

APPLICATION OF CERTAINTY FACTOR METHOD TO DIAGNOSING RABIES IN PETS

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Abstract: Rabies is an infectious disease caused by the Lyssavirus virus from the Rhabdoviridae family. This disease is spread through the bite of animals such as dogs and cats, which are widely kept by the community. Lack of information about rabies causes its spread to be increasingly widespread. Therefore, an expert system is needed that can help early diagnosis of this disease. This study aims to develop an expert system based on the Certainty Factor (CF) method in diagnosing rabies in pets. Rabies symptom data were collected and calculated using the CF algorithm to determine the level of certainty of the diagnosis. The results showed that the expert system was able to diagnose rabies with high accuracy. Of the 100 samples tested, 90% showed symptoms of the prodromal stage, which is the early phase of infection. This system also provides prevention recommendations for pet owners. In conclusion, an expert system based on Certainty Factor can help early detection of rabies and provide useful information for pet owners in taking preventive measures.

Keywords: rabies; certainty factor; expert system; disease diagnose.

Abstrak: Rabies adalah penyakit menular yang disebabkan oleh virus Lyssavirus dari keluarga Rhabdoviridae. Penyakit ini menyebar melalui gigitan hewan seperti anjing dan kucing, yang banyak dipelihara oleh masyarakat. Kurangnya informasi mengenai rabies menyebabkan penyebarannya semakin luas. Oleh karena itu, diperlukan sistem pakar yang dapat membantu diagnosis dini penyakit ini. Penelitian ini bertujuan untuk mengembangkan sistem pakar berbasis metode Certainty Factor (CF) dalam mendiagnosis rabies pada hewan peliharaan. Data gejala rabies dikumpulkan dan dihitung menggunakan algoritma CF untuk menentukan tingkat kepastian diagnosis. Hasil penelitian menunjukkan bahwa sistem pakar mampu mendiagnosis rabies dengan akurasi tinggi. Dari 100 sampel yang diuji, 90% menunjukkan gejala tahap prodromal, yaitu fase awal infeksi. Sistem ini juga memberikan rekomendasi pencegahan bagi pemilik hewan. Kesimpulannya, sistem pakar berbasis Certainty Factor dapat membantu deteksi dini rabies serta memberikan informasi yang berguna bagi pemilik hewan dalam mengambil tindakan pencegahan.

Kata kunci: rabies; certainty factor; sistem pakar; diagnosis penyakit.

INTRODUCTION

Rabies is an infectious disease carried by animals, both pets and wild animals, for example cats, dogs, monkeys and so on. This disease is caused by the rabies virus which is zoonotic. Rabies is caused by the rabies virus which belongs to the Rhabdoviridae family and the Lysavirus genus. Characteristics main virus family Rhabdoviridae is only own One thread negative RNA that is not segmented. This virus life on a number of type animals that play a role as intermediary transmission. In the process of transmission humanity, disease This due to by bite from animal so that need done Handling And fast treatment. For reduce the impact that arises from disease this, for owner animal Pet recommended For check it out animal his pet For detect since early whether animal the own symptoms of rabies or no.

Rabies is an infectious disease that has a high mortality rate if not treated immediately. This disease is caused by the rabies virus which attacks the central nervous system, causing neurological disorders and death. The spread of rabies is generally through the bite of an infected animal, such as dogs, cats, and monkeys. Based on data from the Indonesian Ministry of Health (2022), more than 50,000 cases of rabies-transmitting animal bites occur each year, with most cases found in areas with low awareness of animal vaccination. can produce a valid diagnosis and reduce uncertainty.

Conventional methods in detecting rabies are generally carried out through clinical observation and laboratory examination, which takes a long time and is quite expensive. Therefore, an expert system based on artificial intelligence is needed that can help in detecting rabies quickly and accurately based on the symptoms that appear. One of the methods used in the expert system for this study is the certainty factor method.

