IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY
RABIES DISEASE DIAGNOSIS EXPERT SYSTEM WITH WEB-BASED CASE REASONING USING NEAREST NEIGHBOR ALGORITHM IMPLEMENTATION

Sardjoeni Moedjiono*, Jean Mailissa, Aries Kusdaryono
* Budi Luhur University, Jakarta, Indonesia
Budi Luhur University, Jakarta, Indonesia
Budi Luhur University, Jakarta, Indonesia

ABSTRACT
Rabies is an acute infectious disease, attacks the central nervous system caused by a virus and cause death. The rabies virus can affect all warm-blooded animals and humans. The research is an initiative of researchers with the aim of providing a solution to every patient with rabies. Web-based expert system is a system that is designed to be accessed and used by any user to experience and feel the early symptoms caused by rabies virus. Expert systems are designed as a system created by the method of Case Base Reasoning using Nearest Neighbor algorithms as a method to the working equalize the case of the old with a new case so as to produce a more accurate solution, so patients with infections caused by rabies viruses will more quickly get treatment and medication.

KEYWORDS: Expert System, Rabies Virus, Case Base Reasoning, Nearest Neighbor algorithm

INTRODUCTION
Rabies otherwise known as Lyssa, Tollwut, Hydrophobia, or known as hydrophobia are viral infection and acute nervous system that is characterized clinically progressive paralysis and ends in death. The disease can infect all warm-blooded animals and is a problem in humans because it is zoonotic (transmitted from animals to humans). Rabies in Indonesia was first discovered in the buffalo by Esser (1884), dogs by Penning (1889), and in humans by Evde Haan (1894) were the three found in West Java, Central Java and East Java (1953), North Sumatra (1956), South Sumatra and North Sulawesi (1958), South Sumatra (1959), Aceh (1870), Jambi and Yogyakarta (1971), East Kalimantan (1974), Riau (1975), Central Kalimantan (1978), South Kalimantan (1983), Flores NTT (1997), the island of Ambon and Seram Island (2003).

Rabies in humans have caused many casualties. From 1977 to 1978, eleven provinces recorded 142 cases of rabies in humans. During the period 1979-1983 in Indonesia has reported 298 cases of rabies with an average of 60 cases per year. The spread of rabies area walking until now. In the decades nine dozens of events on the island of Sumatra annually no less than 1000 cases of rabies animal were found to suffer. While cases of rabies were reported on the island of Flores during the years 1997-2005 from 11786 the number of animal bite rabies, a total of 149 confirmed deaths (1.35%). In the last five years (2009-2013) the average number of cases of rabies animal bites are 79299 cases per year and an average of 66744 cases of anti-rabies vaccine.

With the rate of deaths caused by rabies vector through a bite, then the information needs quickly and accurately from a health expert is required. This has encouraged the development of an expert system diagnosis of rabies by requesting data from the patient's symptoms. Diagnosis will be processed in the system, then the results will be submitted again to the patient.

Expert systems should be equipped with a facility that can provide assurances as to the value of the system output. Many options can be used to calculate the value of the uncertainty of the system output. However, in this study using Case Base Reasoning with the application of Nearest Neighbor algorithms to process the problems posed by the use of the solution in the previous case that has similarities and at the same time looking for the highest weight so that the end result of the knowledge base will contain the solutions that have been achieved previously, then lowered a solution to the current situation (facts).

THEORETICAL BASIS
Understanding Expert System
According Arhami (2005: 3), Expert System is one of branch that makes extensive use of Knowledge specific to the settlement level of human experts. According Kusrini (2008: 3), the expert system is a computer-based application that is used to solve the problem, as is thought by experts. Specialists here are people who have special skills that can solve problems that cannot be resolved by the layman. Arifin (2003: 183), Expert system is a system that aims to make decisions more quickly than experts. According McLeon (2008: 537), expert systems (expert systems) is a computer program that attempts to show that expert human knowledge in the form of heuristic.

From the above understanding, it can be concluded that the definition of an expert system is a system that is trying to adopt human knowledge into a computer that is designed to model the ability to solve problems like an expert.

Expert System Components
The components of an expert system and the following description of each component (Sri Kusumadewi, 2003), namely:
1. Subsystem expansion of knowledge. This section is used to enter the knowledge, construct or expand knowledge in the knowledge base. Knowledge of the bias comes from the book, experts, databases, studies, and drawings.
2. Knowledge Base. Contains the knowledge needed to understand, formulate and solve problems.
3. Monitor Inference (Inference engine). The program contains the methodology used to conduct the reasoning of the information knowledge base and blackboard, and is used to formulate conclusions.
4. Blackboard. An area in memory that is used to record ongoing events including temporary decision.
5. Media interface is used for communication between the user and the program.
6. Subsystem explanatory. Used to track respond and give an explanation about the behavior of expert system interactively through the questions.
7. Filter system knowledge. This system is used to evaluate the performance of the expert system itself to see if the knowledge is still suitable for use in the future.

