Expert System for Detecting Cat Skin Disease using Certainty Factor Method

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Abstract – *With the increasing number of people contaminated with cat disease, many veterinarians specializing in cats in Indonesia open up a practice in big cities only. Thus, it is not uncommon for cat owners who are late to provide treatment for skin diseases since the initial symptoms occur. Based on the problems to overcome skin diseases in cats, it is necessary to build a computerized system that has knowledge such as veterinarians and the system can be a tool in diagnosing types of diseases and provide solutions for treatment and prevention with the expert system of Certainty Factor (CF), because the Certainty Factor (CF) method is to prove whether a fact is certain or uncertain in the form of a metric that is usually used in expert systems. The results of the system are to help users, among others, veterinarians in diagnosing skin diseases in cats and animal owners, especially cats to find skin diseases in cats. It is expected to make it easier for doctors and cat owners to determine the type of skin disease based on existing symptoms and get the right treatment method.* ***Copyright © 2017 Universitas Muhammadiyah Yogyakarta- All rights reserved.***

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I.   Introduction

Various diseases that exist in everyday life, the diseases exist in humans, animals and plants. The disease varies in level from moderate to fatal or death, as well as types of infectious and non-infectious diseases. One disease that exists in humans and many who experience it, especially in Indonesia, are stroke, heart and kidney failure.

While diseases that are very easy and dangerous are diseases originating from animals through direct contact or indirect, we can see this in cats, which almost every house has its own cat or cat pet that lives in a house. One disease that is harmful to humans in cats is a skin disease [1].

With increasing numbers of people contaminated with cat disease, many veterinarians specializing in cats in Indonesia open up practice in big cities only [1]. So it is not uncommon for cat owners who are late to provide treatment for skin diseases since the initial symptoms occur.

Recently, many of researchers have advocated and developed the imaging of human vision or in the loop approach to visual object recognition. The development of a skin diseases diagnosis system allowed user to identify diseases of the human skin and to provide advises or medical treatments. The identification accuracy of 85% for Eczema, 95% for Impetigo and 85% for Melanoma [2].

Other paper proposed a multilayer decomposition aided method using Multiclass Support Vector Machine (MSVM) and Extreme Learning Machine (ELM) for classification while the features are extracted based on textural and color feature for detection and classification of skin cancer images [3]. Artificial neural network was used in the other research [4]. Textural features and Support vector Machine (SVM) is used for classification image into cancerous or non-cancerous [5]. Other research used

decision tree algorithm for classifying the skin images [6].

An automatic segmentation of lesion are significant and indicated with good accuracy. An average correlation of 90% and average overlapping score of 83% has been obtained [7]. A minimum correlation of 91.7% and a maximum overlapping score of 97.03% has been obtained for other digital images segmentation method [8]. Early skin cancer detection used image enhancement techniques and a multi-scale retinex with color restoration technique for skin cancer detection [9].

Certainty factor (CF) is the level of trust, CF states the degree of confidence in an event or fact or hypothesis based on evidence or expert opinion and then combined the forward chaining inference technique. Certainty Factor can handle uncertainty, where CF values are used to express the level of expert confidence in the data used. The certainty factor of certainty factor expresses trust in an event (fact or hypothesis) based on evidence or expert judgment.

Expert systems try to find satisfying solutions as done by an expert, such as providing an explanation of the steps taken and giving reasons for the suggestions or conclusions found. With the existence of this expert system it is expected to produce information about skin diseases in cats, how to diagnose skin diseases in cats, and how to treat skin diseases in cats that must be done to help the performance and accuracy of diagnosis by an expert [10].

Making an expert system with the Certainty factor method is expected to be an alternative help cat owners in obtaining information on handling cats that can be used at any time. In addition, by using the system it is expected that cats detected with symptoms of the disease can immediately get proper and fast treatment without having to wait for a doctor's practice schedule and reduce the budget for the costs that must be spent.

Based on problems to overcome skin diseases in cats, it is necessary to build a computerized system that has knowledge such as veterinarians and the system can be a tool in diagnosing types of diseases and provide solutions to treatment and prevention with expert systems using Certainty Factors. This paper has objective to develop an expert system using certainty factor to solve the cat skin disease problems.

II. Research Method

To simplify the execution of this research, the authors make a research framework consisting of several stages, as in Figure 1.

II.1. *Data Collection*

Method data collection carried out with way observer directly the object under study for get data. Observation do with way interview (Interview) with face to face advance directly with do ask answer with Doctor Animals (Drh.Indahlia, S .B who served in the Clinic PRO VET) so that obtained some statement that will analyzed before taking decision.
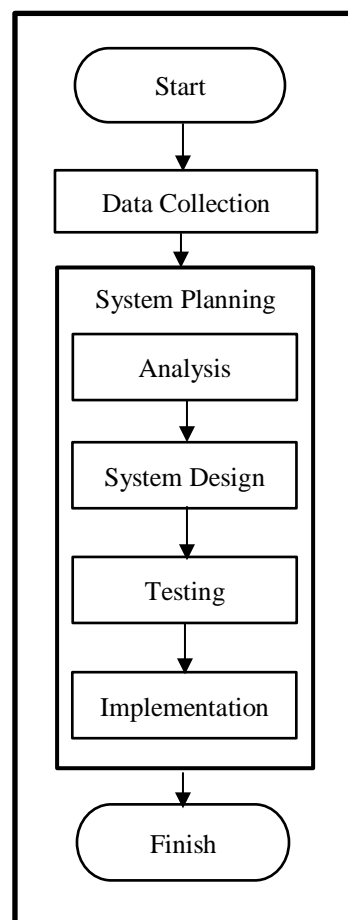

