RESEARCH ARTICLE

RECOMMENDER SYSTEM FOR THE DETECTION AND PREVENTION OF DENGUE

*Amardeep Singh, Sharanjit Singh, Sharanjit Singh and Pratibha

Department of Computer Science and Engineering, G.N.D.U Regional Campus, Gurdaspur (Punjab), India

ARTICLE INFO	ABSTRACT
	In recent years huge amounts of information has been collected in health based databases depicting patients' health status (e.g., as laboratory results, treatment plans, medical reports). Thus, diagnosis of patient's health has been considered as one of the vital processes in health care expert systems for the detection of acquired diseases from the given symptoms of the affected person. Dengue fever is a mosquito-borne disease caused by the dengue virus that in recent years has become a major public health concern because it can result in the death of the affected person if no action is taken. This disease is caused by the mosquito bite infected by one of the four dengue virus surrogates. It is one of those diseases whose symptoms are hard to detect. The main problem with the dengue fever detection is many people cannot depict whether they are infected by dengue fever or not which make them do nothing as they thought it is only a normal fever. However, early clinical diagnosis and careful clinical management by trained can increase survival of patients. In that case some reliable system is needed that can predict the disease and allow the user to take the necessary steps. This paper discusses the development of a wellness recommender system that would help users to detect dengue. Fuzzy systems are widely used in health care systems and are one of the most common subjects of today's Medical Informatics. This paper has proposed a model that makes use of expert system based on fuzzy logic that analyzes symptoms introduced by the user and formulates a diagnosis using fuzzy sets to detect whether person is infected with dengue or not. Thus the proposed model uses rules of fuzzy logic in order to check whether person's symptoms are to be qualified to be in infected category or not.

INTRODUCTION

Dengue or the "break bone fever" is caused by the mosquito bite which is infected by one of the four dengue virus serotypes. Dengue is spread by several species of mosquito of the Aedes type. When dengue mosquito bites, the infection will be visible after 3-14 days of the bite. Dengue is not transmitted from person to person and symptom will range from mild fever to high fever. Some of the common symptoms of the dengue fever are severe joint and muscle pain, swollen lymph nodes, headache, fever, exhaustion, and rash. The presence of fever, rash, and headache is characteristic of dengue fever. Some other signs of dengue may include bleeding gums, severe pain behind the eyes, and red palms and soles. Dengue fever is prevalent throughout the tropics and subtropics regions. Some dengue fever can affect only children. Some viruses may affect younger and old persons. Since this fever is caused by a virus, the medicine for dengue is not yet commercially available.

*Corresponding author: Amardeep Singh,
Department of Computer Science and Engineering, G.N.D.U Regional Campus, Gurdaspur (Punjab), India.

This will cause the disease to be more dangerous. The problem with the person infected with dengue is that they do not show any symptoms. The characteristic symptoms of dengue will be certain onset fever. The quick headache is also the symptom for the dengue disease. In a small proportion of cases, the disease can develop into the life-threatening dengue hemorrhagic fever which can result in bleeding, low levels of blood platelets, low blood pressure and blood plasma leakage. Dengue fever has become one of the major health problems since the Second World War and is common in more than 110 countries. Each year nearly 50 to 528 million people are infected with this fever and approximately 20,000 people die who are infected with dengue fever. Most of the dengue cases occur in tropical areas of the world, with the greatest risk occurring in Indian subcontinent, Southeast Asia, Southern China, Taiwan, The Pacific Islands, The Caribbean (except Cuba and the Cayman Islands), Mexico, Africa and Central and South America (except Chile, Paraguay, and Argentina). Dengue fever is now considered to be the major cause of acute febrile illness in U.S. travelers returning from the Caribbean, South America, and Asia.

Near about 40% population of the world prevails in areas endemic with dengue. According to the WHO report about 22,000 deaths occur yearly, mostly among children who are found infected with dengue. The proposed system is going to work on the recommender system which will determine whether the person is infected with the dengue or not. User has to input the attribute values which are generally the symptoms of the person within the recommender system and the recommender system will compare the values of the dengue corresponding to the various attributes with the user attributes. When most of the attributes or symptoms matches then person is said to have dengue fever.

The recommender system will be based on the filtering mechanism. The filtering mechanism will go to filter the attributes which are matched with the attributes of the dengue. The filtering mechanism which is used is divided into following categories.