Case Base Reasoning
Case Base Reasoning (CBR) or case-based reasoning is a problem-solving approach that emphasizes previous experience for solving future problems or in other words a new problem solved using it again and if necessary adapt the solutions to similar problems are solved in the past (Mantaras, et al., 2005, p.2). CBR is a problem solving paradigm in many ways fundamentally different from the approach of other major artificial intelligence. Only rely on general knowledge about an issue, or make associations throughout relations prorated between problem descriptions and conclusions, CBR is able to use the knowledge of the experience of the specific previous situations real problems (cases). A new problem is solved by finding a similar past cases, and reuse in new problem situations (Aamodt & Plaza, 1994, pp.39-40). The advantage to using CBR is (Pal & Shiu, 2004, p. 9):
1. Reducing the task of knowledge acquisition.
2. Avoid repeating the mistakes made in the past.
3. Providing flexibility in modeling knowledge.
4. Reasoning on matters not yet fully understood, defined, or modeled.
5. Make a prediction of the likelihood of success of the solutions presented.
6. Learning from time to time.
7. Reasoning in a problem with little knowledge.
8. Reasoning with data and concepts that are incomplete or incorrect.
9. Avoid repeat all the steps that need to be taken to achieve a solution
10. Providing annotation tools.
11. Extending for different purposes.
12. Expanding to various problems.
13. Reflects human reasoning

There are four steps in the CBR system depicted circular (Aamodt & Plaza, 1994, p.7):
1. *Retrieve*, the process of obtaining a similar case to be compared with the set of cases in the past. This process begins with the stage of recognition of the problem and ending when the case you want to find a solution has been found resemblance to a case that already exist. The stages that exist in retrieving this is as follows:
   a. Identification of problems.
   b. Started Matching.

   c. Selecting.
2. Reuse, i.e. the process of re-use of existing cases (past cases) that is used to find solutions to new problems (now problems). Reuse a case in the context of new cases focused on two aspects, namely the difference between the existing case with a new case and which parts of retrieving case that can be used to scan and reuse of cases that have been there, namely reuse the solution of the cases that have been there (reuse transformation).
3. Revise, i.e., the process of change and adopt solutions that offer if necessary. At revise this stage there are two main tasks are:
   a. Evaluation Solution, which is how the results obtained after comparing the solution with the actual situation. In this evaluation phase often takes a long time depending on what applications are being developed.
   b. Fix, improvements include the introduction of a case of a mistake made solutions and take or make a description of the error.
4. Retain, that this process still uses the latter solution as part of a new case. At this stage there is a process of incorporation of new cases the correct solution to the existing knowledge. There are three phases include: extract, index and integrate.

Nearest Neighbor algorithm

Nearest Neighbor algorithm technology is probably the most widely used in CBR method as provided by most devices CBR (Watson, 1997, p.12). Nearest neighbor algorithm is an approach to looking for a case with the closeness between the new cases with old cases, which is based on the suitability of the weight of a number of existing features (Kusrini & Emha T., 2009, p.9). This method of finding the distance to the destination of the data that has been stored previously. Having obtained the distance is then searched the shortest distance. The closest distance that is used to search for identity purposes. Nearest neighbor algorithm is classified into two types, namely 1-NN and k-NN. If the 1-NN classification process is performed on the data label nearest 1 whereas if k-NN classification process is performed on the data label nearest k (k> 1) (Yu, Ji, & Zhang, 2002). In the process of processing both equally new data to calculate the distance to each label data is then determined the data label that has the closest distance or minimum.
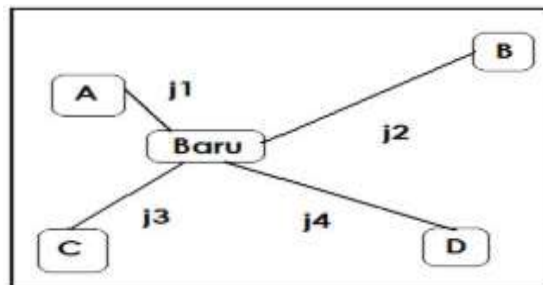