Figure 1. Framework Work Research

II.2. *System Planning*

Design system analysis certainty factor method for detect it disease skin cat based on some stage, namely:

a. Needs Analysis

After all data is obtained, the next process is carried out is analysis of data obtained from results interview and compile in a manner systematic. Data is organized to in category, describe to in units, compile to in pattern, thus make it easy for system that was designed in the next step.

b. Testing

Testing process focusing on the internal logic of the device soft , make sure that all stated already tested, and on the external functionality , i.e. directing testing for find errors - errors and ensure that input is restricted will give away results appropriate factual with the results needed.

There are several types and symptoms disease skin in cats, namely:

1. Ringworm
   a. Scratching - scratching your body excessively
   b. Skin seen reddish
   c. Fur fall out excessive
   d. Generally itching in the body cat
   e. Is available crust in the area his body
   f. Is available - freckles bald
   g. Skin seen dry / scaly
   h. Is available circular to head , ears, and arm front
   i. Fur to be fall out on the edge circular wound
   j. Fur cat seen broken
2. Sporotrichosis
   a. Festering issued smell
   b. This wound shaped lump
   c. Swelling in the area body
   d. Fever
   e. Loss lust eat
   f. Is available infection in part his body (especially once on the nose and face), feet and tail
3. Stuild tail
   a. Is available chocolate a case candle put on tail
   b. Fur seen greasy
   c. Fur to be tangled
   d. Tail hair loss
   e. Take out distasteful odor delicious

4. Scabies
   a. Scratching - scratching your body excessively
   b. Skin seen reddish
   c. Fur fall out excessive
   d. Generally itching in the body cat
   e. Is available - freckles bald
   f. Appear lesion red on the surface skin
   g. Usually start appear at the end ears and palms hand
5. Eosinophilic Granuloma
   a. Scratching - scratching your body excessively
   b. Skin seen reddish
   c. Seen wound wet behind neck / thigh in
   d. Mouth or chin swelling (edema) like boils / thrush
6. Alergic Dermatitis
   a. Scratching - scratching your body excessively
   b. Skin seen reddish
   c. Fur fall out excessive
   d. Inflammation of the wound
   e. Bite sole
7. Feline acne
   a. Festering issued smell
   b. This wound shaped lump
   c. Acne around chin
   d. Blackheads
8. Flea / incandescent
   a. Scratching - scratching your body excessively
   b. Color fur pale and dirty black
   c. Depletion hair on top
9. Abscesses
   a. Festering issued smell
   b. This wound shaped lump
   c. Swelling in the area body
   d. Fever
   e. Pain
   f. Sometimes - sometimes hair fall out (bald in area abscess)
10. Pemphigus
    a. Scratching - scratching your body excessively
    b. Skin seen reddish
    c. Fur fall out excessive
    d. Generally itching in the body cat
    e. Flagging / increasingly thin
    f. Superficial wounds (wound shaped hollow small)

Some types and symptoms from disease, then given code rule that will connect deliver diseases, namely:

1. Type symptoms:
   G01: Scratching - scratching too much
   G02: Skin looks reddish
   G03: Excessive hair loss
   G04: Generally itchy body on the cat's body
   G05: Festering smell
   G06: Lethargic / thinner
   G07: This wound is a lump
   G08: There is a crust in the area of his body
   G09: There are spots - bald spots
   G10: Swelling in the body area
   G11: Fever
   G12: Loss of appetite
   G13: Skin looks dry / scaly
   G14: There is a circular wound on the head, front ear and arm
   G15: Feathers fall out on the edge of the wound the circular one
   G16: Cat hair looks broken and dandruff
   G17: There is an infection in his body (especially on the nose and face) feet and tail
   G18: There is chocolate like a candle at the base tail
   G19: Fur looks oily
   G20: Fur becomes tangled
   G21: Tail of hair that falls out
   G22: Gives off a bad smell
   G23: A red lesion appears on the surface of the skin
   G24: Usually it starts to appear at the end of the ear and palms
   G25: Looks wet wounds behind deep neck / thighs
   G26: Swollen mouth or chin (edema) such as boils / thrush
   G27: Inflammation of the wound
   G28: Biting the foot
   G29: Acne around the body
   G30: Blackheads
   G31: The color of the hair is pale and dirty black
   G32: Thinning hair above the base of the tail
   G33: Pain
   G34: Sometimes hair loss (baldness in the area of the abscess)
   G35: Superficial wound (small hole-shaped Wound