The filtering mechanisms which are available are

- Content Based System:- These systems check the response of user according to the content he/she search for, from that recommender system easily know the user response. For example if user is searching for sports based news then the system guesses that the user is interested about sports.
- Collaborative Filtering System:- These systems guesses the response not for a single person but for a group of persons or community. For example if we talk about the taste of boys then he always want to check in news about sports, latest market trends etc.

The proposed system will use the content based filtering in order to determine whether the person is infected or not. The recommender or expert system that will be used to detect dengue fever uses fuzzy logic known as fuzzy expert system or fuzzy recommender system. A fuzzy expert system is collection of fuzzy rules and membership functions that are used to reason about data and to arrive at the possible outcome based upon that data and information available from the databases. Fuzzy Recommender Systems are used to solve decision problems, i.e. to make a decision and act accordingly. A fuzzy "if-then" rule follows the pattern: "If x is A then y is B" where x is the input variable and y is the output variable.

Fuzzy Systems generally consists of four modules

Fuzzification module: This module tales the inputs from the system and transforms them into fuzzy sets. This is done by applying a fuzzification function.

Knowledge base: This module stores IF-THEN rules provided by experts.

Inference engine: This module basically simulates the human reasoning process by making fuzzy inference on the inputs and IF-THEN rules.

Defuzzification module: This module transforms the fuzzy sets which are obtained by the inference engine into a crisp value.

This proposed recommender system works on the basis of the symptoms which are provided as input by the user, with more efficient fuzzification and defuzzification will be done. The purpose of the recommender system is to take initial symptoms of the patient to diagnose the normal fever, and then on the basis of the result proceed for further symptoms provided as input by the user to diagnose the dengue fever. In this paper we will use section 1 as related work, section 2 will describe proposed model, section 3 will describe proposed algorithm, section 4 describes conclusion and future work and the last section describes the references used within the paper.

RELATED WORK

The work has been done towards the recommender system related to health based recommendations. The work will be as described considering the various papers in this field (An *et al.*, 2007). Fuzzy sets are being used commonly for the detection of the various diseases present within the human being. Fuzzy Logic works on the fever symptoms that help in the diagnosis of dengue fever. The suggestions are also being postulated using such systems (Avila-Vazquez *et al.*, 2014). The paper will suggest the system in which the location of the health system like hospital will be contained. When the user is under some health problem then the location of the nearest health station will be suggested (Kim *et al.*, 2009). Most of the problems to the human beings are because of the diet which they take. This paper works towards the diet that the human being takes. In other words diet plans will be presented by this paper (Lopez-Nores *et al.*, 2011). The health system with the social network will be presented. The electronic health record which is maintained can be accessed by the use of the recommender system. The recommender system will be going to recommend the health tips based on the previously stored record of the patient (Lopez-Nores *et al.*, 2011). The recommender system using collaborative filtering is suggested in this case. The collaborative filtering will be the one in which decision will be taken on the basis of the reviews taken from the group of users (Pradhan *et al.*, 2014). The concept of trust is used in this paper. The dental care is the prime objective of this paper. The recommender system suggested in this case use content based filtering. The medicines required for dental care is promoted in this case (Rivero-Rodriguez *et al.*, 2013). The recommender system is suggested in this case is based upon the youtube videos. The youtube videos regarding the health will be used in the recommender system. The dynamic contents will be used in the recommender system created (Sanchez-Bocanegra *et al.*, 2015).

People are looking for appropriate health information which they are concerned about. The Internet is a great resource of this kind of information, but we have to be careful if we don't want to get harmful info. Health recommender systems are becoming a new wave to apt health information as systems suggest the best data according to the patients' needs. The main goals of health recommender systems is to retrieve trusted health information from the Internet, to analyze which is suitable for the user profile and select the best that can be recommended, to adapt their selection methods according to the knowledge domain and to learn from the best recommendations. A brief definition of recommender systems will be given and an explanation of how are they incorporated in the health sector.

A description of the main elementary recommender methods as well as their most important problems will also be made. And, to finish, the state of the art will be described (Sezgin and Ozkan, 2013). The literature survey on various papers related to health care is done in this case. There are number of mechanism which can be used in the health care system. All of these mechanisms including recommender system are suggested in this paper (Zaman and Li, 2014). Social health care system is considered in this case. The recommender system which can work on he social networking is suggested. The properties of the health care system must meet the desired standards will be recommended using this system (http://www.springer.com/jp/book/9781461418931#. Accessed: 09-Feb-2016]). The social tagging system is suggested in this case. The health care system which satisfies the minimum requirements will be recommended using this system. The Fuzzy Recommender Systems employs Fuzzy IF THEN rules. Rules are made based on expert opinion and research. Proposed method of recommender systems such as the fuzzy sets has various advantages than other methods of expert system such as artificial neural networks. Fuzzy system used in expert systems has a capacity to tolerate inaccurate data, and can successfully model a very complex nonlinear function (http://doi.org/10.1051/epjconf/20146800003). The proposed system will be going to deal with the recommender system which will focus on the disease dengue. The proposed Fuzzy logic based methodology is implemented in MATLAB (Matrix Laboratory) environment. The existing work does not work on this disease.

