CHECKING CAT DISEASES SYMPTOMS SYSTEM USING RULE-BASED TECHNIQUE

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ABSTRACT

Checking Cat Diseases Symptoms System Using Rule-based Technique (CCDS) is a system that mimics the role played by a veterinarian to diagnose cat disease. CCDS is aimed to change manual disease diagnosis into computerized and recommendation the solution for the treat the disease. The purpose of CCDS is to save cat owner's time, energy and money. User need to answer questionnaire to diagnose what disease is suffering by their cat and to know the solution. The prototype of this system use rule-based expert system technique. This technique will replace most of the human task and can determine the solution for treat cat disease based on rules and constraints.

ABSTRAK

Sistem Memeriksa Gejala Penyakit Kucing dengan menggunakan Teknik "Rule-based" (CCDS) adalah sebuah sistem yang meniru peranan yang dimainkan oleh seorang doktor haiwan untuk mendiagnosis penyakit kucing. CCDS bertujuan untuk menukar diagnosis penyakit secara manual kepada sistem berkomputer dan memberi cadangan penyelesaian untuk mengubati penyakit tersebut. Tujuan CCDS dibangunkan adalah untuk menjimatkan masa, tenaga dan wang pemilik kucing. Pengguna harus menjawab soalan-soalan untuk mendiagnosis penyakit apa yang dihidapi oleh kucing mereka dan mengetahui penyelesaiannya. Prototaip sistem ini menggunakan teknik berasaskan "rule-based expert system". Teknik ini akan menggantikan sebagian besar tugas manusia dan dapat menentukan penyelesaian untuk mengubati penyakit kucing berdasarkan pada peraturan dan kekangan.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

An expert system is artificial intelligence application software that created to reproduce the performance of human experts in a specific problem domain. Expert system uses a knowledge that gathered from human experts, analogous to a database but containing rules that may be applied to solving a specific problem. (en.wikipedia.org)

Typically, such a system contains a knowledge base containing accumulated experience and a set of rules for applying the knowledge base to each particular situation that is described to the program. Sophisticated expert systems can be enhanced with additions to the knowledge base or to the set of rules. (http://searchcio-midmarket.techtarget.com/)

The 'Checking Cat Diseases Symptoms System Using Rule-based Technique (CCDS)' is developed to mimic the role played by a veterinarian. This system has two main functions consist of diagnosis and solution. The user will answer questionnaire to diagnose what disease is suffering by their cat. After that, the system will give solution to the user such as list of medicines. If their cat

suffered a chronic disease, they can bring their cat meet veterinary for treatment. With the early step, the percent of the cat recover is higher.

CCDS is a prototype web based and can used at any places which have the internet application and network communication field. CCDS can make ease for the cat owner where they can use the system that act as expertise.

1.2 Problem Statement

Statistics were compiled from the American Pet Products Manufacturers Association (APPMA) 2007-2008 National Pet Owners Survey shown that there are approximately 88.3 million owned cats in the United States (http://www.hsus.org/). The statistic shown many people adore cat as their pet. But they did not take seriously about their cat healthy. Many cat owners did not seek veterinary care for their animals because they did not even have time to bring their pet meet veterinary due to hectic schedule. Besides that, the cost of veterinary visit is too expensive that burden to owner who has small salary. Usually veterinary clinic only has in city. It makes the cat owners who live in rural area is difficult to bring their pet to meet veterinary.

This system is for cat owners who want to know their cat diseases without meet veterinary. They need to answer questionnaire to identified type of disease that suffer by their cat. It make cat owners can take early step to avoid the disease become worse. This system helps the cat owner to solve their problems mentioned above.

In this thesis, problems are investigated according to these questions:

i. What is the best solution to replace manual technique in checking symptoms cat diseases?
ii. How the system that will be developed can save cat owner's time, money and energy?

1.3 Objectives

The objectives to develop this system are:

i. To develop a prototype web-based system for checking cat skin diseases symptoms.

ii. To recommend a solution for the cat skin diseases and give care tips for the cat.

1.4 Scope

This system is developed for Windows platform and it uses the resources from pet's health website, book and also veterinary. It uses the Macromedia Dreamweaver as the system is developed in web based format. MySQL tool is used as the database management.

The scopes of this system are:

i. This system is developed for cat owners who want checking symptoms their cat skin diseases.

ii. The system will diagnose twelve skin diseases that suffer by cat according by symptoms which are ringworm, feline acne, flea allergy dermatitis, hookworms, cheyletiella, alopecia, atopy, hemangiosarcoma, demodectic mange, abscesses, pruritus and pyoderma.

iii. The solution will give after the disease has known.

