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Expert System of Diagnosing Chikungunya Disease by Certainty Factor Method

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ABSTRACT

One of the diseases distributed in the population is chikungunya fever transmitted by viruses from the genus Alphavirus, Togaviridae family, and transmitted by Aedes' bite aegypti and Ae mosquitoes. Virus albopictus involved. Chikungunya (CHIK) has three distinct symptoms: fever, joint pain (arthralgia), and skin infection (rash). Chikungunya (CHIK) is a self-limiting illness, and Chikungunya fever (CHIK) is not treated individually. Treatment efforts are symptomatic. Controlling and considering this disease is the right initiative. One consideration that can be achieved using expert system analysis is to use the form of certainty factor to derive the certainty value.

1. Introduction

Chikungunya fever is a type of infectious disease with the main symptoms of sudden fever, joint pain including the knee joint, wrist, toes and hands and spine accompanied by a rash (reddish spots) on the skin caused by a type of Chikungunya virus, Genus Alphavirus, Family of Togaviridae. Chikungunya fever is a disease caused by viruses transmitted to humans through the mosquito of the genus Aedes. In dealing with this disease, the sufferers of Chikungunya disease still do not know about its symptoms. This happened because of a lack of information. The current information is elementary to obtain. It is just that there is a need for media or easy access to get the right information that comes from experts or people who are experts in a particular field. A disease sufferer needs information about the illness before consulting a doctor so that easy access to information is needed for sufferers to find out about the illness. One of them is the existence of an expert system to diagnose the disease based on the sufferer's symptoms, which then produces information about the disease. An expert system is a system that attempts to adopt human capabilities or knowledge into a computer. Computers can solve a problem like an expert or someone who has expertise in a particular field, namely experts who have the knowledge or special abilities that are unknown and owned by others. The expert system is a branch of Artificial Intelligence (AI). Research with similar themes, namely expert systems for diagnosing diseases, has been investigated in previous studies. One is an expert system for diagnosing diseases of the respiratory and pulmonary tracts that can identify disease by documenting information or knowledge from experts with the conclusion search method using the Certainty Factor method. Another study is an expert system used to diagnose stroke types with the CF method (Certainty Factor) to obtain certainty. This expert system can be used to diagnose chikungunya disease by applying it to the certainty factor method.

Chikungunya (CHIK) is a disease caused by a virus from the genus Alphavirus, family of Togaviridae, and transmitted by the bite of Aedes aegypti and Ae mosquitoes. albopictus, who was infected by the virus. Robinson and Lumsden first reported the disease after the outbreak in the Makonde valley in 1952. As with malaria and dengue, this disease has become endemic in countries in Africa and Asia. Moreover, it has caused an outbreak in places. CHIK is characterized by three distinct symptoms (trias), namely fever, joint pain (arthralgia), and skin rash (rash). CHIK is a self-limiting disease, and there is no specific treatment for CHIK fever. Treatment efforts are only symptomatic; therefore, vector control is a reasonable effort to prevent disease [1]. One of the vector-borne diseases that outbreaks in the community are chikungunya fever, which the carrier is the mosquito vectors derived from the genus Aedes aegypti and Aedes albopictus. The disease is not as dangerous as malaria or dengue fever that can lead to death. Chikungunya virus is a self-limiting disease. Losses resulting from this disease are the decline in labor productivity due to loss of opportunity because of its symptoms. This review describes the epidemiology of the chikungunya virus and the problem in public health [2]. Two factors cause disease, called Congenital and Acquired. Congenital

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refers to a disease a person is born with, while Acquired refers to a disease acquired after a person was born, such as infection, trauma, and neoplasm. The infected person will sometimes require information on the disease before going to the doctor or a hospital. Such information may be found from a system which receives input on the symptoms and gives a clear information on the corresponding disease. This may be achieved via a system of experts, in which the expert refers to an ENT (Ear, Nose, and Throat) specialist. Such information is hoped to provide a solution on the disease. The system of ENT specialists designed and research in this paper used the certainty factor method. The method will overcome the uncertainty in decision making depending on the symptoms described by the user. This paper successfully applied the certainty factor method used as an instrument of decision-making in ENT specialists' system.