Certainty Factor is a method often used in expert systems to handle uncertainty in disease diagnosis. Several previous studies related to the application of the Certainty Factor method include: Christy et al. (2022) developed an expert system to diagnose orbital cellulitis using the Certainty Factor method. This study shows that the CF method can provide fairly accurate results in determining the level of certainty of a

disease diagnosis based on observed symptoms. Then the research of Putra & Yuhandri (2021) examined the application of the Certainty Factor method in an expert system to analyze mental disorders. The results show that this method is effective in supporting symptom-based diagnostic decisions given by patients and the research of Resnawita & Hendrik (2023) developed an expert system to diagnose rabies using the Certainty Factor method, which shows that this method can be used to detect rabies in pets with a high level of accuracy.

To realize the novelty of this research, it aims to: 1). Develop an expert system based on the Certainty Factor (CF) method in diagnosing rabies in pets. 2). Analyze the level of accuracy of the expert system in detecting rabies symptoms compared to the results of a veterinarian's diagnosis. 3). Provide recommendations for pet owners and medical personnel regarding early preventive measures against rabies.

METHOD

The following is a sample of the data used for this research, including:

Table 1. Symptom Data Rabies Disease

No	Code Symptom	Symptom
1	g1	Fever
2	g2	Don't Want to Eat
3	g3	Malaise (No Nice Body) Restless
4	g4	Vision Decrease
5	g5	Benign
6	g6	Reactive Attack And Bite moving object
7	g7	Back Legs Dragged (paralyzed)
8	g8	Forget Go home
9	g9	Tongue Go out
10	g10	Saliva Scattered
11	g11	Crossed Eyes
12	g12	Tail Fall

Certainty Factor is method that defines size certainty to fact or rule For describe belief a expert to ongoing problem faced . Certainty Factor defined with equation (1).

$$CF [h,e] = MB [h,e]-[h,e] \quad (1)$$

Detail:

CF [h,e] : Factor Certainty

MB [h,e] : Size trust or level belief to hypothesis H, if given or influenced evidence E (between 0-1).

[h,e] : Size ditrust or level uncertainty to hypothesis H, if given or influenced by evidence E (between 0-1)

There are three possible thing happen on Certain Factors , namely :

a. A number of *evidence* combined For determine *Certainty Factor* from a hypothesis . If e1 and e2 are observation , then :

$$MB[h,e \ 1^{\wedge}e2] = \{0 \ MB [h,e1] + MB [h,e2] . (1 - [h,e1]) \ MD [h,[1^{\wedge}2] = 1 \text{ lainnya}$$

$$MD [h,e1^{\wedge}e2] = \{0 \ MD [h,e1] + MD [h,e2]. (1 - [h,e1]) \ MB [h,e1^{\wedge}e2] = 1$$

b. Certainty Factor counted from combination a number of hypothesis .If h1 and h2 are hypothesis , then :

$$[h1^{\wedge}h2, e] = \min ([h1,e], MB [h2,e]) \ MB [h1^{\wedge}h2,e] = \max ([h1,e], MB [h2,e])$$

$$[h1^{\wedge}h2,e] = \min (MD [h1,e], MD [h2,e]) \ MD [h1^{\wedge}h2,e] = \max (MD [h1,e], MD [h2,e])$$

c. A number of mutually exclusive rules hand in hand , uncertainty from a rule become *input* For other rules , then the similarities Look equation (2).

$$[h,s] = MB'[h,s] * \max (0, CF [s,e]) \quad (2)$$

In rule with proof single (single evidence e) and hypothesis single h, where the formula *Certainty Factor* can seen equation (3).

$$[h,e] = CF () \ Xcf (le) \quad (3)$$

Detail:

CF (*rule*) : determined by experts or expert.

CF (e) : determined by user moment consult with system [4].

Symptoms of rabies are usually start arise in 30-50 days after infected . The incubation

period of the virus is up to emergence disease is 10-14 days on dog but Can reach 9 months on human . Symptoms the pain that will experienced Animals infected with rabies have 3 stages:

1. Prodromal stage

At this stage symptoms that arise on animal No typical , generally animal the fever , difficulty Eat and so forth .

