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APPLICATIONS OF FUZZY LOGIC IN FLU DETECTION

[1] A. Shameena Begam, [2] M. Saravanan, [3] G. Venkatnarayanan

[1]PG Student, [2,3]DAssistat Professor
[1,2] Department of Mathematics, Mannar Thirumalai Naicker College, Madurai – 625004, India
[3] Department of Mathematics, St. Joseph's College of Engineering, Chennai – 600119, India

Abstract : Fuzzy plays important role in quantifying linguistic variables. Using artificial intelligence in medical field, patient linguistic terms such as pain, cough, chillness, running-nose etc., should be taken as numerical quantity to conclude decision. In this paper, an attempt to flu detection using fuzzy logic is made. Based on the terms used by patient, fuzzy variables are assigned with fuzzy membership values. These fuzzy values are processed by using fuzzy logic and then compared with the identified symptoms of flu.

Index Terms - Fuzzy set theory, Fuzzy logic, Flu, α-cut, decision making problem.

1.INTRODUCTION

In our daily life there is so many problems about take a decision on inclusion or exclusion. Probability theory, fuzzy set theory, vague set theory, rough set theory are some important theories dealing with real time problems. In medical field, the terms used by the patients are ambiguous terms. The interpretation of these terms may vary to each medical practitioner. The importance of each term is assumed by the medical practitioner and then they prescribe the medicine. If ignorance of some symptoms or giving less importance has big impact on treatment processing. Assigning correct membership values for each linguistic terms is most important in medical field. In decision making problems by artificial intelligence, assigning member values for each symptom should be scientific and most reliable.

In 1965, L. Zadeh, introduced fuzzy and fuzzy set theory [1]. Fuzzy defines the ambiguity terms in mathematical approach. Quantifying the linguistic terms is explained by fuzziness. Fuzzy set theory dilutes the boundary of crisp set theory. It accepts elements with membership values in [0, 1]. This acceptance property increases the importance of elements which may have partial property of consideration. In medical field, all patients do not have same symptoms due their physical conditions with some other complications. Some patients may feel simple pain while some one feel heavy pain for same physical problems. This implies every symptom is very sensitive and essential in diagnosis of disease. The technical terms used in this article taken in the sense described in [2].

Decision making by using fuzzy logic in management problem for a human resource manager is discussed in [3,4] Fuzzy logic is used in diagnosis of disease in Medical Engineering by artificial intelligence. Awotunde et. al in [5] discussed the application of fuzzy logic in diagnosis.

2 Problem Description

In this paper, a set of patients are considered with some symptoms related to flu. Based on their experience each symptom is assigned to fuzzy membership values. Using fuzzy logic concepts these concepts are processed and conclude the patient has flu fever or normal fever.

Kanchana et. al in [5] identified Corona virus by using rough topology and indiscernibility matrix. This rough set approach is improved by using fuzziness. A set of five patients namely P1, P2, P3, P4 and P5 are considered as sample data. These patients have some symptoms similar to flu fever. Using fuzzy logic, these symptoms are analyzed and conclude whether they have either flu fever or common fever.

3 Membership values

The universal set U consists of five patients, U={P1, P2, P3, P4, P5}. Five parameters are chosen as five symptoms of flu fever and it is queried to each patient. The parameters are fever, dry couch, chillness, head ace and runny nose. The membership values are taken from the following fuzzy graphs. For dry cough and chillness, the membership values are taken from the graph defined in figure 1.

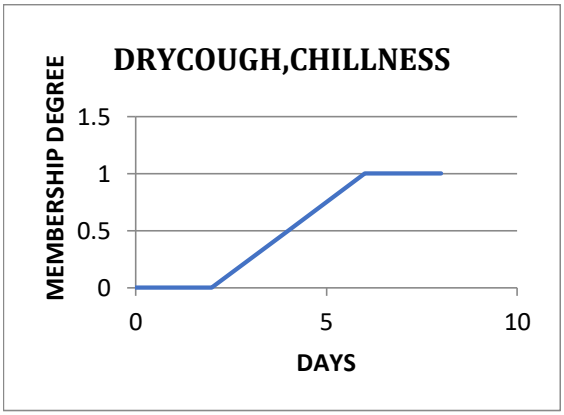

Fig. 1: Membership values for dry cough and chillness

For running nose and head ache, the membership values are taken from the graph defined in figure 2.