The system is web-based, enabling the user to easily access and choose the disease's symptoms and acquire information on ENT diseases easily [3]. Diabetes mellitus (DM) or commonly called diabetes, is a chronic metabolic disorder caused by the pancreas not producing enough insulin or the body cannot use the insulin produced effectively. Patients with Diabetes Mellitus in Pohuwato Regency have increased by 8.5% every year. Expert systems are computer programs that mimic an expert's reasoning with expertise in a particular area of knowledge. Expert systems try to find solutions and provide suggestions or conclusions consistent with the problems they find. This research will be designed using the Dreamweaver Application and the PHP programming language, and the MySQL database. I hope the author, this system can help the community in diagnosing diabetes mellitus.

Through this application, users can consult with the system like consulting an expert to diagnose symptoms that occur in users and find solutions to problems. The results of testing the system obtained by the value of Cyclomatic complexity = 5 with the number of Region (R) = 5, Node (N) = 10, Edge (E) = 13 Predicate Node (P) = 4 [4]. Nowadays, computers have been widely used in the medical world to help diagnose an illness. The most important and often found the disease is cholesterol. Prevention of Disease is better than treatment. Therefore, the prevention of cholesterol is preceded by early diagnosis. One technique in diagnosing cholesterol is an expert system. This study aims to develop an expert system that is used to diagnose early cholesterol based on perceived symptoms. The system will display the amount of trust in these symptoms against the possibility of the user's disease. The amount of the trust value results from a calculation using the Certainty Factor (CF) method. The knowledge representation used in this study is the production rule. The inference method used to get conclusions is forward reasoning (forward chaining) [5].

2. Method

An expert system prepared by three main modules, module revenue knowledge, module consultation, and module explanation system, is module knowledge. He received experts' knowledge in collecting knowledge to be used for system development, committed to a knowledge engineer's assistance. The system is a position answering the matter submitted by the user, expert system, and module consultation. In this module, the user interacts with the system with said the questions asked by the system. This module explains the decision-making process by the system how a decision can be obtained) [4].

2.1 Certainty Factor Method

Certainty factor ( ) Shortliffe and Buchanan propose a theory in 1975 to accommodate so much uncertainty about the community's ideas (inexact reasoning) of a master mused. The theory develops simultaneously as the creation of a system, the expert, and then the MYCIN. The development team clarifies that MYCIN noted that a doctor was frequently realized to analyze information from egress expressions: maybe, more likely that the, nearly always come away, and so forth. To accommodate a thing to now, the team MYCIN uses certainty factor (CF) reflects the rebel attempts to exert control level of confidence the expert and then the against on problem currently faced by. In general, the rule is represented in the form of as follows:

IF E1 [AND / OR] E2 [AND / OR] … En THEN H (CF = CFi)

Description:

E1: The facts (*evidence*)

H: Hypothesized produced (Conclusion) [3].

Stages in representing qualitative data:

a) The ability to express the degree of faith by the methods already discussed earlier.
b) The ability to locate and combine these beliefs in expert systems

In the express degrees blessings of assured conviction of used a value called certainty factor (CF) to assume degrees blessings of assured conviction of a master mused has kicked off a data. The following are the formulation of the basis of the certainty factor.

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CF[H.E] = MB[H,E] – MD[H,E]

Description:

CF: certainty factor in hypothesis H by which it is affected by the fact E.

MB = measure of belief level of confidence is the size of a percent increase in becomes a matter of faith hypothesis H.

MD = measure of disbelief proves it to be false. The impact is increasing from distrust hypothesis h influenced the fact E

E = *Evidence*

H = hypothesis

To combine two or more rules, a knowledge-based system with several rules, each of which yields the same conclusion but the uncertainty factor is different. Each rule can then be presented as a piece of evidence supporting the conclusion of Shared [4].

Shortliffe and Buchanan proposed the certainty Factor (Theory) in 1975 to accommodate an expert's inexact reasoning. This theory evolved along with the creation of the MYCIN expert system. The MYCIN development team notes that doctors often analyze existing information with phrases such as: perhaps, most likely, almost certainly, and so on. To accommodate this, the MYCIN team uses a certainty factor (CF) to illustrate the level of expert confidence in the problem at hand. In general, the rule is represented in the following form:

IF E1 [AND / OR] E2 [AND / OR] … En THEN H (CF = CFi)

Information:

E1***:*** the facts (evidence) that En exists.

H: the resulting hypothesis or conclusion [3].

