Identification of Types Headache by using Intuitionistic Fuzzy Relations in Medical Science: A Criticial Analysis

Suvidha

Assistant Professor, JVMGRR College, Charkhi Dadri

ABSTRACT

Medical Science is a branch of science that deals with the maintenance of health and the prevention and treatment of diseases. The word diagnosis may be say as the art or act of identifying a disease from its signs and symptoms. In this paper, we use the Sánchez's approach to identify the types of headache. This method is based on the relation between the reasons (also say symptoms) and diseases by intuitionistic fuzzy sets. For this purpose, we develop a hypothetical case study with assigned degree of membership, degree of non membership and hesitation index containing some medical information.

Keywords: - Fuzzy Sets, Intuitionistic Fuzzy Sets (IFS), Fuzzy Relations, Medical Introduction, Hypothetical Case Study.

INTRODUCTION

The exact medical diagnosis of some ideas is a difficult aspect even today. That is why; medical diagnosis investigations are very complex and difficult. In clinic practice, doctors personally assess patients in order to diagnose, treat and prevent disease using clinical judgment. The doctor-patient relationship typically begins an interaction with an examination with an examination of the patient's medical history and medical record, followed by medical interview and a physical examination. Mainly inspection, feeling and listening type actions are taken in physical examination. After examination for signs and interviewing for symptoms, the doctor may order medical tests or prescribe pharmaceutical drugs of other therapies.

In this paper, we describe an attempt to provide a formal model of the process to diagnose the types of headache by using IFS and IFR theory. Losch {6} suggested the process of diagnosis of glaucoma by using fuzzy sets. Kumar, Biswas and Roy {5}, Ann [2] has done the applications of IFS theory in diagnosis of various types of diseases. Adlassingh [1] has applied fuzzy Sets. Ju Hong [4] use interval valued fuzzy sets in supporting medical diagnostic reasoning. Also Gupta Priti, Prince and Kumar Vijay [3] have used Sanchez's approach in the medical diagnosis of Diabetes.

A headache is defined as a pain in the head or upper neck. It is one of the most common locations of pain in the body has many causes. Mostly headache is the common problem of every person from childhood to old. We know that there are many factors that affect the headache and it has many causes and symptoms and is one of the most common reasons for neurological disease detection. Mainly headache is divided into three categories: (a) Primary headache, (b) Secondary headache (c) Cranial neurological, facial pain and other headache. Primary headache mainly includes tensions, migraine and cluster headache. In this paper primary headache is divided into five categories as tension type (due to sunlight), sinus headache (due to infection), rebound headache (over use of pain killer), biometric pressure headache (due to atmosphere) and poor night vision (due to lack of food grains) with their reasons. Secondary headaches are those that are due to an underlying structural problem in the head of neck. There are numerous causes of this type of headache. Bleeding in the brain, tumor etc. are called secondary headache. In this paper, we propose a method for diagnosis of primary headache.

Firstly, we establish IF relation between patients and reasons of causes of headache with assigned degree of membership

and degree of non-membership as explained in table (1.1). Secondly, we establish relation between the types and reasons or causes of headache as explained in table (1.2). Finally, we apply Sanchez's approach and get results of table (1.3), then calculate hesitation index and find out the result of table (1.4) as weight elements. If there is a tie in weight elements then patient may have the risk of both kind of headache with their causes of reasons.

Brief introduction to IFS and IFR:-

Intuitionistic fuzzy sets are sets whose elements have degrees of membership and degrees of non-membership. Fuzzy sets have been introduced by Krassimir Atanassov in 1983 as an extension of Lofti Askar Zadeh's notion of fuzzy sets, which itself extends the classical notion of a set. The theory of IFS allows theassessment of the elements of the elements by two functions say u for membership and v for non-membership. The sum of both the functions varies between the range 0 and 1. Like IFSs and IFRs are also the extensions of crisp relations. In IFSs the degree of association can be represented by membership grade. We use the relations or operations like inclusions, equality, conjunction, disconjuction etc. on intuitionistics fuzzy sets.