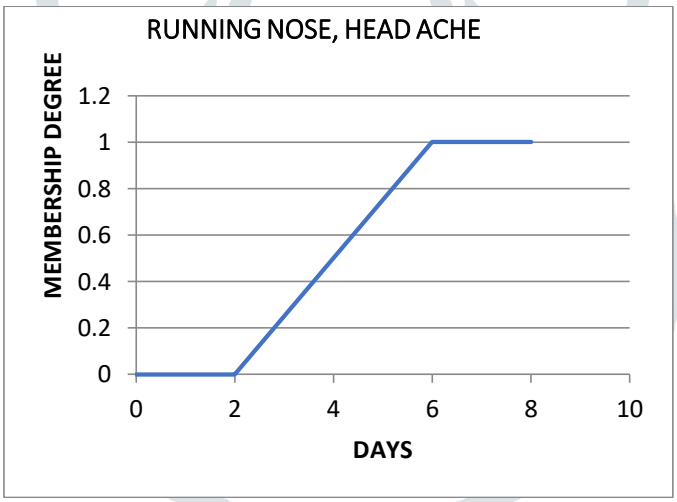

Fig. 2: Membership values for running nose and head ache

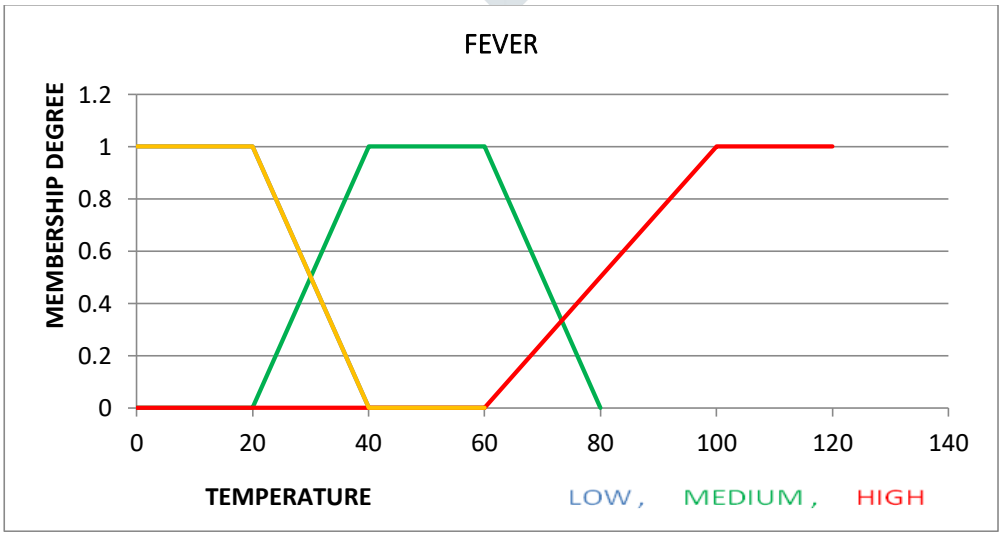

Fig. 3 Fuzzy membership value of fever

The membership value for the linguistic term fever is taken from the fuzzy graph shown in figure 3. The α cut and strong α cut are used to identified to patients for flu fever. Let E = { e_1, e_2, e_3, e_4, e_5} be the set of parameters to be considered for flu detection, where e_1 = fever, e_2 = dry cough, e_3 = chillness, e_4 = head ache, e_5 = runny nose. Suppose the patient P1 have high fever and, dry cough, head ache and runny nose for four days. Then the membership values are assigned as for e1 as 1 and dry cough, head ache and runny nose as 0.5. The chillness has the membership value as 0. Similarly, all the other patents data are collected and tabulated as given in table 1.