In expressing the degree of confidence, a value called Certainy Factor (CF) is used to assume the degree of confidence of an expert against a data. Here are the basic formulations of Certainly Factor:

CF[H.E] = MB[H,E] – MD[H,E]

Information :

CF = *Certainty Factor in hypothesis H influenced by fact E.*

MB = Measure of Belief (*level of confidence*), *is a measure of the increase of hypothesis H's belief influenced by fact E.*

MD = *Measure of Disbelief, is the rise of mistrust hypothesis H influenced the fact of E.*

E = Evidence (event or fact).

H = Hypothesis (Alleged)

To combine two or more rules, a knowledge-based system with several rules, each of which yields the same conclusion but the uncertainty factor is different. Then each rule can be presented as a piece of evidence supporting the conclusion together. To calculate the CF (confidence) of the conclusions, it is necessary to combine the following combinations

CF (R1,R2) = CF (R1) + [CF (R2)] x [1-CF(R1)]

If we only add CF R1 and R2, the certainty of the combination will be more than 1.

Modify the amount of certainty through addition with a second certainty factor and multiply it (1 minus the first certainty factor). Thus, the larger the first CF, the smaller the certainty of the second edition. However, additional factors always add some certainty. For the third rule added, the following rule may be used

CF (R1,R2,R3) = CF (R1,R2) + [CF (R3)] [1-CF(R1,R2)]

= CF (R1,R2) + CF (R3) – [CF(R1,R2)].[CF(R3)

For solutions with more rules, can use the stratified equations as in the above persuasion produce the conclusions of disease that may suffer [4].

2.2 Certainty Factor Calculation Method

Using the dig from the interview with the expert. The value of CF (Rule), as well as the weight of each fact, are obtained from the interpretation of the term from the expert to the value CF individual weights, the example in the following table

Table 1.

Interpretation of CF Value

Uncertain Term	**CF**
Definitely Not	-1.0
Not Almost Certainly	-0.8
Not Probably	-0.6
Maybe Not	-0.4

Unknown	-0.2 to 0.2
Maybe	0.4
Probably	0.6
Almost Certainly	0.8
Definitely	1.0

Table 2
Interpretation of Weight Value

Characteristics	Weight
Less Influential	0.1 s/d 0.4
Take effect	0.5 s/d 0.7
Very influential	0.8 s/d 1

Example:
Expert:" If headache and the common cold and fever 'most likely' disease is influenza."
Rule: IF symptoms 1=headache (weight=0.3) AND symptoms2=cold (weight =0.3) AND symptoms 3 = fever (weight =0.2) THEN Disease = influenza (CF = 0.8) [3]

2.3 Chikungunya (CHIK) And Chikungunya Disease

CHIK is an infectious disease caused by Arbovirus and spread to humans through the bite of the Aedes mosquito and often causes outbreaks. Outbreaks that occur in urban areas are sporadic, but their characteristics are explosive. The epidemic then disappeared and recurred at irregular intervals. (3) For the first time, CHIK's disease was reported by Robinson (4) and Lumsden (5) from an outbreak in the Makonde valley, along the Tanganyika and Mozambique borders, in 1952. The name CHIK comes from the Makonde verb itself, which is "kungunyala" which means "to dry up" or "become bent" (to become contorted).

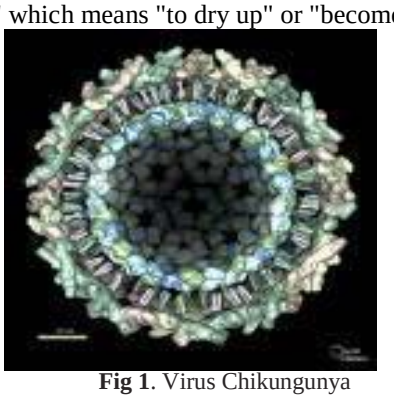

Fig 1. Virus Chikungunya

Furthermore, Robinson (4) uses the term more specifically to describe people who suffer from CHIK in bending due to arthritis symptoms by the disease. Initially, CHIK was found in an outbreak in Africa and caused diseases that gave dengue feve [1]. Chikungunya fever is caused by a CHIK virus (CHIKV). This virus enters the Alphavirus family. Historical facts state that the Chikungunya virus occurred first in an African country and subsequently spread to Asia. Chikungunya has spread to several regions such as Africa and Asia, including India, Sri Lanka, Myanmar, Thailand, Indonesia, and Malaysia. Phylogenetic studies report that the virus chikungunya strain is included in three genotypes based on African, central/eastern Africa, and Asia cases. Subsequently, it is included in the group isolated from Klang in Malaysia. Chikungunya fever was diagnosed in migrants in the United States in 2005 and 2006. The case of chikungunya fever was reported again in the areas of Europe, Canada, the Caribbean (Martinique), and South America (French Guyana) during 2006. From 2005 - 2006, 12 cases of fever were diagnosed serologically and virologically by the Centers for Disease Control and Prevention (CDC) in the United States from areas known as epidemic areas or endemic to chikungunya fever. 6 the Ae mosquito vector causes the epidemic that occurs in Asia in urban/urban areas. ae-Egypt and Ae. albopictus. The seroprevalence studied with Macaca Sinica in Sri Lanka reported that this population's vulnerability to viruses is unknown. Transmission of Chikungunya disease in Asia, mainly transmitted by the Aedes aegypti mosquito vector through the cycle of person-to-person transmission in densely populated (urban) settlements. It is not known how this virus can be preserved in nature.