Zadeh [8], for a fixed set X, an IFS of A is defined as: A={<x, $u_A(x), v_A(x)$/ xεX}. Where$u_A(x):X\square[0,1]$ and $v_A(x): X\square$ [0,1] define the degree of membership and degree of non-membership of the element x ε X to the set A.

For every x ε X, $0 \leq u_A(x) + V_A(x) \leq 1$ and the amount is called the intuitionistic index or hesitation index, which may require to membership value, non-membership of the element x ε X to the set A.

Again, Let A bean IFS of the set X and let R be an IF relation from $x \square X$, then max-mini-max composition of IFS X with the IF relation R ($X\square$ Y) is defined as B=R o A with membership value and non-membership function defined as:

$U_B(y) = \max_{x\varepsilon X}\{\min[u_A(x), u_R(x,y)]\}$

And

$v_B(y) = \min_{x\varepsilon X}\{\max[v_A(x), v_R(x,y)]\}$

Let R={$r_1, r_2.........r_m$}; D={$d_1, d_2 ....d_m$};

P ={$p_1, p_2.........p_q$}; be the finite set of reasons, diseases and patients respectively. According to Biswas[5],two fuzzy set relation (FR),Q and R aredefine as:

Q= [<(p,r), u_Q (p,r), v_Q (p,r)> (p,r) >ε P x R }

R= [<(r,d), u_R (r,d), v_R (r,d)> (r,d) > (r,d) ε R x D }

Where $u_Q(p,r)$ indicate the degree that the disease appear in the patient p due to the reason r and $v_Q(p,r)$ indicate the degree that the disease does not appear in the patient p due to the reason r.

Similarly $u_R(r,d)$ indicate the degree to which the reason r does not confirm the disease d.The composition T of IFR_s R and Q (T=R o Q) describe the state of patient p_i in terms of the diagnosis of disease from P to D given by membership and non-membership as:

$u_r(p_1,d) = \max_{r\varepsilon R}\{\min[u_Q(p_1,r), u_R(r,d)]\}$

And $v_r(p_1,d) = \min_{r\varepsilon R}\{\max[v_Q(p_1,r), v_R(r,d)]\}, p_1\varepsilon P$ and d ε D

Now, we can estimate the labels of headache of patients using the information obtained from the chart of given case study. This information plays a significant role in diagnosis when many types of headache are presented in patients.

From Q and R, one may complete new measure of IFR T for which, in general the diagnostic table of patients' P for any disease d such that the following is to be satisfied:

(i) $S_T = u_T - V_T$. is greatest and

(ii)   The equality T- RoQ is retained.

This measure of T will translate the higher degree of association of symptoms as well as lower degrees of intuitionistic index to the diagnosis. If there is almostequal values for different diagnosis labels in T is obtained, we consider the case forwhich intuitionistic index is least.

Case Study:-

Let P= {p_1 , p_2, p_3, p_4} be the set of patients and

R = { r_1, r_2, r_3, r_4, r_5} be the set of reasons or causes from the patient may suffer.New let the IFR Q (P ☐ R) is given by (hypothetically)

Table-1

Q	R_1		R_2		R_3		R_4		R_5	
Patients	u_Q	v_Q	u_Q	v_Q	u_Q	v_Q	u_Q	v_Q	u_Q	v_Q
P_1	0.8	0.1	0.3	0.6	0.5	0.4	0.3	0.6	0.9	0.1
P_2	0.2	0.3	0.7	0.2	0.6	0.2	0.6	0.2	0.3	0.3
P_3	0.1	0.7	0.5	0.4	0.4	0.3	0.1	0.6	0.4	0.4
P_4	0.9	0.1	0.3	0.4	0.3	0.3	0.2	0.7	0.2	0.7

Now D- {Tension, Sinus, Rebound, Biometric Pressure, Poor Night Vision}be the set of disease may appear in the patient.