2. Type of disease:
   P01: Ringworm
   P02: Sporotrichosis
   P03: Stuid tail
   P04: Scabies
   P05: Eosinophilic graunuloma
   P06: Alergic Dermatitis
   P07: Fline acne
   P08: Flea / massage
   P09: Abscesses
   P10: Pemhphigus

3. Rule of skin disease in cats

Rule 1:
If scratching - scratching your body excessively and skin looks reddish and fur falling out and and generally generally itching on the body of a cat and there is a crust in his body and there are bald spots and skin looks dry / scaly and there is a circle to the head, ears, and front arms and feathers fall out on the edge of a circular wound and the cat's fur looks broken then ringworm

Rule 2:
If festering which emits and and smells this wound is in the form of lump and swelling in the body area and fever and loss of appetite and there is infection in the part of the body (especially on the nose and face), legs and tail then sporotrichosis

Rule 3:
If there is chocolate like a candle at the base of the tail and the fur looks oily and the feather becomes a tangled and tail of hair that falls out and removes an unpleasant smell then stuild tail

Rule 4:
If scratching - scratching your body excessively and skin looks reddish and fur falls out excessively and generally itching on the body of a cat and there are bald spots and red lesions appear on the surface of the skin and usually begins to appear at the tip of the ear and palm then scabies

Rule 5:
If scratching - scratching your body excessively and skin looks reddish and visible wet wounds behind neck / thighs in and mouth or chin swelling (edema) such as boils / thrush then eosinophilic graunuloma

Rule 6:
If scratching - scratching the body excessively and the skin looks reddish and feathers fall out excessively and inflammation in and wounds biting the foot of the foot then alergic dermatitis

Rule 7:
If festering gives off odor and this wound is shaped like lumps and acne around the chin and blackheads then feline acne

Rule 8:
If scratching - scratching the body excessively and the color of the hair is pale and dirty black and thinning of the hair above the base then lice / incandescent

Rule 9:
If festering which emits odor and this wound is in the form of lump and swelling in the body area and fever and pain and sometimes hair loss (bald diarrhea abscess) then abscess

Rule 10:
If scratching - scratching your body excessively and skin looks reddish and fur falling out and and generally generally itchy on the cat's body and lacking / thinner and shallow wounds (small hollow wounds) then pemphigus.

III.   Results

The following is an example of a calculation with two rules for calculating certainty factor for each symptom and type of disease. The calculation is as follows:
1. Ringworm
   a. Scratching - scratching excess body = 0,7
      : yes = 0,6
   b. The skin looks reddish = 0,2
      : no = 0,4
   c. Excessive hair loss = 0,8
      : no = 0,4
   d. Generally itching in the cat's body = 0,8
      : no = 0,4
   e. There is crust in the body area = 0,3
      : no = 0,4
   f. There are bald spots = 0,4
      : no = 0,4
   g. The skin looks dry / flaky = 0,4
      : no = 0,4
   h. There is a circle to the head, ears, and forearm = 0,4
      : no = 0,4
   i. The feathers fall out at the edges of a circular wound = 0,3
      : no 0,4
   j. Cat hair looks broken and dandruff = 0,3
      : yes = 0,6
      $CF[H,E]1 = CF[H]1 * CF[E]1$
      $= 0,6 * 0,7$
      $= 0,42$
      $CF[H,E]2 = CF[H]2 * CF[E]2$
      $= 0,4 * 0,2$
      $= 0,8$

$CF[H,E]3 = CF[H]3 * CF[E]3$
$= 0,4 * 0,6$
$= 0,24$
$CF[H,E]4 = CF[H]4 * CF[E]4$
$= 0,4 * 0,8$
$= 0,32$
$CF[H,E]5 = CF[H]5 * CF[E]5$
$= 0,4 * 0,3$
$= 0,12$
$CF[H,E]6 = CF[H]6 * CF[E]6$
$= 0,4 * 0,4$
$= 0,16$
$CF[H,E]7 = CF[H]7 * CF[E]$
$= 0,4 * 0,4$
$= 0,16$
$CF[H,E]8 = CF[H]8 * CF[E]8$
$= 0,4 * 0,4$
$= 0,16$
$CF[H,E]9 = CF[H]9 * CF[E]9$
$= 0,4 * 0,3$
$= 0,12$
$CF[H,E]10 = CF[H]10 * CF[E]10$
$= 0,6 * 0,3$
$= 0,18$
Cfcombine $CF[H,E]1,2 = CF[H,E]1 + CF[H,E]2 * (1 − CF[H,E]1)$
$= 0,42 + 0,8 * (1 − 0,42)$
$= 1,22 * 0,58$
$= 0,7076$ (old1)
Cfcombine $CF[H,E]old 1,3 = CF[H,E]old1 + CF[H,E]3 * (1 − CF[H,E]old1)$
$= 0,7076 + 0,24 * (1 − 0,7076)$
$= 0,9476 * 0,2924$
$= 0,2771$ (old2)
Cfcombine $CF[H,E]old 2,4 = CF[H,E]old2 + CF[H,E]4 * (1 − CF[H,E]old2)$
$= 0,2771 + 0,32 * (1-0,2771)$
$= 0,5971 * 0,7229$
$= 0,4316$ (old3)
Cfcombine $CF[H,E]old 3,5 = CF[H,E]old 3 + CF[H,E]5 * (1 − CF[H,E]old3)$
$= 0,4316 + 0,12 * (1 − 0,4316)$
$= 0,5516 * 0,5683$
$= 0,3135$(old4)
Cfcombine $CF[H,E]old 4,6 = CF[H,E]old4 + CF[H,E] * (1 − CF[H,E]old4)$
$= 0,3135 + 0,16 * (1 − 0,3135)$
$= 0,4735 * 0,6865$
$= 0,3251$(old5)
Cfcombine $CF[H,E]old 5,7 = CF[H,E]old5 * (1 − CF[H,E]old5)$
$= 0,3251 + 0,16 * (1 − 0,3251)$
$= 0,4851 * 0,6749$
$= 0,3274$(old6)

