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CAT DISEASE DIAGNOSIS EXPERT SYSTEM USING THE NAÏVE BAYES METHOD

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Abstract: Many people choose cats as pets. Cats can benefit humans, but when cats are sick, they can suffer damage, just as cat disease does in humans. Lack of knowledge about the management of cats is one of the leading causes of the high incidence of diseases in cats. The wonosobo area, the cat keeper and the abundance of wild cats, is no exception to the knowledge and insight needed in caring for good cats, and even the number of experts and animal clinics in particular is small. Therefore it requires a system that supports the role of a veterinarian in treating cat diseases, where it can quickly and accurately diagnose diseases in cats based on symptoms of diseases in cats based on previous medical summarizations. System development using SDLC (Software Development Life Cycle). Calculations were carried out using Naive Bayes. Systems built on websites for accessibility and usage. The system's accuracy rate reached 90%, with a 95% f1 score to give the overall size of a model.

Keywords: Cat Disease, Naïve Bayes, Diagnosis, Accuracy, F1 Score

1. INTRODUCTION

Information technology has now become an important part of society in various fields and walks of life. Not only in the fields mentioned above, pets, namely cats, are also not spared from information technology which greatly influences the lives of cats. Cats can be useful to humans, but when cats get sick, it can have a bad impact, just like cats contracting disease to humans. So that cat health is very important, the role of the veterinary clinic is needed to carry out medical procedures on pets. However, veterinarians are limited in diagnosing feline diseases.

The lack of a system that can assist in diagnosing cat diseases by cat owners and the general public as a prevention or first aid measure is one of the causes of the high incidence of disease in cats (Sukma & Petrus, 2020). The Wonosobo area is no exception, where there are still very few experts or veterinary clinics that can help diagnose cat diseases and treat cat diseases. Things like this should be resolved immediately, especially for cat lovers, both individuals and communities with socialization or even direct treatment of cat diseases. Therefore we need a system that supports the role of veterinarians in treating cat diseases, where the system can quickly and accurately diagnose disease in cats based on symptoms of disease in cats based on previous medical summaries (Ramadhan et al., 2021).

In the implementation of information technology in this problem that meets these requirements is an expert system (Yuliana et al., 2021). An Expert System, commonly known as a Knowledge Base System, is a computer application intended to assist in decision making or problem solving in a more specific domain. In general, expert systems try to apply knowledge possessed by humans to computers, so that computers can solve problems that are usually solved by experts. One of the expert system applications for diagnosing diseases in cats uses the Naïve

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Bayes method (Saputro & Sari, 2020). The Naïve Bayes method is a method that uses statistical and probability calculations. And the advantage of Naïve Bayes is that this method only requires a small amount of training data to determine the parameter estimator needed for the classification process (Amalia et al., 2022).

Based on the explanation of the problems above, researchers are interested in developing an expert-based system to be able to help the community, especially doctors and cat lovers, to diagnose diseases suffered by cats with various symptoms, as well as help the public to obtain information about the disease. This research can provide theoretical and practical benefits, namely practical benefits for cat owners and the general public to study cat symptoms and diseases for early diagnosis and take first aid measures based on advice from specialists in cat animals. As well as for its theoretical benefits, namely providing insight for researchers about diseases, symptoms, and diagnoses of cat diseases.

2. METHOD

System Development Method

In this research, system development was carried out using the SDLC (Software Development Life Cycle) model, the process of changing and creating systems, models and methods used to develop the system. The SDLC model used in this study is the waterfall model. The Waterfall or Classic Life Cycle model is the most widely used model in Software Engineering (SE), it is called Waterfall because to execute the next stage you have to wait for the previous stage to complete and it has to run sequentially.

The Naïve Bayes method

The classification of the Naïve Bayes method, namely predicting future opportunities based on previous experience, is known as Bayes' Theorem. The main feature of this Naive Bayes Classifier is the very strong (simple) assumption of independence for each condition/event (Alfianty & Mulyati, 2022).