In Africa, nonhuman primates are also involved in the transmission cycle with various vector mosquito species. Cercopithecus baboons and monkeys are considered to have a role as hosts between those who spread the virus to humans. Mosquitoes responsible for the enzootic transmission of savanna and African tropical forests are grouped in two subgenera of Aedes, namely: (a) Subgenera: Stegomes (Ae. Africanus, Ae. Luteocepha-us, and Ae. Opok) (b) Subgenera: Tempered (Ae. Cordillieri, Ae. Furcifer, and Ae. Taylor).

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As the cause of chikungunya fever, the chikungunya virus is still not known for its pattern of entry into Indonesia. About 200-300 years ago, the chikungunya virus was a virus in primates in the middle of a forest or savanna in Africa. Primate animals considered a virus preserver are the ba-boon (Papio sp), Cercopithecus sp. Sylvatic cycles among primates are carried out by Aedes sp (Ae. Africanus, Ae. Luteocepha-plus, Ae. Opok, Ae. Furciper, Ae taylor, Ae Cordelier). Scientific evidence covering isolation and identifying new viruses was successfully carried out during an outbreak in Tanzania 1952-1953. primate animals, sometime later turned into attacking humans. Not all viruses from animals can change the cycle like that. In urban areas, the chikungunya virus cycle is assisted by Ae mosquitoes. aegypti. In certain situations, Manzoni Africana also acts as a vector that transfers viruses from primate hosts to humans. This disease is similar to dengue fever. The difference is, the dengue virus will produce poisons that attack blood vessels and cause death. While the chikungunya virus attacks the bones, making all the pesantren aches. The symptoms of this disease can be described as follows [6].

3. Results and Discussion

To facilitate understanding the logic of this expert system in using the use of expert system application then built a system of expert diagnosis of chikungunya disease using Certainty Factor method as the process of calculating the value of certainty of the occurrence of the disease. Users can make a diagnosis by choosing the symptoms of chikungunya. The 5 menus of the disease diagnosis system of chikungunya is the home menu, information (Disease, symptoms, etc.), input, diagnosis, and contact. Home menu as the main view on this chikungunya disease of expert system

Fig 2. Home Page

The home page menu contains information about chikungunya disease, type of disease, symptoms, and all pertinent information about chikungunya disease.

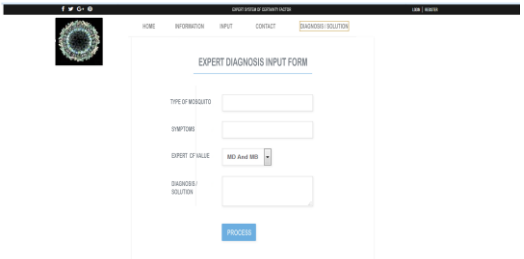

Fig 3. Expert Diagnosis page

The input menu expert diagnosis contains data input addressed to experts to input data rules or rules between symptoms with the disease and the value or data MB (the value of trust) and MD (the value of unbelief).

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Fig 4. Expert Diagnosis page

In this diagnostic menu, users or users of the system are asked to enter data by data about patients' complaints or problems with chikungunya disease. The user will then be able to directly know what type of disease is attacking, symptoms - symptoms caused by chikungunya disease, and treatment or treatment according to the type of symptom he suffered.

4. Conclusion

Based on the analysis and testing system that has been done, the expert system of chikungunya disease diagnosis can be drawn in a conclusion as follows: This expert system can diagnose chikungunya disease based on questions submitted by users/patients to this expert system. Expert systems can provide a diagnosis of the disease and how to care and care. This expert system assists users in making decisions to obtain information about chikungunya disease.

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