Cfcombine CF[H,E]old 6,8 = CF[H,E]0ld6 *
(1 – CF[H,E]old6)
= 0,3274 + 0,16 * (1 – 0,3274)
= 0,4874 * 0,6726
= 0,3278(old7)
Cfcombine CF[H,E]old 7,9 = CF[H,E]old7 *
(1 – CF[H,E]old7)
= 0,3278 + 0,12 * (1 – 0,3278)
= 0,4478 * 0,6722
= 0,3010(old8)
Cfcombine CF[H,E]odi 8,10 = CF[H,E]0ld8
* (1 – CF[H,E]old8)
= 0,3010 + 0,18 * (1 – 0,3010)
= 0,481* 0,699
= 0,3362(old9)
CF [H,E]old9 * 100% = 0,3362 * 100% =
33,62%

2. Sporotrichosis
    a. Breathing that emits odor = 0,2
        : no = 0,4
    b. This wound is in the form of a lump = 0,2
        : yes = 0,6
    c. Swelling in the body area = 0,2
        : no = 0,4
    d. Fever = 0,2
        : no = 0,4
    e. Appetite loss = 0,2
        : yes = 0,6
    f. There is an infection on the part of his body (especially on the nose and face), feet and tail = 0 ,4
        : no = 0,4
        CF[H,E]1 = CF[H]1 * CF[E]1
        = 0,4 * 0,2
        = 0,8
        CF[H,E]2 = CF[H]2 * CF[E]2
        = 0,6 * 0,2
        = 0,12
        CF[H,E]3 = CF[H]3 * CF[E]3
        = 0,4 * 0,2
        = 0,8
        CF[H,E]4 = CF[H]4 * CF[E]4
        = 0,4 * 0,2
        = 0,8
        CF[H,E]5 = CF[H]5 * CF[E]5
        = 0,6 * 0,2
        = 0,12
        CF[H,E]6 = CF[H]6 * CF[E]6
        = 0,4 * 0,4
        = 0,16
        Cfcombine CF[H,E]1,2 = CF[H,E]1 + CF[H,E]2 * (1 – CF[H,E]1)
        = 0,8 + 0,12 * (1 – 0,8)
        = 0,92 * 0,2

= 0,184 (old1)
Cfcombine CF[H,E]old 1,3 = CF[H,E]old1 + CF[H,E]3 * (1 – CF[H,E]old1)
= 0,184 + 0,8 * (1 – 0,184)
= 0,984 * 0,816 =
0,8029(0ld2)
Cfcombine CF[H,E]old 2,4 = CF[H,E]old2 + CF[H,E]4 * (1 – CF[H,E]old2)
= 0,8029 + 0,8 * (1 – 0,8029)
= 1,6029 * 0,1971
= 0,3159(0ld3)
Cfcombine CF[H,E]old 3,5 = CF[H,E]old3 + CF[H,E]5 * (1 – CF[H,E]old3)
= 0,3159 + 0,12 * (1 – 0,3159)
= 0,4359 * 0,6841
= 0,2982(0ld4)
Cfcombine CF[H,E]old 4,6 = CF[H,E]old4 + CF[H,E]4 * (1 – CF[H,E]old4)
= 0,2982 + 0,16 * (1 - 0,2982)
= 0,4582 * 0,7018
= 0,3216(0ld5)
CF [H,E]old9 * 100% = 0,3216 * 100% =
32,16 %

3. Stuild tail disease
    a. There is chocolate like a candle at the tail = 0,3
        : no = 0,4
    b. Fur looks greasy = 0,2
        : no = 0,4
    c. The fur becomes tangled = 0,3
        : no = 0,4
    d. Falling hair tail = 0,6
        : no = 0,4
    e. Removes an unpleasant odor = 0,2
        : yes = 0,6
        CF[H,E]1 = CF[H]1 * CF[E]1
        = 0,4 * 0,3
        = 0,12
        CF[H,E]2 = CF[H]2 * CF[E]2
        = 0,4 * 0,2
        = 0,8
        CF[H,E]3 = CF[H]3 * CF[E]3
        = 0,4 * 0,3
        = 0,12
        CF[H,E]4 = CF[H]4 * CF[E]4
        = 0,4 * 0,6
        = 0,24
        CF[H,E]5 = CF[H]5 * CF[E]5
        = 0,6 * 0,2
        = 0,12
        Cfcombine CF[H,E]1,2 = CF[H,E]1 + CF[H,E]2 * (1 – CF[H,E]1)
        = 0,12 + 0,8 * (1 – 0,12)
        = 0,92 * 0,88