1.5 Thesis Organization

Chapter 1 is the introduction of the thesis including project's problem statement, objectives and the scope of the project. Chapter is the literature review. This chapter represents research and literature review related to this project. Chapter 3 is about methodology that will be applied. Through this chapter, procedures such as project planning, design, testing and implementation will be discussed. Chapter 4 is discussing about implementation of system which are database, codes and interface. Chapter 5 is result and discussion. Advantages and disadvantages, further enhancement is discussed in chapter 5. The last chapter, chapter 6 is the conclusion of this project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter briefly discuss about literature review of Checking Cat Diseases Symptoms System Using Rule-based Technique (CCDS). Several methods and techniques from previous study are explained through this chapter. Most of the case studies are from several websites, articles, and journals based on previous researches and studies about expert system.

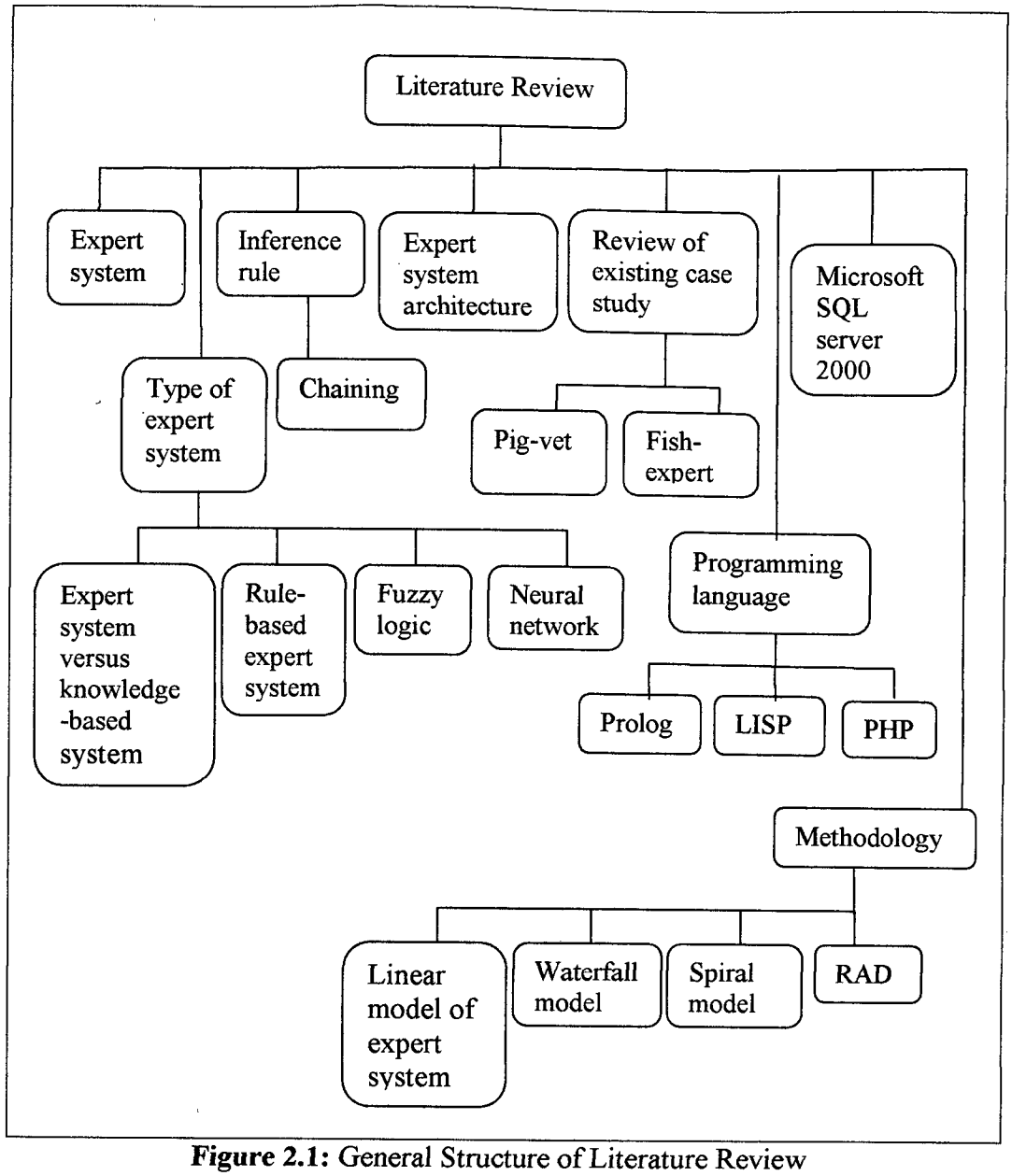

Figure 2.1: General Structure of Literature Review

2.2 Expert System

An expert system is artificial intelligence application software that created to reproduce the performance of human experts in a specific problem domain. Expert system uses a knowledge that gathered from human experts, analogous to a database but containing rules that may be applied to solving a specific problem. (en.wikipedia.org)

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These knowledge-based systems collect the small fragments of human know-how into a knowledge-base which is used to reason through a problem, using the knowledge that is appropriate. A different problem can be solved using the same program without reprogramming within the domain of the knowledge-base. The ability of these systems to explain the reasoning process through back-traces and to handle levels of confidence and uncertainty provides an additional feature that conventional programming does not handle. (www.pcai.com)

An expert system is intended to act as a human expert who can be consulted on a range of problem that fall within his or her domain of expertise. Typically, the user of an expert system will enter into a dialogue in which he or she describe the problem such as the symptoms of the fault and the expert system offers advice, suggestions, or recommendations. The dialogue may be led by the expert system, so that the user responds to a series of questions or enters information into a spreadsheet. Alternatively, the expert system may allow the users to take initiative in the consultation by allowing them to supply information without being asked for it. (Adrian A. Hopgood, 2001)