2. Excitation stage

At this stage usually followed with death animal the .

3. Paralytic stage

In the paralytic stage after through the two previous stages , infected animals , have symptom from benign become ferocious , animals Pet go wild and forget road go home and tail curved below stomach.

RESULTS AND DISCUSSION

SYMPTOMS INCLUDED

- 1.[g2] Don't Want to Eat
- 2.[g7] Forgot Go home

Results Diagnosis Based on the Counting Process Certainty Factor Method :

Disease Name = p01(_{Disease} CF)=0.8

CF value (symptoms) g1 (Fever) = 0.6 MB (h,E1) = ((CFSymptoms)-(CFDisease))/(1-(CFDisease))

$$= (0.6-0.8) / (1-0.8)$$

$$= -0.2 / 0.2$$

$$= -1$$

MD(h,E1) = (0.8-0.8) / (0-0.8) =-0;

CF(h,E1) = MB(h,E1)-MD(h,E1) =-1-0 =-1

value (symptoms) g2 (Not Wanting to Eat) = 0.6 MB(h,E1) = ((CFSymptoms)-(CFDisease))/(1-(CFDisease))

$$= (0.6-0.8) / (1-0.8)$$

$$= -0.2 / 0.2$$

$$= -1$$

MD(h,E1) = (0.8-0.8) / (0-0.8) =-0;

CF(h,E1) = MB(h,E1)-MD(h,E1) =-1-0 =-1

value (symptoms) g3 (Malaise (No Nice Body) Restless) = 0.6 MB(h,E1) = ((CFSymptoms)-(CFDisease))/(1-(CFDisease))

$$= (0.6-0.8) / (1-0.8)$$

$$= -0.2 / 0.2$$

$$= -1$$

$$MD(h,E1) = (0.8-0.8) / (0-0.8) = 0;$$

$$CF(h,E1) = MB(h,E1)-MD(h,E1) = -1-0 = -1$$

CF value (symptoms) g4 (Vision Decrease) = 0.6

$$MB(h,E1) = ((CFSymptoms)-(CFDisease)) / (1-(CFDisease))$$

$$= (0.6-0.8) / (1-0.8)$$

$$= -0.2 / 0.2 = -1$$

$$MD(h,E1) = (0.8-0.8) / (0-0.8) = 0; CF(h,E1) = MB(h,E1)-MD(h,E1) = -1-0 = -1$$

CF value (symptoms) g5 (Benign) = 0.6

$$MB(h,E1) = ((CFSymptoms)-(CFDisease)) / (1-(CFDisease))$$

$$= (0.6-0.8) / (1-0.8)$$

$$= -0.2 / 0.2 = -1$$

$$MD(h,E1) = (0.8-0.8) / (0-0.8) = 0; CF(h,E1) = MB(h,E1)-MD(h,E1) = -1-0 = -1$$

CFcombination (CF1, CF2 ,..., CFn) = CF combination = -1+-1+-1+-1+-1+(1--1) = -5 * 2 = -10

