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Decision Support System for Malaria and Dengue Disease Diagnosis (DSSMD)

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Abstract

In this paper the main objective of our research is to design the decision support system for mosquito born disease diagnosis, where medical experts are not easily available i.e. rural areas (or) remote areas. It is a symptom based decision support system, while designing the decision support system we kept this face in mind that the diagnosis can be explored by Para medical human resources or by patient itself. Due to non availability of pathological and imaging based medical diagnosis tool in remote areas, many times patient's life is in danger and patients may lead to death due to not proper diagnosis and treatment of diseases, so the decision support system will be very useful in the diagnosis of disease and early detection of disease will lead to save patients life .This system is useful to help doctors or users to diagnosis the disease of patient in a short time and effectively via the identified symptoms. The proposed system is designed and developed by using MATLAB's GUI feature with the implementation of fuzzy logic.

Keywords: Malaria, Dengue, Disease Diagnosis, Decision support system, Fuzzy logic.

1. Introduction

Mosquitoes are dipterans insects and blood sucking fly pests of man. Mosquitoes are surviving on earth since millions of years. They have always given tough time to men as important carriers of various diseases. People fight globally against mosquitoes and mosquito borne diseases. Malaria, dengue, filarial, Japanese encephalitis, west nile virus and chikungunia are the major diseases spread globally by different mosquito. These diseases challenge the developed and developing countries of the world for irradiating. Malaria and dengue remains to be the most vital cause of morbidity and mortality in India and in many other tropical countries with complete 2 to 3 million new cases arising every year. Malaria is a major health problem in the world. Malaria is well-known oldest chronic and most widespread fatal disease that has plagued mankind for centuries, which also causes economical loss. At present, malaria is the Third World's most dreaded killer (Singh and Rahman, 2001). The direct costs of malaria include combustion of personal and public expenditures on both prevention and treatment of the disease and the indirect cost of malaria are the human sufferings caused by the disease.

2. Methodology

Phase 1: Problem Identification

Our approach is to develop decision support system for mosquito born disease like malaria and dengue. Especially we have designed this decision support system for rural areas or remote areas where pathological labs and experts are not available. This system makes diagnosis easier for medical personnel and even any person carry out diagnosis by answering the question with respect to the disease.

Phase 2: Knowledge Acquisition

We gathered the information with the help of expertise / doctors, Surfing internet and refer to the appropriate books about mosquito diseases. Knowledge is gain from internet. Search the topics about mosquito's disease using search engine like google.com

Phase 3: Knowledge Representation

There are more than 200 rules that successfully generated from the knowledge acquisition.

Phase 4: Verification and Validation

Rules designed for the disease using symptom that added to database is the correct. The entire symptom is always been checked to make sure the correct symptom for correct disease. The rule base is designed with the consultation of symptoms to the doctors.

Phase 5: Implementation

The system is developed using the Using MATLAB R2013a the overall classification was done using fuzzy logic toolbox. The system has following module

- ***GUI Interface***: this provides a graphic interface showing the symptoms considered and their respective acronyms Enter Patient's Symptoms into the system: based on the interaction between the patient and the medical Doctor, the patient's symptoms (in relation to the symptom intensity) is entered into the system

- ***Knowledge Base:*** the symptoms of the patient is keyed into the system and based on the weights of the symptoms stored in the knowledge base, the symptoms are fuzzified.
- ***Interference Engine***: this is where the Fuzzified value is defuzzified in the decision support system model
- Results Table: the result is displayed which shows the diagnosis of the patient

Fig. 1.1 shows the process chart of methodology used for developing DSSMD

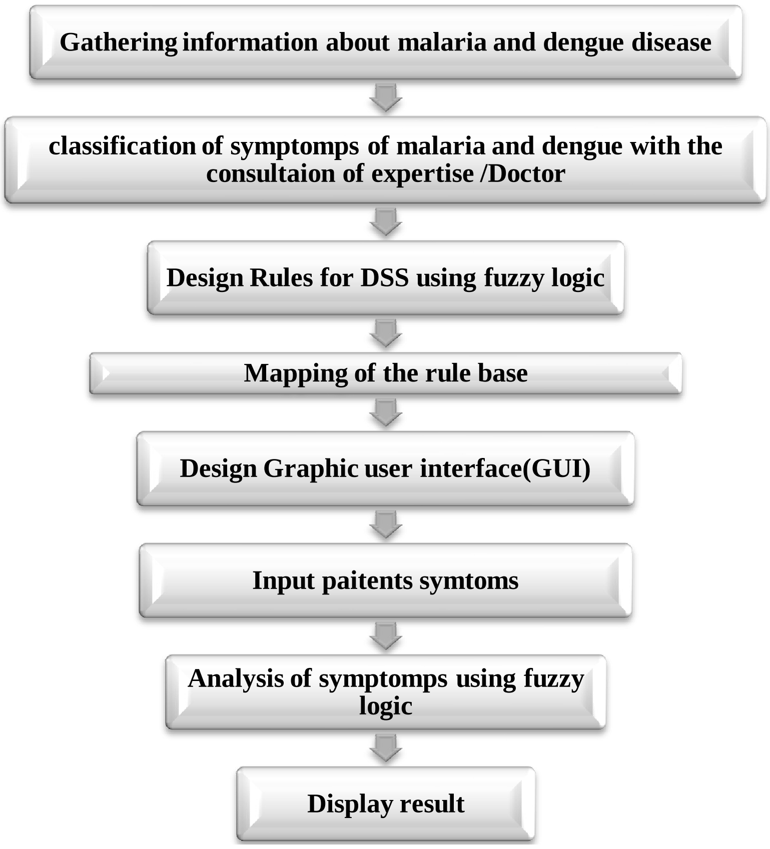

Figure 1: Process chart of methodology.