= 0,8096(old1)

Cfcombine CF[H,E]1,3 = CF[H,E]0ld1 + CF[H,E]3 * (1 − CF[H,E]1)

= 0,8096 + 0,12 * (1 − 0,8096)

= 0,9296 * 0,1904

= 0,1769(0ld2)

Cfcombine CF[H,E]2,4 = CF[H,E]old2 + CF[H,E]4 * (1 − CF[H,E]2)

= 0,1769 + 0,24 * (1 − 0,1769)

= 0,4169 * 0,8231

= 0,3431 (0ld3)

Cfcombine CF[H,E]3,5 = CF[H,E]0ld3 + CF[H,E]5 * (1 − CF[H,E]3)

= 0, 3431+ 0,12 * (1 − 0,3431)

= 0,4631 * 0,6569

= 0,3042(old4)

CF [H,E]old4 * 100% = 0,3042 * 100% = 30,42 %

4. Scabies disease
   a. Scratching - scratching excess body = 0,7
      : yes = 0,6
   b. The skin looks reddish = 0,2
      : no = 0,4
   c. Excessive hair loss = 0,6
      : no = 0,4
   d. Generally itching in the cat's body = 0,8
      : no = 0,4
   e. There are bald spots = 0,4
      : no = 0,4
   f. Red lesions appear on the surface of the skin = 0,2
      : no = 0,4
   g. Usually starts to appear at the tip of the ear and palm = 0,2
      : yes = 0,6

   CF[H,E]1 = CF[H]1 * CF[E]1
   = 0,6 * 0,7
   = 0,42

   CF[H,E]2 = CF[H]2 * CF[E]2
   = 0,4 * 0,2
   = 0,8

   CF[H,E]3 = CF[H]3 * CF[E]3
   = 0,4 * 0,6
   = 0,24

   CF[H,E]4 = CF[H]4 * CF[E]4
   = 0,4 * 0,8
   = 0,32

   CF[H,E]5 = CF[H]5 * CF[E]5
   = 0,4 * 0,4
   = 0,16

   CF[H,E]6 = CF[H]6 * CF[E]6
   = 0,4 * 0,2
   = 0,8

CF[H,E]7 = CF[H]7 * CF[E]7

= 0,6 * 0,2

= ,12

Cfcombine CF[H,E]1,2 = CF[H,E]1 + CF[H,E]2 * (1 − CF[H,E]1)

= 0,42 + 0,8 * (1 − 0,42)

= 1,22 * 0,58

= 0,7076(old1)

Cfcombine CF[H,E]1,3 = CF[H,E]old1 + CF[H,E]3 * (1 − CF[H,E]1)

= 0,7076 + 0,24 * (1 − 0,7076)

= 0,9476 * 0,2924

= 0,2771(old2)

Cfcombine CF[H,E]old 2,4 = CF[H,E]old2 + CF[H,E]4 * (1 − CF[H,E]old2)

= 0,2771 + 0,32 * (1-0,2771)

= 0,5971 * 0,7229

= 0,4316 (old3)

Cfcombine CF[H,E]old 3,5 = CF[H,E]old 3 + CF[H,E]5 * (1 − CF[H,E]old3)

= 0,4316 + 0,16 * (1 − 0,4316)

= 0,5916 * 0,5684

= 0,3363(old4)

Cfcombine CF[H,E]old 4,6 = CF[H,E]old4 + CF[H,E]5 * (1 − CF[H,E]old4)

= 0,3363 + 0,8 * (1 − 0,3363)

= 1,1363 * 0,6637

= 0,7542(old5)

CF [H,E]old5 * 100% = 0,7542 * 100% = 75,42%

5. Eosinophilic Granuloma Disease
   a. Scratching - scratching excess body = 0,7
      : yes = 0,6
   b. The skin looks reddish = 0,3
      : no = 0,4
   c. Wet wounds behind the neck / thighs are visible = 0,3
      : no = 0,4
   d. Swollen mouth or chin (edema) such as boils / thrush = 0,3
      : no = 0,4

   CF[H,E]1 = CF[H]1 * CF[E]1
   = 0,6 * 0,7
   = 0,42

   CF[H,E]2 = CF[H]2 * CF[E]2
   = 0,4 * 0,2
   = 0,8

   CF[H,E]3 = CF[H]3 * CF[E]3
   = 0,4 * 0,3
   = 0,12

   CF[H,E]4 = CF[H]4 * CF[E]4
   = 0,4 * 0,3
   = 0,12

Cfcombine CF[H,E]1,2 = CF[H,E]1 + CF[H,E]2 * (1 − CF[H,E]1)
= 0,42 + 0,8 * (1 − 0,42)
= 1,22 * 0,58
= 0,7076(old1)
Cfcombine CF[H,E]1,3 = CF[H,E]old1 + CF[H,E]3 * (1 − CF[H,E]1)
= 0,7076 + 0,12 * (1 − 0,7076)
= 0,8276 * 0,2924
= 0,2411(old2)
Cfcombine CF[H,E]2,4 = CF[H,E]old2 + CF[H,E]4 * (1 − CF[H,E]2)
= 0,2411 + 0,12 * (1 − 0,2411)
= 0,3611 * 0,7589
= 0,2740(old3)
CF [H,E]old3 * 100% = 0,2740* 100% =27,4%