Advantages of expert system are:

i. Reproducibility - many copies of an expert system can be made, but training new human experts is time-consuming and expensive. (http://accounting.rutgers.edu/)

ii. Consistency - provides consistent answers for repetitive decisions, processes and tasks. (wiki.answers.com)

iii. Timeliness - fraud and/or errors can be prevented. Information is available sooner for decision making. (http://accounting.rutgers.edu/)

iv. Efficiency - can increase throughput and decrease personnel costs. (http://accounting.rutgers.edu/)

v. Preservation of scarce expertise – expert systems are used to preserve scarce know-how in organizations, to capture the expertise of individuals who are retiring, and to preserve corporate know-how so that it can be widely distributed to other factories, offices or plants of the company. (http://www.wtec.org/)

2.3 Type of Expert System

There are few types of expert system that can be specify as follows:

i. Expert System Versus Knowledge-based Systems
ii. Rule-based Expert Systems
iii. Fuzzy Logic
iv. Neural Network

2.3.1 Expert System Versus Knowledge-based Systems

An expert system is a type of application program that makes decisions or solves problems in a particular field by using knowledge and analytical rules defined by experts in that field. A knowledge-based system is a system that uses the knowledge provided with to solve problems in a specific domain. (www.omandev.net)

Books and manuals have a tremendous amount of knowledge but a human has to read and interpret the knowledge for it to be used. Taking this into consideration it can be said that a human cannot perform a complex problem because of the different disadvantages he/she might be facing. The disadvantage of being unreliable, speed, and not enough memory capacity would cause a human to make a mistake or be inefficient. (www.omandev.net)

Using the knowledge that is appropriate, knowledge-based systems collect the small fragments of human know-how into a knowledge-base which is used to reason through a problem. The ability of these expert systems to explain the reasoning process through which they carry is a feature which they cannot do. (www.omandev.net)

Knowledge-based system is a more general than the expert system. Expert systems are a specified domain of a knowledge based as expert system uses the representation of knowledge to solve problems. (www.omandev.net)

Figure 2.1 represents how knowledge travels from state to state to then end user interface of an expert system.

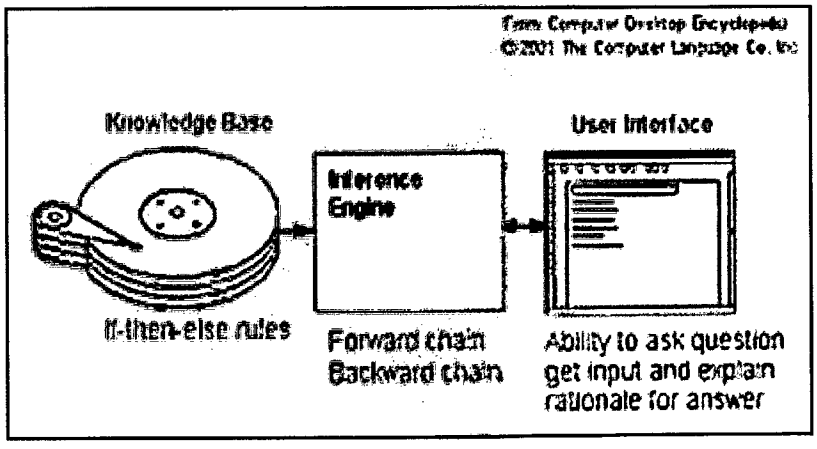

Figure 2.2: Knowledge Travel (www.omandev.net)

