowadays, it is necessary to make a system application with artificial intelligence that can diagnose skin diseases and provide solutions for skin diseases using one of the methods, namely the Naïve Bayes Classifier. Naïve Bayes is a simple classification algorithm where each attribute is independent and may contribute to the final decision. The goal is to produce an expert system website that helps the general public in diagnosing skin diseases and providing solutions for detected skin diseases. The results of this study concluded that based on the application of skin cancer diagnosis can display the results of skin cancer diagnosis decisions.

**Keywords:** expert system; naïve bayes; skin disease

**Abstrak:** Kulit merupakan pembungkus yang elastis yang melindungi tubuh dari pengaruh lingkungan, kulit merupakan organ tubuh yang terletak paling luar dan membatasinya dari lingkungan hidup manusia. Penyakit kulit dapat disebabkan oleh jamur, virus, kuman, parasit hewani, infeksi bakteri dan lain-lain. Mengidentifikasi penyakit kulit biasanya kita harus ke dokter, namun masih mengalami kendala dalam menangani pengidentifikasi penyakit hal itu terkadang dipengarui oleh masyarakat terkadang merasa malu untuk mengkonsultasikan penyakit kulitnya ke dokter karena tanda-tanda penyakit kulit sudah mulai tampak, biaya konsultasi dan obat yang tergolong mahal. Perkembangan teknologi saat ini mampu mengolah pengetahuan dengan teknik kecerdasan buatan. Karena banyaknya gejala penyakit pada masa sekarang ini perlu dibuat aplikasi sistem dengan kecerdasan buatan yang dapat mendiagnosa penyakit kulit dan memberikan solusi dari penyakit kulit dengan salah satu metode yaitu Naïve Bayes Classifier. Naïve bayes merupakan algoritma klasifikasi yang sederhana dimana setiap atribut bersifat berdiri sendiri dan memungkinkan berkontribusi terhadap keputusan akhir. Tujuannya adalah menghasilkan *website* sistem pakar yang dan membantu masyarakat luas dalam mendiagnosa penyakit kulit dan memberikan solusi dari penyakit kulit yang terdeteksi. Hasil dari penelitian ini menyimpulkan bahwa berdasarkan aplikasi diagnosa penyakit kanker kulit dapat menampilkan hasil keputusan diagnosa penyakit kanker kulit.

**Kata kunci**: Naïve Bayes; Penyakit Kulit; sistem pakar

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## INTRODUCTION

Expert system is software or computer program intended as a provider of advice and assistance in solving problems in a particular field of knowledge [1].

Along with the development of computer technology, it is no longer used as a substitute for a typewriter or an ordinary calculator. Expert systems are able to recommend a series of user actions to be able to apply corrections and utilize reasoning capabilities to reach a conclusion [2].

Expert systems can be used to assist expert experts in making a decision based on system processing. Currently, expert systems are not only used in the field of digital technology, but expert systems are also used in the health sector, such as to identify skin diseases.

The skin is an elastic covering that protects the body from environmental influences. Skin diseases can be caused by various things such as fungi, viruses, germs, parasites, animals, bacterial infections etc. Currently, many people suffer from skin diseases without them knowing it is certainly very dangerous.

The problem is to identify skin diseases that people suffer from, they have to go to the doctor first, but they still experience difficulties in dealing with these skin diseases due to embarrassment to consult a skin disease suffered by a doctor because the signs of skin disease have started to appear, besides the cost of consulting a doctor is very expensive, making people prefer not to treat their illness and drugs that are relatively expensive.

Based on these problems, a solution is needed to help people detect skin diseases they suffer with the help of an application using an expert system with the Naïve Bayes method so that skin diseases can be identified online and can be accessed by people anywhere at any time and can provide the right solution.

The purpose of this research is first, to build an expert system that can diagnose skin diseases in humans and provide solutions for skin diseases that are detected. The second is applying the Naive Bayes Classifier method to an expert system website for diagnosing skin diseases. The latter built a skin disease detection system with the aim of making it easier for patients to detect skin diseases suffered by patients and their solutions.