Bayes' theorem is stated mathematically or formulated as follows:

$$P(H|X) = \frac{P(X\backslash H).\ P(H)}{P(X)} \qquad (1)$$

Where:

1) X is data with an unknown class.
2) H is the hypothesis that the data is a specific class.
3) P(H|X) is the probability of hypothesis H based on condition X (posterior probability).
4) P(H) is the probability of hypothesis H (prior probability).
5) P(X|H) is the probability of X based on the conditions in hypothesis H.
6) P(X) is the Probability of X.

The steps for applying Naïve Bayes are: 1) Finding the prior value for each class by calculating the average - each class with the equation P = H/A (2) where is the occurrence of disease data in the dataset and A is the total number of datasets; 2)Calculating the likelihood value for each class using the equation L = X/H (3), where X is the occurrence of symptoms in the disease that occurs and H is the occurrence of the disease or class in the dataset; 3)Calculate the posterior value of each class using the equation P(H|X) = P(X|H) * P(H) /P(X) (4). 4)Then compare the probability results for each class and take the highest result as the final diagnosis.

Research Objects and Subjects

The object of this research is cat symptoms and diseases. Meanwhile, the subject in this research is the Sukma Animal Care Veterinary Clinic in Wonosobo.

Method of collecting data

Methods of data collection in this study were divided into 3 methods, namely: (1) Observation, observations in this study were carried out by observing or going directly to the field at the Sukma Animal Care animal clinic in Wonosobo to obtain information regarding symptoms, diseases, and how to handle or the solution; (2) Interviews, interviews were conducted to obtain more detailed information regarding symptoms, percentage of symptoms, disease, and solutions, which interviews were conducted with drh. Rafif Naufal Dani as a specialist in animals at Sukma Animal care; (3) Literature Study. In this method, it is carried out by collecting library data,

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reading and taking notes, and managing research materials related to the data needed related to disease diagnosis and treatment of cat diseases using the Naïve Bayes method in journals and other data sources available on the internet.

3. RESULT AND DISCUSSION

Naïve Bayes calculations

After conducting the research, it was found that there were 7 types of diseases and 16 symptoms of cat diseases which would become the basis for the rule base. The following is a table of disease and symptom data (Febrianti & Prasetyaningrum, 2023).

Table 1 Disease Data

No	Disease	Calculation
1	P1	Dermatophytosis (fungus)
2	P2	Helminthiasis (worms)
3	P3	Feline Panleukopenia Virus
4	P4	Scabies
5	P5	Feline Infectious Peritonitis
6	P6	Intoxication (poisoning)
7	P7	Feline Immunodeficiency Virus

Table 2 Symptom Data

Code	Symptom
G1	Vomit
G2	Diarrhea
G3	No appetite
G4	Bad breath
G5	Dehydration
G6	Weight loss
G7	Cough
G8	Have a cold
G9	Nervous Symptoms
G10	Scab on the ear
G11	Distended stomach
G12	Crusts on the skin / dandruff
G13	baldness
G14	Muscle spasms
G15	Difficulty breathing
G16	Eye incoordination

For an example of the application of the Naïve Bayes calculation, one of the data is taken from the dataset (training data) where the cat's symptoms are selected, namely G1, G5, G15, then the manual calculation is carried out as follows: (Fadhilah et al., 2020)