2.3.2 Rule-based Expert Systems

A rule-based system is knowledge-based system where the knowledge base is represented in the form of a set, or sets, of rules. Rules are an elegant, expressive, straightforward, and flexible means of expressing knowledge. (Adrian A. Hopgood, 2001)

To implement data-driven rule-based expert systems use forward chaining. Given a certain set of facts, use the rules to generate new facts until the desired goal is reached. (http://www.cs.nott.ac.uk/)

To forward chain the inference engine must:

i. Match the condition patterns of rules against facts in working memory.

ii. If there is more than one rule that could be used or fire, select which one to apply. This is called conflict resolution.

iii. Apply the rule, maybe causing new facts to be added to working memory

iv. Halt when some useful or goal conclusion is added until all possible conclusions have been drawn.

To implement goal-driven rule-based expert systems use backward chaining. Work backwards from a hypothesized goal, attempting to prove it by linking the goal to the initial facts. (http://www.cs.nott.ac.uk/)

To backward chain from a goal the inference engine must:

i. Select rules with conclusions matching the goal.

ii. Replace the goal by the rule's premises. These become sub-goals.

iii. Work backwards till all sub-goals are known to be true - either they are facts or the user provides the information.

2.3.3 Fuzzy Logic

Fuzzy logic is a form of multi-valued logic derived from fuzzy set theory to deal with reasoning that is approximate rather than precise. In contrast with binary sets having binary logic, also known as crisp logic, the fuzzy logic variables may have a membership value of not only 0 or 1. The term "fuzzy logic" emerged as a consequence of the development of the theory of fuzzy sets by Lotfi Zadeh. (en.wikipedia.org)

Earlier than Zadeh, a paper introducing the concept without using the term "fuzzy" was published by R.H. Wilkinson in 1963 and thus preceded fuzzy set theory. He did this by first creating various linear voltage ramps which were then selected in a "logic block" using diodes and resistor circuits which implemented the maximum and minimum Fuzzy Logic rules of the INCLUSIVE OR and the AND operations respectively. (en.wikipedia.org)

2.3.4 Neural Network

An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements (neurones) working in unison to solve specific problems. ANNs, like people, learn by example. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process. Learning in biological systems involves adjustments to the synaptic connections that exist between the neurones. (www.doc.ic.ac.uk)

Neural networks, with their remarkable ability to derive meaning from complicated or imprecise data, can be used to extract patterns and detect trends that are too complex to be noticed by either humans or other computer

techniques. A trained neural network can be thought of as an "expert" in the category of information it has been given to analyse. This expert can then be used to provide projections given new situations of interest and answer "what if" questions. (www.doc.ic.ac.uk)

Neural networks process information in a similar way the human brain does. The network is composed of a large number of highly interconnected processing elements (neurones) working in parallel to solve a specific problem. Neural networks learn by example. They cannot be programmed to perform a specific task. The examples must be selected carefully otherwise useful time is wasted or even worse the network might be functioning incorrectly. The disadvantage is that because the network finds out how to solve the problem by itself, its operation can be unpredictable. (www.doc.ic.ac.uk)

2.4 Inference Rule

An understanding of the "inference rule" concept is important to understand expert systems. An inference rule is a statement that has two parts, an if-clause and a then-clause. (www.i2osig.org)

An expert system's rule base is made up of many such inference rules. They are entered as separate rules and it is the inference engine that uses them together to draw conclusions. One advantage of inference rules over traditional programming is that inference rules use reasoning which more closely resemble human reasoning. (en.wikipedia.org)

2.4.1 Chaining

There are two main methods of reasoning when using inference rules: backward chaining and forward chaining.