PROPOSED MODEL

The proposed model lists the attributes and features commonly referred as the symptoms which must be present within the person to be infected by the dengue virus. The proposed model will use the symptoms of the disease in order to determine whether the other users have the same disease or not. The attributes specified can also be used in order to determine whether person is infected by other related disease or not. The proposed model we have designed here using fuzzy logic will be implemented in MATLAB environment.
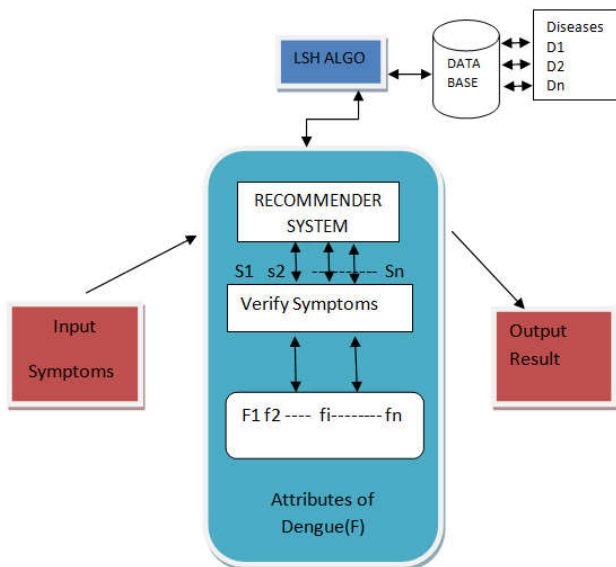
Fig. 1. Recommender System for Detection of Dengue

Fuzzy Logic is based on fact that the given structure belongs to the set or not. In the proposed system membership function (u) will be used. The value of the u can be between 0 and 1.

$$0 <= u <= 1$$

The value can be fractional also. Closer the value of u to 1, more will be the belongings. The value close to 1 indicates that person is infected. Values lower than 0.5 will indicate that chances of infection are negligible. There are numerous operations possible on fuzzy system. Some of them are listed as
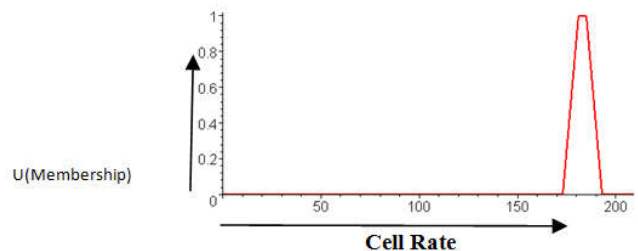
X And $Y = \min(X, Y)$
X OR $Y = \max(X, Y)$
Not $X = 1 - X$
X implies $Y = \max(X, 1 - Y)$

The fuzzy system will be listed in terms of the graph. We consider a situation in terms persons having cell rate in between 150 to 200 are infected. The membership function of such system is listed as

Fig 2. Showing the persons having cell rate in between 150 to 200 are infected with dengue.

It is also possible to express the membership function as a universal set. The universal set will contain the values between 0 and 1. The universal set associated with the dengue membership function includes fever, cough, pain behind the eyes etc. The level of eye pain is expressed through the following membership graph
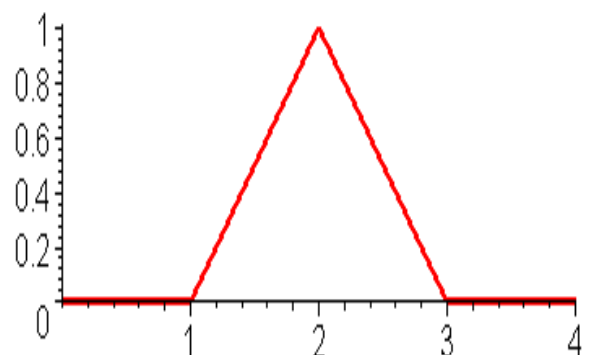
Fig. 3. Showing the levels of eye pain causing dengue

Proposed Algorithm

The algorithm which will describes the creation of Recommender system for the Dengue is describes through the following steps. The proposed system will create a fuzzy based recommender system and determine whether a person is infected with dengue or not.