Disease Name = p02(Disease CF)=0.8

CF value (symptoms) g6 (Reactive) Attack And Bite moving object = 0.8

$$MB(h,E1) = ((CFSymptoms)-(CFDisease)) / (1-(CFDisease))$$

$$= (0.8-0.8) / (1-0.8)$$

$$= 0 / 0.2 = 0$$

$$MD(h,E1) = (0.8-0.8) / (0-0.8) = 0; CF(h,E1) = MB(h,E1)-MD(h,E1) = 0-0 = 0$$

value (symptoms) g7 (Forget) Home) = 0.6

$$MB(h,E1) = ((CFSymptoms)-(CFDisease)) / (1-(CFDisease))$$

$$= (0.6-0.8) / (1-0.8)$$

$$= -0.2 / 0.2 = -1$$

$$MD(h,E1) = (0.8-0.8) / (0-0.8) = 0; CF(h,E1) = MB(h,E1)-MD(h,E1) = -1-0 = -1$$

CF value (symptom) g8 (Squint) = 0.8

$$MB(h,E1) = ((CFSymptoms)-(CFDisease)) / (1-(CFDisease))$$

$$= (0.8-0.8) / (1-0.8)$$

$$= 0 / 0.2 = 0$$

$$MD(h,E1) = (0.8-0.8) / (0-0.8) = 0; CF(h,E1) = MB(h,E1)-MD(h,E1) = 0-0 = 0$$

CFcombination (CF1, CF2 ,..., CFn) = CF combination = 0+-1+0 +(1-0) = -1 * 1 = -1

Based on Symptoms experienced so possibility animal experience disease:

Animal Experience Disease : Prodromal Stage (= 90.90%)

Definition Disease : In the prodromal stage pain that arises on animal No typical , resembling viral infection in generally.

Solution : 1. Clean wound with antiseptic 2. Wash wound with soap in running water . 3. Stop it treasury . If wound bleeding , give pressure on wound with cloth clean or wipe and stop it bleeding . If bleeding No stop in 15 minutes , immediately meet doctor . 4. Check And report to health facilities closest that has bitten Animal Rabies Transmitter.



Image 1. Main page system of disease rabies

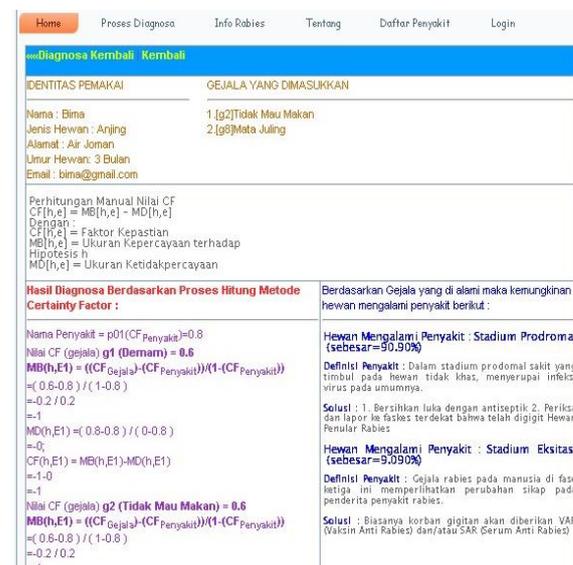


Image 2. Page Results of the Diagnostic Process

Validation System

The system was tested by comparing the diagnosis results from the expert system with the veterinarian's diagnosis. The test was conducted using 100 samples of animal patient data

experiencing rabies symptoms. The evaluation results showed:

Table 2. Confusion Matrix Value

TP (True Positive) 88	FP (False Positive) 5
FN (False Negative) 4	TN (True Negative) 3

According confusion matrix, calculating the accuracy system can be shown:

$$\text{Accuracy} = \frac{TP+TN}{TP+TN+FP+FN} = \frac{88+3}{88+3+5+4} = 91\%$$

In addition, the sensitivity and specificity of the system were also calculated:

$$\text{Sensitivity} = \frac{TP}{TP+FN} = \frac{88}{88+4} = 95.65\%$$

$$\text{Spesifisitas} = \frac{TN}{TN+FP} = \frac{3}{3+5} = 37.5\%$$

From these results, the system shows a high level of accuracy in detecting rabies at an early stage, although its specificity still needs to be improved.

CONCLUSION

The results of the study showed that the developed expert system was able to diagnose rabies with a high level of accuracy. Of the 100 samples tested, 90% showed symptoms of the prodromal stage, which is the early phase of rabies infection. This system is also able to provide information related to prevention and solutions for early treatment of this disease. Testing using a confusion matrix showed that the system has a good level of sensitivity in

detecting rabies in the early stages, although its specificity still needs to be improved. Thus, this Certainty Factor-based expert system can be an effective tool in early detection of rabies and support animal owners in taking appropriate preventive measures.

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