Forward chaining starts with the data available and uses the inference rules to conclude more data until a desired goal is reached. An inference engine using forward chaining searches the inference rules until it finds one in which the if-clause is known to be true. It then concludes the then-clause and adds this information to its data. It would continue to do this until a goal is reached. Because the data available determines which inference rules are used, this method is also called data driven. (www.i2osig.org)

Backward chaining starts with a list of goals and works backwards to see if there is data which will allow it to conclude any of these goals. An inference engine using backward chaining would search the inference rules until it finds one which has a then-clause that matches a desired goal. If the if-clause of that inference rule is not known to be true, then it is added to the list of goals. (www.i2osig.org)

2.5 Expert System Architecture

Figure 2.2 shows the most important modules that make up a rule-based expert system. The user interacts with the system through a user interface which may use menus, natural language or any other style of interaction. Then an inference engine is used to reason with both the expert knowledge and data specific to the particular problem being solved. (http://www.macs.hw.ac.uk/)

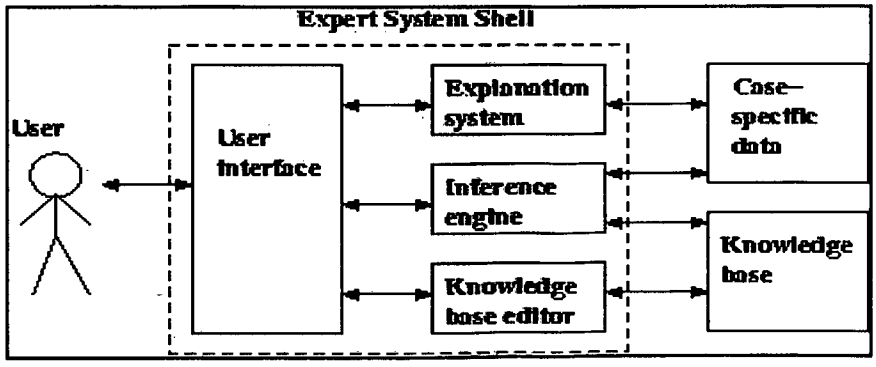

Figure 2.3: Expert System Architecture (http://www.macs.hw.ac.uk/)

As we see in the figure 2.2, the shell will provide the inference engine and knowledge representation scheme, a user interface, an explanation system and sometimes a knowledge base editor. Given a new kind of problem to solve, we can usually find a shell that provides the right sort of support for that problem, so all we need to do is provide the expert knowledge. (http://www.macs.hw.ac.uk/)

2.6 Review of Existing Case Study

There are a lot of expert systems being built that is very useful to many people. In this section, only focused on two expert systems as following:

i. Pig-vet: a web-based expert system for pig disease diagnosis
ii. Fish-Expert: a web-based expert system for fish disease diagnosis

2.6.1 Pig-vet: a web-based expert system for pig disease diagnosis

Fu Zetian, Xu Feng, Zhou Yun, Zhang XiaoShuan (2005) describes Pig-Vet, a web-based expert system for pig disease diagnosis, has been developed by Key Laboratory for Modern Precision Agriculture System Integration, Ministry of Education at China Agricultural University. It was a major outcome of Technology Research Project (863 projects). The paper analyzes users' needs and describes the architecture, main components, and their functions. The system has over 300 rules and 202 images and graphics for different types of diseases and symptoms. It can diagnose 54 types of common diseases of pigs. (Zetian, Feng, Yun, XiaoShuan, 2005)

To better meet the needs of farmers and acquiring part of knowledge of pig disease, a questionnaire was designed to investigate the farmers' problems and needs. The questionnaire includes four components:

i. The first requested the profiles of the participants within the pig industry, including his name, age, the experience in sty, and the site of the sty. There into, the experience in sty and the site of the sty are very important factors, the former is relation to the correctness of data and the later will be used during analyzing the difference of pig disease among these areas.

ii. The second component of the questionnaire is required the interviewee to answer lots of question about the forward inference. To understand the mechanism of disease diagnose, the reasoning machine that can affect it must first be found. The interviewee should select some symptom when pig suffered from some disease, and be required to give the probability of symptom.

iii. The third component of the questionnaire required the participants to select the pathogeny. The experts do consider subjective factors as important in their disease diagnose process. Each of the cause should be weighted to indicate their relative importance.

iv. The last competent of the questionnaire made a general survey. For example, the most common species of pig farmers breed, the most common pig diseases or symptoms farmers encounter, the farmer's own experience in identifying, treating and preventing pig disease, which they believe, can be shared by other farmers, help needed to tackle pig disease problem and expected help and support functions from a computer-based system. It explores how an effective Pig-Vet system can be a valuable and viable tool as a support role for diagnosing pig disease.