Now suppose the IFR R (R☐D) is given by (hypothetically)

Table-II

T	Tension		Sinus		Rebound		BiometricPressure		Poor Night Vision	
Patients	u_Q	v_Q	u_Q	v_Q	u_Q	v_Q	u_Q	v_Q	u_Q	v_Q
R_1	0.2	0.5	0.3	0.2	0.7	0.1	0.3	0.4	0.3	0.5
R_2	0.9	0.1	0.1	0.5	0.5	0.5	0.7	0.1	0.7	0.2
R_3	0.3	0.4	0.7	0.1	0.4	0.3	0.6	0.1	0.4	0.4
R_4	0.4	0.5	0.6	0.3	0.3	0.2	0.5	0.2	0.3	0.1
R_5	0.6	0.2	0.5	0.1	0.2	0.6	0.4	0.6	0.1	0.8

Now the composition T=R o Q is following as:

Table-III

T	Tension		Sinus		Rebound		Biometric Pressure		Poor Night Vision	
Patients	u_Q	v_Q	u_Q	v_Q	u_Q	v_Q	u_Q	v_Q	u_Q	v_Q
P_1	0.6	0.2	0.5	0.1	0.7	0.1	0.5	0.4	0.4	0.4
P_2	0.7	0.2	0.6	0.2	0.5	0.2	0.7	0.2	0.7	0.2
P_3	0.5	0.4	0.4	0.3	0.5	0.3	0.5	0.3	0.5	0.4
P_4	0.3	0.4	0.3	0.2	0.7	0.1	0.3	0.3	0.3	0.4

Now we calculate $S_T = u_T - v_T$is greatest where is called the intuitionistindex of hesitation index.

Table-IV

T	Tension	Sinus	Rebound	Biometric Pressure	Poor Night Vision
P_1	0.56	0.46	0.68	0.46	0.32
P_2	0.68	0.56	0.44	0.68	0.68
P_3	0.46	0.31	0.44	0.44	0.46
P_4	0.18	0.20	0.68	0.18	0.18

Now the table we conclude that patient P_2 is effecting from three types of headache namely Tension, Biometric Pressure and Poor Night Vision. P_3 is effecting from Tension and Poor Night Vision. While the patients P_1 and P_4 are affecting from Rebound Headache. We have also explained the reasons for all types of headache explained above. After knowing the type with its reason a doctor can give better treatment to the patient.

CONCLUSION

In this paper, we have used the generalized concept of crisp and fuzzy set theory. A Study by applying Max-Min. and Min-max composition has been made with IFS theory. There are some other compositions like maximum, minimum etc. may also apply. This method is an effective tool for decision making problems and we can extend to medical diagnosis of any type of disease by taking a hypothetical case study.

REFERENCES

[1]. Adlassing K.P, Fuzzy set theory in medical diagnosis. IEEE Transictions on Systems, Man, and Cybernetics SMC; vol. 16:260-265,1986.
[2]. Ahn J.Y., Kim Y. H., Kim S.K., Oh, S.Y., Han B.S., A fuzzy method for diagnosis of headache. IEICE Trans. INF.& SYST. Vol. E 91-D, No. 4 : 1215-1217,2008.
[3]. GuptaPriti, Prince, Kumar, Vijay., An application of Intuitionistic Fuzzy Sets and Fuzzy Relations for medical diagnosis of Diabetes. In the proceedings of International conference of Recent Trends in Materials and Devices (ICRTMD); 193-19, 2013, Amity University, Noida.
[4]. Ju Hong- mei, Wang Feng-Ying ; A similarly Measure for Interval-Valued Fuzzy Sets and Its Applications in Supporting Medical Diagnostic Reasoning. In the tenth International Symposium on Operations Research and Its Applications (ISORA), pp 251-257,2011.
[5]. Kumar S., Biswas R., Roy A.R., An Application of intuitionistic fuzzy sets in medical diagnosis. Fuzzy Sets and Systems; 117:209-2013,2001.
[6]. Losch B., Application of Fuzzy Sets to the Diagnosis of Glaucoma. 18th Ann. Intel. Conf. of the IEEE Engg. In Medicine and Biology Society, Amsterdam, 1997.
[7]. Szmidt E., Kacprzyk J., A measure for Inuitionistic Fuzzy Sets. Fuzzy sets and systems; 121,2003.
[8]. Zadeh L.A., Fuzzy Sets. Information and control; 8:338-353.1965.