3. Fuzzy Logic

Dengue and malaria are the silent killer diseases and the need to optimize the management using fuzzy logic approach is a dual need. This is because, Fuzzy logic technology provides a simple way to arrive at a definite conclusion from vague, ambiguous, imprecise or using linguistic variables that are not necessarily precise so for The diagnosis of disease involves several levels of uncertainty and imprecision For the development of the decision support system for malaria and dengue fuzzy logic is used.

The structure knowledge is concerned with facts, rules and events of Malaria and dengue, which were commonly agreed upon by experts in the field of medicine. The fuzzy rules for this research were developed with the assistance of domain experts (medical doctors) who are experts in the field of internal medicine. The knowledge-base of DSSMD has more than 200 fuzzy rules. Sample fuzzy rule base for malaria and dengue diagnosis is shown in table -1 below.

Symptom's abbreviation:-FVR- fever JP- Joint pain MP- muscle pain PBE-Pain behind eyes SR-Skin rash LOA- loss of appetite, NAU/VOM- Nausea and vomiting, HDCH-Headache, CONV-convulsion, BLED-bleeding SLEP sleepiness TEMP-Temperature, YELL- yellowish C-H-S cold hot and sweating stage Symptom's of the disease is the input and the result of the diagnosis is divided into five parts :- sure dengue , maybe be dengue ,Sure malaria may be malaria, not defined.

Table 1: IF-THAN Rules for DSSMD.

Rule NO.	**FVR**	**JP**	**MP**	**PBE**	**SR**	**LOA**	**NAU/VOM**	**HDCH**	**CONV**	**BLED**	**SLEP**	**TEMP**	**YELL**	**C-H-S**	**RESULT**
1	high	Severe	yes	yes	yes	No	yes	severe	No	yes	yes	104	no	No	Sure Dengue
2	Short	severe	yes	no	no	yes	yes	moderate	yes	no	no	101	yes	yes	Sure Malaria
5	high	moderate	yes	no	yes	yes	yes	severe	no	no	no	104	no	no	Sure dengue
15	no	severe	yes	no	no	yes	no	low	no	no	no	99	no	no	Not define
28	high	low	yes	yes	no	no	yes	moderate	no	no	no	103	no	yes	May be dengue
39	short	moderate	no	no	no	yes	yes	severe	no	no	yes	100	yes	no	May be malaria
55	high	low	yes	yes	yes	no	no	low	no	yes	yes	104	no	no	Sure dengue
63	no	low	yes	no	yes	no	yes	moderate	yes	no	no	99	no	no	Not defined

79	high	severe	no	no	no	yes	yes	severe	no	no	yes	100	no	yes	Sure malaria
88	short	severe	yes	no	yes	no	yes	moderate	no	no	yes	101	yes	yes	May be malaria
225 …..	short	low	yes	yes	no	yes	yes	low	no	no	yes	102	no	no	May be dengue

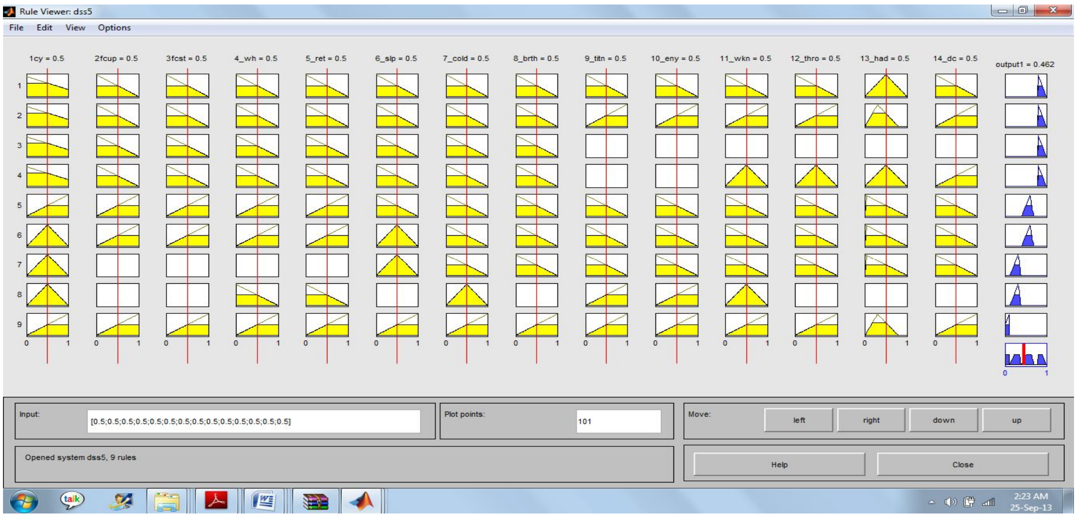

Figure 2: Simulated Rule Viewer of the Rule-base of DSSMD.

4. Result and Discussion

In our research we have designed a decision support system for malaria and dengue (DSSMD). Diagnosis of disease is solely based on the non - clinical symptoms of the disease using Artificial intelligence. Decision support system is developed for the diagnosis of disease on the basis of symptoms of disease. For developing the decision support system for malaria and dengue we have used fuzzy logic .The performance of the system was analyzed by comparing the result of DSSMD with the clinical report of the patients. Total 69 patient's data was analyzed in which 35 patients of malaria and 34 patients of dengue disease– Out of 69 patient's data 63 results are positive

In case of malaria out of 35- 32 results are positive In case of dengue out of 34- 31 results are positive

True positive(TP) result = 63, True negative (TN) result=6

So overall accuracy of the system is given by the formula

Accuracy = TP/ (TP + TN) = 63/ (63+6) = 91.3%

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