P(Hi|G1 G5 G15) =

$$\frac{P\,(Hi \mid G1)\ x\ P\,(Hi \mid G5)\ x\ P\,(Hi \mid G15)\ x\ P\,(Hi)}{\begin{array}{l}P\,(Hi \mid G1)\ x\ P\,(Hi \mid G5)\ x\ P\,(Hi \mid G15)\ x\ P\,(H1)+\\ P\,(Hi \mid G1)\ x\ P\,(Hi \mid G5)\ x\ P\,(Hi \mid G15)\ x\ P\,(H2)+\\ P\,(Hi \mid G1)\ x\ P\,(Hi \mid G5)\ x\ P\,(Hi \mid G15)\ x\ P\,(H3)+\\ P\,(Hi \mid G1)\ x\ P\,(Hi \mid G5)\ x\ P\,(Hi \mid G15)\ x\ P\,(H4)+\\ P\,(Hi \mid G1)\ x\ P\,(Hi \mid G5)\ x\ P\,(Hi \mid G15)\ x\ P\,(H5)+\\ P\,(Hi \mid G1)\ x\ P\,(Hi \mid G5)\ x\ P\,(Hi \mid G15)\ x\ P\,(H6)+\\ P\,(Hi \mid G1)\ x\ P\,(Hi \mid G5)\ x\ P\,(Hi \mid G15)\ x\ P\,(H7)\end{array}} \quad (1)$$

$$\frac{0.1\ x\ 0.1\ x\ 0.1\ x\ 0.1}{\begin{array}{l}0.1\ x\ 0.1\ x\ 0.1\ x\ 0.1\ +\ 0.66\ x\ 0.1\ x\ 0.1\ x\ 0.15\ +\ 0.75\ x\ 0.25\ x\ 0.1\ x\ 0.2\ +\\ 0.1\ x\ 0.1\ x\ 0.1\ x\ 0.15+\ 0.1\ x\ 0.33\ x\ 0.33\ x\ 0.15+\ 0.66\ x\ 0.33\ x\ 0.66\ x\ 0.15+\\ 0.1\ x\ 0.1\ x\ 0.1\ x\ 0.1\end{array}}$$

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P1 =

$$P1 = \frac{0.0001}{0.0001+0.00099+0.00375+0.00015+0.0016335+0.0215622+0.0001}$$

$$P1 = \frac{0.0001}{0.0282857}$$

P1 = 0.0035

This process is carried out repeatedly for all diseases and then compared and produced:

Disease Name	Probability Result
Dermatophytosis	0.0035
Helminthiasis	0.0350
Feline Panleukopenia Virus	0.1325
Scabies	0.0053
Feline Infectious Peritonitis	0.0577
Intoxication	0.7623
Feline Immunodeficiency Virus	0.0035

From the results of calculations carried out using the Naive Bayes method. It can be concluded that based on the selected symptoms, the probability of a cat suffering from these symptoms is Intoxication with a value of 0.7623 or 76.23% or rounded up to 76%.

System and Interface Implementation

Fig 1. Main Page Display

In Figure 1, it is a display of the expert system's initial page.

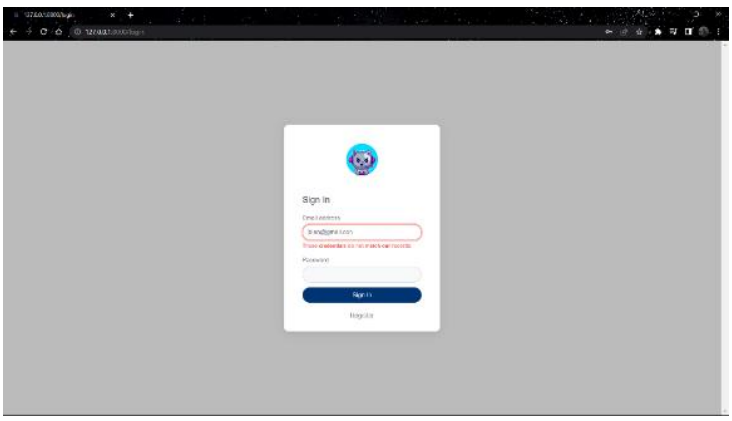

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Fig 2. Login Page Display

In Figure 2 the display of this page, users must first log in if they already have an account, while those who don't have an account must first register an account.