Implementation of expert system has been widely used in previous research with the title "Application of the Naïve Bayes Method in Expert System Applications for Diagnosing Skin Diseases in Cats" In this study, the authors designed an expert system to diagnose skin diseases in cats using the Naïve Bayes method [3].

The research with the title "Skin Disease Diagnostic Expert System Based Website Using the Naive Bayes Method" In this study uses Naïve Bayes to prediction skin disease at mataram univercity [4].

The research with the title "Expert System for Diagnosing Diseases in Cats Using the Naive Bayes Classifier Method" In this Study expert system was built using the naïve bayes classifier method as the decision maker [5].

The research with the title "Expert System for Diagnosing Viral Skin Diseases Using Bayes Theorem". This research was conducted from the mercu buana univercity[6].

The research with the title "Implementation of Naives Bayes-Certainty Factor for Diagnosing Chicken Infectious Diseases"[7].

This research with the title "Development Of An Expert System For The Diagnosis Of Skin Diseases In Humans

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Using The Naive Bayes Method". In this study using the development of an expert system for diagnosing skin diseases using naive Bayes produces an accuracy rate of 92% [8].

The research namely "Expert Istem In Diagnosis Of Skin Diseases In Toddlers Using Naïve Bayes And Forward Chaining Methods Case Study Of Puskesmas Cemaka Sungkai Selatan". This research was conducted at Puskesmas Cempaka Sungkai Selatan [9].

The research with the title "Implementation of an Expert System to Detect the Covid-19 Virus by Comparison of Naïve Bayes Method and Certainty Factor" usese naïve bayes to predicting someone's chance of being exposed to Covid-19 in the future based on symptoms experienced in the past packaged with a web-based program [10].

Naive bayes classifier is a simple classification algorithm where each attribute is independent and can contribute to the final decision [11]. In Naïve Bayes calculations using the following formula :

$$P(H|X) = \frac{P(X|H)\ X\ (P(H)}{P(X)} \quad (1)$$

Description :
X : Data Unknown class
H : Hypothesis data is a specific class
P(H|X) : Probability of Hypothesis H based on condition X
P(H): Hypothesis probability H
P(X|H): Probability of X based on condition Hypothesis H
P(X): Probability X

Therefore, based on the background described above, a solution is needed to overcome the above problems, namely by creating a web-based system that is integrated with an expert system using the Naïve Bayes method for predicting skin diseases.

## METHOD

The method used in this study is a scientific method with the aim of obtain ing information that will be used for re search purposes. Methodology is a theo retical analysis of a method or procedure :

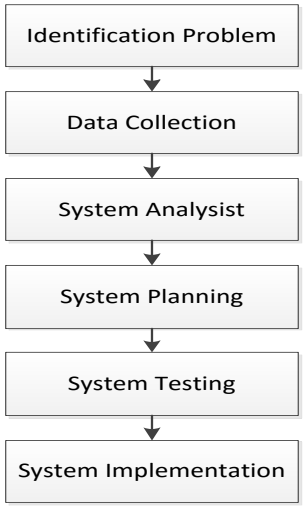


Image 1. Research Framework

The method above can be explained:

1. Problem Identification, identification of the problem in this study is the lack of knowledge in diagnosing skin diseases.
2. Data Collection, data is collected from various existing sources. Data collection in this study was carried out using three techniques, namely observation, interviews, documentation and literature study as well as several journals downloaded on the internet.
3. System Analysis, after data collection is done, then system analysis is carried out. This analysis aims to determine the system that is currently running. Thus, it is hoped that researchers can find constraints and problems that occur in the process of diagnosing human skin diseases.
4. System Planning, system design is the stage of how to form the system that will be made. This system is imple-

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mented in PHP programming language and MySQL database.