6. Alergic Dermatitis Disease
   a. Scratching - scratching excess body = 0,7
      : yes = 0,6
   b. The skin looks reddish = 0,2
      : no = 0,4
   c. Excessive hair loss = 0,6
      : no = 0,4
   d. Inflammation of the wound = 0,4
      : no 0,4
   e. Biting footprint = 0,5
      : no = 0,4
      CF[H,E]1 = CF[H]1 * CF[E]1
      = 0,6 * 0,7
      = 0,42
      CF[H,E]2 = CF[H]2 * CF[E]2
      = 0,4 * 0,2
      = 0,8
      CF[H,E]3 = CF[H]3 * CF[E]3
      = 0,4* 0,6
      = 0,24
      CF[H,E]4 = CF[H]4 * CF[E]4
      = 0,4 * 0,4
      = 0,16
      CF[H,E]5=CF[H]5 * CF[E]5
      = 0,4 * 0,5
      = 0,20
      Cfcombine CF[H,E]1,2 = CF[H,E]1 + CF[H,E]2 * (1 − CF[H,E]1)
      = 0,42 + 0,8 * (1 − 0,42)
      = 1,22 * 0,58
      = 0,7076(old1)
      Cfcombine CF[H,E]1,3 = CF[H,E]old1 + CF[H,E]3 * (1 − CF[H,E]1)
      = 0,7076 + 0,24 * (1 − 0,7076)
      = 0,9476 * 0,2924
      = 0,2771(old2)

Cfcombine CF[H,E]2,4 = CF[H,E]old2 + CF[H,E]4 * (1 − CF[H,E]2)
= 0,2771 + 0,16 * (1 − 0,2771)
= 0,4371 * 0,7229
= 0,3151(old3)
CF [H,E]old3 * 100% = 0,3151* 100% = 31,51%

7. Feline acne Disease
   a. Breathing that emits odor = 0,2
      : no = 04
   b. This wound is in the form of a lump = 0,2
      : yes = 0,6
   c. Acne around the chin = 0,3
      : no = 0,4
   d. Blackheads = 0,2
      : no = 0,4
      CF[H,E]1 = CF[H]1 * CF[E]1
      = 0,4 * 0,2
      = 0,8
      CF[H,E]2 = CF[H]2* CF[E]2
      = 0,6 * 0,2
      = 0,12
      CF[H,E]3 = CF[H]3 * CF[E]3
      = 0,4 * 0,3
      = 0,12
      CF[H,E]4 = CF[H]4 * CF[E]4
      = 0,4 * 0,2
      = 0,8
      Cfcombine CF[H,E]1,2 = CF[H,E]1 + CF[H,E]2 * (1 − CF[H,E]1)
      = 0,8 + 0,12 * (1 − 0,8)
      = 0,92 * 0,2
      = 0,184 (old1)
      Cfcombine CF[H,E]1,3 = CF[H,E]old1 + CF[H,E]3 * (1 − CF[H,E]1)
      = 0,184 + 0,12 * (1 − 0,184)
      = 0,304 *0,816
      = 0,2481(old2)
      Cfcombine CF[H,E]2,4 = CF[H,E]old2 + CF[H,E]4 * (1 − CF[H,E]2)
      = 0,2481 + 0,8 * (1 − 0,2481)
      = 1,0481 * 0,7519
      = 0,7880(old3)
      CF [H,E]old3 * 100% = 0,7880* 100% = 78,8%

8. Flea / incontinence
   a. Scratching - scratching excess body = 0,7
      : yes = 0,6
   b. The color of the hair is pale and dirty black = 0,2
      : no = 0,4
   c. Thinning of hair above the base of the tail = 0,3
      : no = 0,4

CF[H,E]1 = CF[H]1 * CF[E]1
= 0,6 * 0,7
= 0,42
CF[H,E]2 = CF[H]2 * CF[E]2
= 0,4 * 0,2
= 0,8
CF[H,E]3 = CF[H]3 * CF[E]3
= 0,4 * 0,3
= 0,12
Cfcombine CF[H,E]1,2 = CF[H,E]1 + CF[H,E]2 * (1 − CF[H,E]1)
= 0,42 + 0,8 * (1 − 0,42)
= 1,22 * 0,58
= 0,7076(old1)
Cfcombine CF[H,E]1,3 = CF[H,E]old1 + CF[H,E]3 * (1 − CF[H,E]1)
= 0,7076 + 0,12 * (1 − 0,7076)
= 0,8276 * 0,2924
= 0,2411(old2)
CF [H,E]old2 * 100% = 0,2411* 100% = 24,11%