F*igure 1. Nearest Neighbor Algorithm Illustration Case*

The illustration on the image above there are new patients and 4 patients long (A, B, C, and D). When there is a new patient then taken solution is the solution of the case of older patients who have the greatest proximity. J1 is the distance between new patients with patient A, J2 is the distance between a new patient with the patient B, J3 is the distance between a new patient with the patient C, J4 is the distance between a new patient with the patient D. From the illustration shows that the closest J1 with new cases. Thus, the solution of the case of a patient that will be used as a solution of new patients. The formula used in the calculation of proximity (similarity) is as follows (Kusrini & Emha T., 2009, p. 3):

$$Similarity\ (problem, case) = \frac{s1*w1 + s2*w2 + \ldots + sn*wn}{w1 + w2 + \ldots + wn}$$

Description: s = similarity ; w = weight.
Closeness value is between 0 and 1. A value of 0 means that the two cases are not similar absolute or not the same, contrary to the absolute value of 1 both cases are similar or the same.

Rabies

Rabies is also called hydrophobia is an acute infectious disease of the central nervous system caused by rabies virus. This disease is zoonotic disease that can be transmitted from animals to humans through the bite of animal rabies. This disease has been known since centuries ago and is a frightening disease for humans because the disease always ends with death. The disease causes sufferers are tormented by thirst and yet afraid of the water. Rabies is fatal in both animals and humans, almost all patients showed clinical symptoms of rabies (encephalomyelitis) will end with death.

Clinical Symptoms In Humans

According to (Mulyono 2008), the clinical symptoms experienced by humans who are infected with rabies include four stages, namely:

1. Prodromal Stadium
   In the early stages the symptoms are fever, fatigue, lethargy, loss of appetite / anorexia, insomnia, severe headache, sore throat and pain are often found.
2. Sensory Stadium
   At this stage often found tingling or burning sensation (paresthesia) at the site of the bite, anxiety and exaggerated reaction to sensory stimulation.
3. Stadium Eksitation
   At this stage, patients experience a wide variety of neurologic disorders, the patient looked confused, agitated, hallucinating, looking scared accompanied by changes in behavior becomes aggressive, and their assortment of phobia that is hydrophobia, fear of flying, photophobia. Hydrophobie a typical symptom of rabies because it was not found in patients with other encephalitis. Other symptoms of muscle spasm, hiperlakrimasi, hypersalivation, hyperhidrosis and dilated pupils. After a few days the patient died of heart and respiratory Karen ahenti. Of all patients with rabies as much as 80% will experience eksipasi stage and duration of pain for this stage is 7 days with an average of 5 days.
4. Stadium Paralysis
   Other form, paralytic rabies, this form reaches 30% of all cases of rabies and sick time longer than the furious form. This form is characterized by muscle paralysis gradually starting from the former scratches. Loss of consciousness develops slowly and eventually die due to respiratory and cardiac muscle paralytic. In patients with paralytic symptoms are often mistakenly diagnosed and underreported. The duration of pain for the type of paralytic rabies is 13 days, longer than the type of furious.

Framework

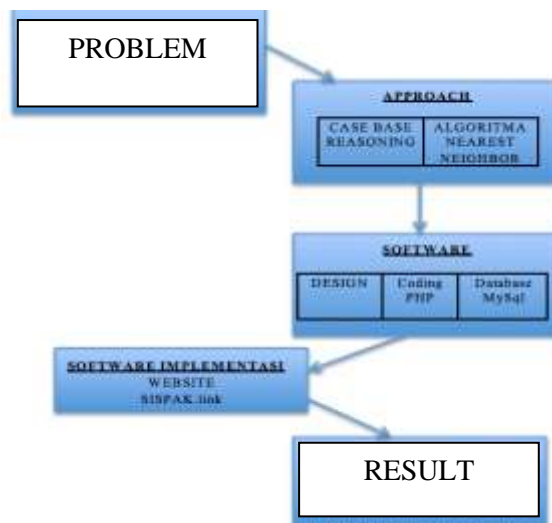Broadly speaking, the framework of thinking can be described as follows:

Figure 2. Framework

Below is an explanation of the mindset to determine an accurate solution to rabies:

1. Problem
   Patients showing symptoms - Clinical symptoms experienced by the patient according to the patient's physical state.

2. Approach

CBR method approach and the application of Nearest Neighbor algorithm underlying intelligent system designed.

3. Software

Software used in building intelligent systems (expert systems), namely, PHP, MySql and design.

4. Software Implementation

Software implementation that is used for all patients with rabies throughout Indonesia can access that sispak.link.

5. Result

CBR method and application of Nearest Neighbor algorithm can generate more accurate solution.