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Algorithm-Recommender Active

1.1  Receive the parameters of the persons to be tested(Pi)
1.2  Compare Pi with the membership function(ui)
1.3  If Pi €ui then
     Membership validated
     Else
     Go to step 1.5
     End of if
1.4  Check the rules of fuzzy to determine Dengue(Vi)
1.5   If Valid(Vi) then
     Enter the person in Recommender system for promotion.
     Else
       Reject the person and move to next person.
     End of if
1.6  Stop
```

Rules of fuzzy logic are used in order to check whether the symptoms of the patient are qualified to be in infected category or not. The person if qualified to be in dengue category than only it is promoted by the recommender system.

Conclusion and Future Work

In the proposed system the recommender system will be created which will compare the parameters which are supplied as input symptoms by the user with the parameters of the dengue. If the maximum parameters match then the recommender system will suggest the solution accordingly. The recommender system so created will help in determining whether the person has this disease or not. The similarity algorithm will be used in this case. In the future we will use hash function for finding the similarity of the attributes corresponding to the dengue. This will introduce more clarity as well as accuracy.

REFERENCES

Afan Salman, Yen Lina, Christian Simon," Computational Intelligence Method for Early Diagnosis Dengue Haemorrhagic Fever Using Fuzzy on Mobile Device" in 2014, EPJ Web of Conferences, 03, 00003. http://doi.org/10.1051/epjconf/20146800003

An, A., Stefanowski, J., Ramanna, S., C. J. Butz, W. Pedrycz, and G. Wang, Eds., Rough Sets, Fuzzy Sets, Data Mining and Granular Computing, vol. 4482. Berlin, Heidelberg: Springer Berlin Heidelberg, 2007.

Avila-Vazquez, D., Lopez-Martinez, M., Maya, D., Olvera, X., Guzman, G., Torres, M., Quintero, R. and Quintana, I. 2014. "Geospatial recommender system for the location of health services," in 2014 9th Iberian Conference on Information Systems and Technologies (CISTI), , pp. 1–4.

Kim, J.H., Lee, J.H. Park, J.S., Lee, Y.H. and Rim, K.W. 2009. "Design of Diet Recommendation System for Healthcare Service Based on User Information," in 2009 Fourth International Conference on Computer Sciences and Convergence Information Technology, pp. 516–518.

Lopez-Nores, M., Blanco-Fern´ndez, Y., Pazos-Arias, J. J., Garcia-Duque, J. and Martin-Vicente, M. I. 2011 "Enhancing Recommender Systems with Access to Electronic Health Records and Groups of Interest in Social Networks," in 2011 Seventh International Conference on Signal Image Technology & Internet-Based Systems, , pp. 105–110.

Lopez-Nores, M., Blanco-Fernandez, Y., Pazos-Arias, J. J., Garcia-Duque, J. and Gil-Solla, A. 2011. "Property-based collaborative filtering for health-aware recommender systems," in 2011 IEEE International Conference on Consumer Electronics (ICCE), pp. 345–346.

Pradhan, S., Gay, V. and Nepal, S. 2014. "Improving dental care recommendation systems using trust and social networks," in 2014 IEEE International Conference on Communications (ICC), pp. 4264–4269.

Recommender Systems for Social Tagging Systems | Leandro Balby Marinho | Springer." [Online]. Available: http://www.springer.com/jp/book/9781461418931#. [Accessed: 09-Feb-2016].

Rivero-Rodriguez, A., Konstantinidis, S. T., Sanchez-Bocanegra, C. L. and Fernandez-Luque, L. 2013. "A health information recommender system: Enriching YouTube health videos with Medline Plus information by the use of SnomedCT terms," in Proceedings of the 26th IEEE International Symposium on Computer-Based Medical Systems, pp. 257–261.

Sanchez-Bocanegra, C. L., Sanchez-Laguna, F. and Sevillano, J. L. 2015. "Introduction on health recommender systems.," *Methods Mol. Biol.*, vol. 1246, pp. 131–46, Jan.

Sezgin, E. and Ozkan, S. 2013. "A systematic literature review on Health Recommender Systems," in 2013 E-Health and Bioengineering Conference (EHB), pp. 1–4.

Zaman, N. and Li, J. 2014. "Semantics-Enhanced Recommendation System for Social Healthcare," in 2014 IEEE 28th International Conference on Advanced Information Networking and Applications, pp. 765–770.

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