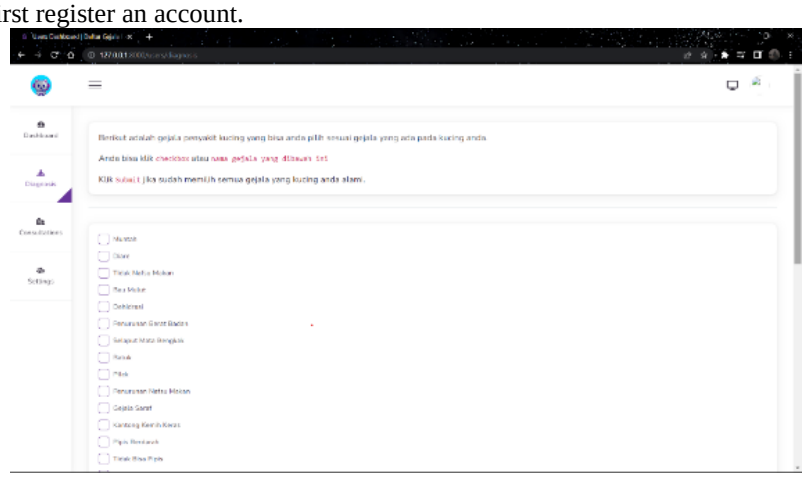

Fig 3. Diagnostics page display

In figure 3, is the diagnosis page display where the user or cat owner must select symptoms to carry out a diagnosis.

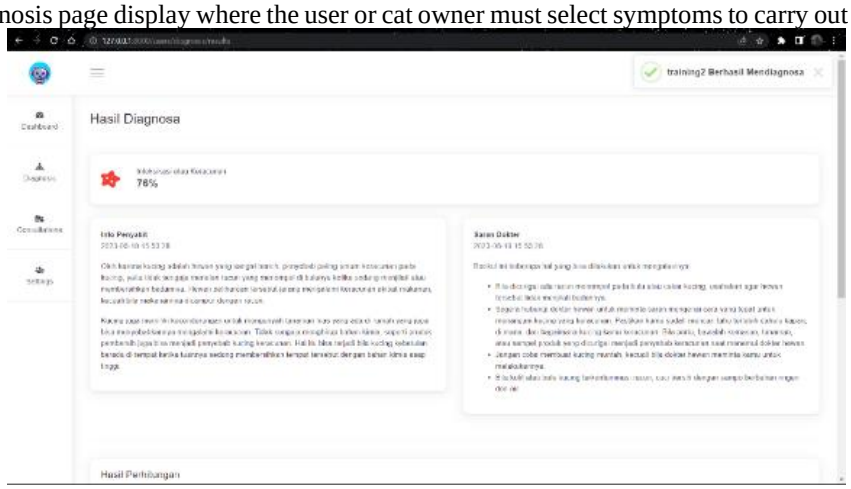

Fig 4. Diagnostic Results Page Display

In Figure 4, is a diagnostic results page where there are diagnostic results from the symptoms selected by the user.

4. CONCLUSION

Based on the problems developed in the expert system for diagnosing cat diseases using the Naïve Bayes method, the conclusion was obtained that this expert system can increase user information regarding knowledge and understanding of cat diseases. This system can be a reference for early diagnosis to take first aid measures using the doctor's advice, and can be a new solution for cat owners when access to experts is difficult. After testing the accuracy level of the model or system performance using the confusion matrix method, the resulting accuracy level was 90% and the F1-score value was 95%. With these results, the disease diagnosis expert system using the Naïve Bayes method is in the very good category.

With the research and creation of an Expert System for Diagnosing Cat Diseases Using the Naïve Bayes Method that has been carried out, the author realizes that there are still shortcomings in both writing reports and the process of building the system. The advice obtained from the author is to be able to assist the development process. 1) There is the development of an expert system for diagnosing cat diseases using the Naïve Bayes method using others as a comparison or reference and can even be collaborated with, 2)Develop the scope of disease and

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symptoms with more and wider data, 3)Improved the interface to make it more attractive according to the needs and developments of trendy designs.

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