U	e_1	e_2	e_3	e_4	e_5
P_1	1	0.5	0	0.5	0
P_2	1	0.9	0.85	0	0.75
P_3	0.2	0.3	0.9	0.8	0.85
P_4	1	0.9	0.85	0	0.5
P_5	0.5	0.2	0.3	1	0.5

Table 1: Patient and Symptoms membership values

From strong α cuts and special α fuzzy sets defined in [2], the following calculations are made.

Using second decomposition theorem,

In patient p_1, the value of $^{0.5}\mathbf{P_1}$ is $\mathbf{e_1}$

In patient p_2, the value of $^{0.5}\mathbf{P_2}$ is $\mathbf{e_1}$, $\mathbf{e_2}$, $\mathbf{e_3}$, ,$\mathbf{e_5}$

In patient p_3 ,the value of $^{0.5}\mathbf{P_3}$ is $\mathbf{e_3}$, $\mathbf{e_4}$, $\mathbf{e_5}$

In patient p_4,the value of $^{0.5}\mathbf{P_4}$ is $\mathbf{e_1}$, $\mathbf{e_2}$, $\mathbf{e_3}$

In patient p_5 the value of $^{0.5}\mathbf{P_5}$ is $\mathbf{e_4}$

0.5 x $^{0.5}\mathbf{P_1}$ = { 0.5 /e_1}

0.5 x $^{0.5}\mathbf{P_2}$ ={ 0.5/e_1 ,0.4/e_2 , 0.4 /e_3, 0.3/e_5 }

0.5 x $^{0.5}\mathbf{P_3}$ ={ 0.4/e_3 , 0.4/e_4 , 0.4/e_5 }

0.5 x $^{0.5}\mathbf{P_4}$ ={ 0.5/e_1 ,0.4/e_2 ,0.4/e_3 }

0.5 x $^{0.5}\mathbf{P_5}$ ={ 0.5/e_4 }

$\cup_{\alpha\varepsilon[0,1]}\alpha^{+A}$ = $_{0.5}\mathbf{P_1} \cup_{0.5} \mathbf{P} \cup_{20.5}\mathbf{P_3} \cup_{0.5} \mathbf{P} \cup_{4\ 0.5}\mathbf{P_5}$

= **max {** 0.5, 0.5,0.5/ **e_1}** + **max {** 0.4, 0.4 / **e_2}** +**max {** 0.4, 0.4 0.4/ **e_3}**+ **max{** 0.4,0.5 /**e_4}** +**max {**0.3, 0.4,/ **e_5}**

A = { 0.5/e_1 ,0.4/e_2 , 0.4/e_3 ,0.5/e_4 , 0.3/e_5 }

4. Observations

The symptom e_1 has maximum value in the patient P_1, P_2, P_4. The symptom e_2 has maximum value in P_2, P_4. The symptom e_3 has maximum value in P_2, P_4, P_3. The symptom e_4 has maximum value in P_5. The symptoms e_5 has the maximum value in P_3. By this data the patient P_2 and P_4 has the positive symptoms of flu, because the patient P_2 and P_4 have the maximum value of the symptoms fever, dry cough and chillness. From [1], it can be taken the symptoms of flu are FEVER, DRY COUGH CHILLNESS. By this data the patient **P_2** and **P_4** has the positive symptoms of flu, because the patient **P_2** and **P_4** have the maximum value of the symptoms FEVER , DRY COUGH AND CHILLNESS.

5. CONCLUSION

In this paper, the set of patients considered who may have the symptoms of flu. These symptoms are converted into fuzzy membership value. And we conclude which patient have symptoms of flu definitely. The are some more advantages of defining and using fuzzy set for decision making problems.

6. REFERENCES

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