5. System Testing, system testing is carried out to find out the deficiencies of the system that has been made to run well, whether the system that is made is in accordance with the design of the system that is designed and whether the error handling function is functioning properly. In system testing use confusion matrix to measure the level of accuration to see the value of precision, recall and f1-score using the confusion matrix table 1 :

Table 1. Confusion Matrix

| Prediction class | ***True Positive (TP)*** | ***False Negative (FN)*** |
|---|---|---|
| | ***False Negative (FN)*** | ***True Negative (TN)*** |

Formula of accuracy :

$$Accuracy = \frac{TP+ FN}{P+N} \quad (1)$$

Formula of precision :

$$Precision = \frac{TP}{TP+ FP} \quad (2)$$

Formula of recall :

$$Recall = \frac{TP}{TP+ FN} \quad (3)$$

Description :

TP : The result of a positive system prediction and in accordance with a positive target.

TN : The result of a negative system prediction and in accordance with a negative target.

FP : The result of positive system prediction, but the target result are negative.

FN : The result of a negative system prediction but the target result are positive.

After the result of classification can be measured, a combination of values is calculated to serve as a measurement value (F1-score). F1-Score can be calculated by the following formula :

$$F1\text{-}Score = 2X \frac{Precision\ Recall}{Precision+ Recall} \quad (4)$$

$$\textbf{F1-}Precision+ Recall \quad (5)$$

6. System Implementation, this system is implemented with the PHP programming language and MySQL database. After the program has been built, at this stage it is also discussed how to use it so that users can optimize the use of the system.

## RESULT AND DISCUSSION

System analysis is the activity of identifying and evaluating problems that arise in order to provide solutions that can be better implemented in new systems if necessary[13]. The purpose of ongoing system analysis is to get an overview of system weaknesses so that improvements can be suggested to develop a better system.

In research, the results of this study will display system results from predicting skin diseases using the Naïve Bayes method in an expert system. The following are the results of the system implementation, namely:

### Dashboard Side

This home menu consists of the initial menu of this application system consisting of the home menu of the skin disease diagnosis system

Image 1. Dashboard Side

### Disease System

The picture below describes the appearance of the skin disease criteria menu in the system that was built

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Image 2. Disease Side

**Skin Cancer Diagnosis**

The picture below describes the appearance of the results of the diagnosis of skin diseases

Image 4. Skin Cancer Diagnosis

**Diagnostic Result Display**

This Picture below describes the result diagnostic system by expert system

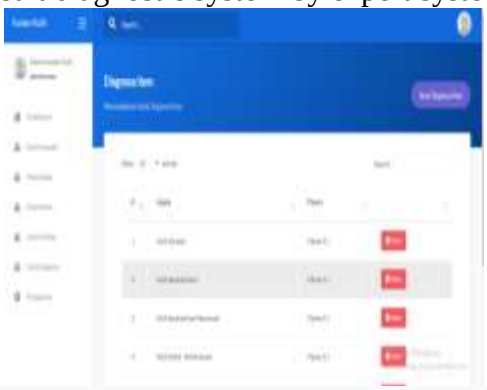

Image 4. Diagnostic Results Display

The table 5 shows the results of calculations for predicting skin diseases using naïve Bayes calculations.

Table 5. Naïve Bayes Calculation

| Disease (P) | Amount Date | | | | Result |
|---|---|---|---|---|---|
| | P | P&G5 | P&G7 | P&G2 | |
| Honey Pox | 20 | 0 | 20 | 0 | 0 |
| Skin Toxins | 122 | 115 | 122 | 122 | 0.0913 |
| Sweat Glands | 180 | 65 | 180 | 180 | 0.0516 |
| Pox | 85 | 0 | 62 | 0 | 0 |
| Nail Swelling | 94 | 7 | 94 | 0 | 0 |
| Lumps on the Skin | 116 | 116 | 116 | 40 | 0.0318 |
| Pytiriasis Versikolor | 257 | 0 | 257 | 148 | 0 |
| Scabies | 51 | 39 | 51 | 23 | 0.014 |
| Tinea pedis | 92 | 64 | 92 | 0 | 0 |
| Tinea korporis | 196 | 0 | 196 | 0 | 0 |

## CONCLUSION

The conclusions that have been obtained after testing the system are this skin disease diagnostic system can decide the results of disease diagnosis decisions in detail and alternatives that are given by the application in displaying decisions in the form of results of values and decisions for diagnosing skin diseases, so this system will make it easier for officers to diagnose skin diseases in humans

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