METHODOLOGY AND RESEARCH DESIGN

Research methods

The method used in this research is the method Reasoning Base Case. Base Case Reasoning on this research aims to solve a problem or a new case which refers to the previous cases using the Nearest Neighbor algorithm. In this method the user can operate directly with the web application to answer the questions posed by the system symptoms. Questions according to the knowledge base, the system will begin to look for symptoms prior to the symptoms and then the system will provide disease information. The system can also provide an alternative prevention and treatment of rabies to suggest remedies and therapies that can be done by the patient as well as more intensive treatment referrals if needed.

Sample Selection Methods Research

The sample of this study include the veterinarian (1) and the employees of the health ministry (20). Samples taken from the physicians and employees as a patient. In order to more accurately study the authors used a questionnaire containing some questions around knowledge of rabies.

Data Collection Methods

Methods of data collection in this study is:

1. Observation

Observation is a systematic observation activities planned and the results are recorded and interpreted in order to gain an understanding of the object observed.

1. Interview

Interviews were conducted with experts in the field of rabies at the Ministry of Health.

3. Literature

Literature study was used to find the necessary information about the expert system that is by reading books and searching for references relating to the development of expert systems with Case Base Reasoning method using Nearest Neighbor algorithm.

4. Documentation

The data collection is done by studying the documents of the Ministry of Health of the Republic of Indonesia.

5. Questionnaires

Questionnaire containing questions to be answered by the respondent. The purpose of this questionnaire was to find out the knowledge of the respondents about rabies.

Instrumentation

The research instrument was a tool or facility used by the author in collecting data in order to work more easily, and the result is better, in the sense of a more thorough, complete, and systematic so more easily processed. This study reviewing literature, where the author studied the literature on disease Rabies and spread using a questionnaire to obtain data and input so that it can set up the desired model. The author prepared a form that contains a list of functional requirements of the system built.

Data Analysis Techniques

The Mechanical Analysis of Rabies disease described in picture research steps as follows:

THOMSON REUTERS
ENDNOTE

[Moedjiono* *et al.,* 6(2): February, 2017]
IC™ Value: 3.00

ISSN: 2277-9655
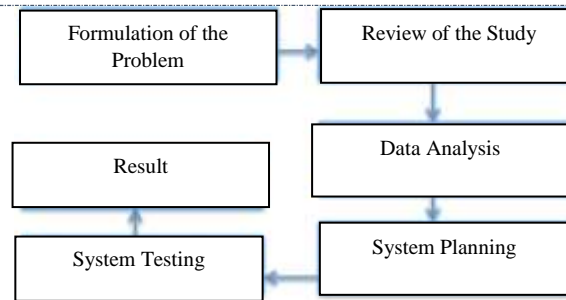**Impact Factor: 4.116**
CODEN: IJESS7

Figure 3: Steps of study

Explanation of above research steps can be explained as follows:
1. Problem Formulation
    Formulation of the problem is the first step in this study. How to conduct interviews with staff about rabies. The result obtained is a clear picture of the dangers of rabies virus infection resulting in death.
2. Study Overview
    Study Overview done is to read various references relating to the formulation of the problem. Analyzing the data of patients with symptoms caused by rabies virus.
3. System planning
    The design of the system is a step to build an intelligent system to produce something useful for the people in overcoming the spread of rabies in the area where they live.
4. Systems Testing
    System testing is done so that the final result obtained appropriate and precise so that the resulting solution can be useful for patients.
5. Result
    Early results are solutions in the form of information about the type of rabies in the suffering and the first step in treating rabies virus.

DISCUSSION
Design Home Administrator
The main page is the main page administrator on the administrator to perform all activities within the system. On the main page there is a menu that can be accessed directly as menu diseases and solutions, symptoms menu, menu CBR relations, reports and logout menue. It looks like in Figure 4 below:
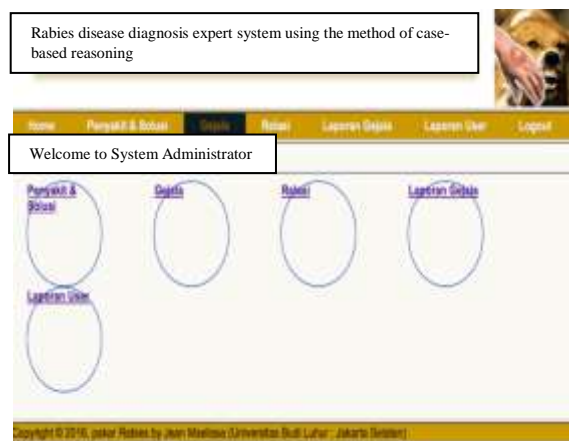