9. Abscesses
   a. Breathing that emits odor = 0,2
      : no = 0,4
   b. This wound is in the form of a lump = 0,2
      : yes = 0,6
   c. Swelling in the body area = 0,2
      : no = 0,4
   d. Fever = 0,2
      : no = 0,4
   e. Pain = 0,2
      : no = 0,4
   f. Sometimes hair loss (baldness in abscesses) = 0,5
      : no = 0,4
      CF[H,E]1 = CF[H]1 * CF[E]1
      = 0,4 * 0,2
      = 0,8
      CF[H,E]2 = CF[H]2 * CF[E]2
      = 0,6 * 0,2
      = 0,12
      CF[H,E]3 = CF[H]3 * CF[E]3
      = 0,4 * 0,2
      = 0,8
      CF[H,E]4 = CF[H]4 * CF[E]4
      = 0,4 * 0,2
      = 0,8
      CF[H,E]5 = CF[H]5 * CF[E]5
      = 0,4 * 0,2
      = 0,8
      CF[H,E]6 = CF[H]6 * CF[E]6
      = 0,4 * 0,5
      = 0,20

Cfcombine CF[H,E]1,2 = CF[H,E]1 + CF[H,E]2 * (1 − CF[H,E]1)
= 0,8 + 0,12 * (1 − 0,8)
= 0,92 * 0,2
= 0,184(old1)
Cfcombine CF[H,E]1,4 = CF[H,E]0ld1 + CF[H,E]3 * (1 − CF[H,E]1)
= 0,184 + 0,8 * (1 − 0,184)
= 0,984 * 0,816
= 0,8029(old2)
Cfcombine CF[H,E]2,4 = CF[H,E]old2 + CF[H,E]4 * (1 − CF[H,E]2)
= 0,8029 + 0,8 * (1 − 0,8029)
= 0,64232 * 0,1971
= 0,1266(old3)
Cfcombine CF[H,E]3,5 = CF[H,E]0ld3 + CF[H,E]5 * (1 − CF[H,E]3)
= 0,1266 + 0,8 * (1 − 0,1266)
= 0,9266 * 0,8734
= 0,8093(old4)
Cfcombine CF[H,E]4,6 = CF[H,E]old4 + CF[H,E]6 * (1 − CF[H,E]4)
= 0,8093 + 0,20 * (1 − 0,8093)
= 1,0093 * 0,1907
= 0,1925(old5)
CF [H,E]old2 * 100% = 0,1925* 100% = 19,25 %

10. Pemphigus Disease
    a. Scratching - scratching excess body = 0,7
       : yes = 0,6
    b. The skin looks reddish = 0,2
       : no = 0,4
    c. Excessive hair loss = 0,6
       : no 0,4
    d. Generally itching in the cat's body = 0,8
       : no = 0,4
    e. Sluggish / thinner = 0,3
       : no = 0,4
    f. Shallow wounds (small hole-shaped wounds) = 0,4
       : no = 0,4
       CF[H,E]1 = CF[H]1 * CF[E]1
       = 0,6 * 0,7
       = o,42
       CF[H,E]2 = CF[H]2 * CF[E]2
       = 0,4 * 0,2
       = 0,8
       CF[H,E]3 = CF[H]3 * CF[E]3
       = 0,4 * 0,6
       = 0,24
       CF[H,E]4 = CF[H]4 * CF[E]4
       = 0,4 * 0,8
       = 0,32
       CF[H,E]5 = CF[H]5 * CF[E]5

= 0,4 * 0,3

= 0,12

CF[H,E]6 = CF[H]6 * CF[E]6

= 0,4 * 0,4

= 0,16

Cfcombine CF[H,E]1,2 = CF[H,E]1 + CF[H,E]2 * (1 – CF[H,E]1)

= 0,42 + 0,8 * (1 – 0,42)

= 1,22 * 0,58

= 0,7076(old1)

Cfcombine CF[H,E]1,3 = CF[H,E]old1 + CF[H,E]3 * (1 – CF[H,E]1)

= 0,7076 + 0,24 * (1 – 0,7076)

= 0,9476 * 0,2924

= 0,2771(old2)

Cfkonbinasi CF[H,E]old 2,4 = CF[H,E]old2 + CF[H,E]4 * (1 – CF[H,E]2)

= 0,2771 + 0,32 * (1-0,2771)

= 0,5971 * 0,7229

= 0,4316 (old3)

Cfcombine CF[H,E]old 3,5 = CF[H,E]old3 + CF[H,E]5 * (1 – CF[H,E]3)

= 0,4316 + 0,12 * (1 – 0,4316)

= 0,5516 * 0,5684

= 0,3135(old4)

Cfcombine CF[H,E]old 3,6 = CF[H,E]old4 + CF[H,E]5 * (1 – CF[H,E]4)

= 0,3135 + 0,16 * (1 – 0,3135)

= 0,4735 * 0,6865

= 0,3251

CF [H,E]old2 * 100% = 0,3251* 100% = 32,51%

From the results of the above calculations, the value of each Certainty Factor (CF) is obtained, namely:

1. Ringworm : 33,62 %
2. Sporotrichosis : 32,16%
3. Stuid tail : 30,42%
4. Scabies : 75,42%
5. Eosinophilic graunuloma : 27,4%
6. Alergic Dermatitis : 31,51%
7. Fline acne : 78,8%
8. Flea / massage : 24,11%
9. Abscesses : 19,25%
10. Pemhphigus : 32,51%

TABLE I

No.	Skin Disease	Symptoms	Weight
1.	Ringworm	1. Generally itching on a cat's body	0,8
		2. Scratching - scratching your body excessively	0,7
			0,6
		3. Feathers fall out too much	0,4
		4. There are bald spots	0,4
		5. Skin looks dry / scaly	0,4
		6. There is a circular wound on the head, ears and forearm	0,4
		7. Feathers fall out on the edge of a circular wound	0,3
		8. There is a crust in his body area	0,3
		9. Cat hair looks broken	0,2
		10. Fur looks reddish	
2.	Sporotrichosis	1. There is an infection on the part of the body (especially on the nose and face), feet and tail	0,4
		2. Swelling of the body area	0,2
		3. Fever	0,2
		4. Loss of appetite	0,2
3.	Stuid tail	1. Tails of hair that fall out	0,6
		2. Fur becomes dull	0,3
		3. There is chocolate like a candle at the tail end	0,2
		4. Feathers look oily	0,2
		5. Removes an unpleasant smell	0,2
4.	Scabies	1. Generally itching on a cat's body	0,8
		2. Feathers fall out too much	0,6
		3. There are bald spots	0,4
		4. There is crust in the body area	0,3
		5. The skin looks reddish	0,2
		6. Red lesions appear on the surface of the skin	0,2
		7. Usually starts to appear on the tips of the ears and palms	0,2

5.	Eosinophilic graunuloma	1. Scratching - excessive body scratching	0,7
			0,3
		2. Wet wounds behind the neck / thigh are visible	0,2
		3. Skin looks reddish	0,2
		4. Swollen mouth or chin (edema) such as boils / thrush	
6.	Alergic Dermatitis	1. Scratching - excessive body scratching	0,7
		2. Feathers fall out too much	0,6
		3. Biting your feet	0,5
		4. Inflammation of the wound	0,4
		5. Skin looks reddish	0,2
7.	Fline acne	1. Acne around the chin	0,3
		2. Festering odor	0,2
		3. This wound is in the form of a lump	0,2
		4. Blackheads	0,2
8.	Flea / massage	1. Scratching - excessive body scratching	0,7
		2. Thinning of hair above the base of the tail	0,3
		3. Pale fur and blackish dirt	0,2
9.	Abscesses	1. Sometimes hair loss (bald in the area of the abscess)	0,5
		2. Festering smell	0,2
		3. This wound is in the form of a lump	0,2
		4. Swelling of the body area	0,2
		5. Fever	0,2
		6. Pain	0,2

IV. Discussion

Every symptom of skin disease in cats has their own weight values. The weight of this value represents the belief of an expert in this case a veterinarian (named Drh. Indahlia S.B served in the PRO VET clinic) on a symptom that affects the occurrence of a particular disease. The following table 1 shows the weight of symptoms found in skin diseases in cats.

The application of the formulation of the certainty level of Scabies in cats is shown, generally itching in the cat's body, excessive hair loss, bald spots, crust in the body area, reddish skin, red lesions appearing on the surface of the skin, usually starting at the ear and Palm. The application of the formulation of the level of certainty of Eosinophilic Granuloma in cats shows, scratching - scratching the body excessively, visible wet wounds behind the neck / inner thighs, reddish skin, mouth or swollen chin (edema) such as boils / thrush.

Application of the formulation of the level of certainty of Alergic disease Dermatitis in cats is shown, scratching - scratching the body excessively, excessive hair loss, biting of the soles of the feet, inflammation of the wound, reddish-looking skin. The application of the formulation of the level of certainty of Feline acne in cats is shown, pimples around the chin, pus which emit odors, these wounds are in the form of lumps, blackheads. The application of the formulation of the level of certainty of the disease / massage in cats is shown, scratching - scratching the body excessively, pressing the hair above the base of the tail, the color of the hair is pale and dirty black.

Application of the formulation of the certainty level of disease Abscesses in cats are shown, sometimes - hair loss (bald in the area of the abscess), suppurating odor, this form of lumps, swelling in the body, fever, pain. The application of the formulation of the level of certainty of Pemphigus disease in cats is shown, generally itchy on the cat's body, excessive hair loss, shallow wounds (small hole-shaped wounds), lethargic / thinner, reddish-looking skin.

The weight of the user's answer

Yes : 0,6
No : 0,4

Based on the results, the higher accuracy is alergic dermatitis and the second higher accuracy is scabies based on the factors.

V. Conclussion

The conclusions that can be taken from the preparation of this research are:
a. With the help of a system to determine cat disease with the CF method, it will be easier to detect accurately and quickly.
b. By determining symptoms through a system that is built by the community or the voter of the cat has determined the type of disease and the solution
c. Successfully implemented a system for determining cat disease by applying the CF method as a solution.

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