Figure 4. Home Administrator

Registration Form Design diagnostic

User registration form is used to register for the user application. Registration diagnostic is done first before the diagnosis is complete the patient personal data to input data such as the patient's name, sex, age of the patient, and email address. Furthermore, the patient pressing the registration and if the registration is successful, the data will be stored in the table and the patient will be directed to a page diagnosis. The zoom can be seen in Figure 5 below:
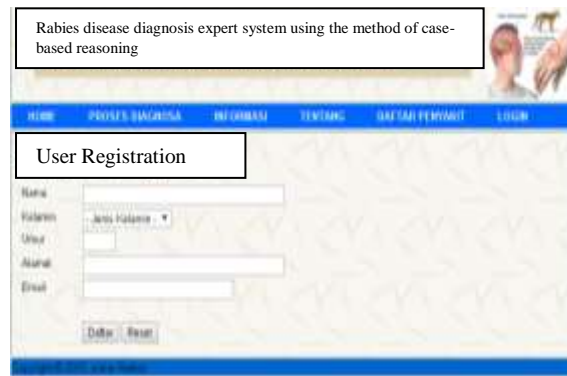

Figure 5. Registration Form diagnostic

Diagnosis Form Design / Consulting

Form disease diagnosis is used to select the disease suffered by the patient to make the process of diagnosis and get results. Patients who perform diagnostics can select some of the symptoms that may be experienced by the patient and can choose more than one symptom with any choice by the symptoms experienced. After selecting the symptoms, the patient can press the diagnostic process to get a diagnosis on the diagnosis results page. The zoom can be seen in Figure 6.

Figure 6. Form Diagnosis / Consulting Disease

Diagnosis Process Results Page Design

The results page is used to display the results of the process of diagnosis. The results of the diagnosis process with the identity of diagnostic displays results at the top, then the information displayed symptoms preselected at the stage of diagnosis, and diagnosis at the bottom to display the name of the disease is detected, explanations and solutions to disease definition of Rabies disease.
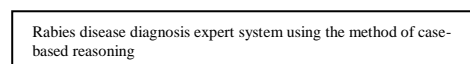
Figure 7. Diagnostic Results Page

Implications of Research Results

Once the rabies expert system is implemented in an application system, there are three aspects of the implications of the applications that have been implemented, namely the aspect of the system, managerial aspects, and aspects of advanced research.

System Aspects

From the aspect of the system implications of the research, namely Software. The implications of the software is not very significant, because the software used general nature such as the browser used to display system, MySQL as the database server, Apache as the web server and hosting.

Aspects of Advanced Research

Rabies is an expert system could be further developed so that it can truly be applied in hospitals and health organizations function as an educational counselor symptoms of rabies introduction and delivery of information. In addition, the future is also expected to be integrated with all existing platforms.

CONCLUSION

Based on the results of the discussion on the theory of disease diagnosis expert system design Rabies can be summarized as follows:
1. Web-based system can be accessed by all users for systems that run on the web application.
2. Rules-based system with Case Based Reasoning method capable of detecting diseases by method of comparison between the old case with a new case and look for the value of the resemblance so on get the solution.

BIBLIOGRAPHY

[1] Dhaliwal, D. S., Sandhu, P. S., & Panda, S. (2011). *Enhanced K-Nearest Neighbor Algorithm. World Academy of Science, Engineering and Technology*, 681-686.
[2] Erna Suwitno, (2004) "Sistem Pakar Dalam Pengobatan Penyakit Tiroid Berbasis Android Menggunakan Metode *Case Based Reasoning*", Jurnal Informatika.
[3] Imama, C., & Indriyanti, A. D. (2013). Penerapan *Case Based Reasoning* dengan Algoritma *Nearest Neighbor* Untuk Analisis Pemberian Kredit di Lembaga Pembiayaan. *Jurnal Manajemen Informatika, Vol 2, No.1*, 11-21.
[4] Kusumadewi dan Purnomo, 2010). Pengantar Dasar Komputer, Wahana : Jakarta.
[5] Marimin (2005), "Sistem Pakar Dan Sistem Pengambilan Keputusan", Graha Ilmu : Jakarta.
[6] Opim, (2012), "Aplikasi Sistem Pakar Berbasis Android Untuk Diagnosa Penyakit Dalam Dengan Pengobatan Obat Tradisional", Jurnal Informatika.
[7] Prasetio, (2006) ,"Implementasi Sistem Pakar Untuk Diagnosis Penyakit Umum Dan Membantu Pengambilan Keputusan Pemilihan Obat", Jurnal Informatika.
[8] Sankar K. Pal, Simon C. K. Shiu. "*Foundations of Soft Case-Based Reasoning*". Canada: *Published by* John Wiley & Sons, Inc., Hoboken, New Jersey.