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Fuzzy Matrix for Medical Application

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Abstract: ***The object of this paper is design a triangular AIFM for thyroid disease diagnosis, by making use of the notion of triangular AIFM$_s$. Further, we extended our approach in the sector of addition and multiplication factors of triangular AIFM$_s$based on membership and non-membership function. In this work Elevated fever, headache, fatigue, eye pain, swollen are taken as important parameters of thyroid disease diagnosis. Finally, we presented a decision making problem based on one of the operation of triangular AIFM$_s$.***

Keywords: Fuzzy Matrix, Atanassovs Intuitionistic Fuzzy Matrix(AIFM) , Triangular- AIFM, Thyroid Gland Diseases Diagnosis.

I. INTRODUCTION

The pharmacy field is one of the most fascinating and fruitful application areas for the theory of fuzzy set. In fuzzy set, there was no depth of service for thought about the wavering in membership degrees that arises in different situations in real-life.Atanassov's invention of intuitionistic fuzzy sets (AIFSs) of Atanassov overcomes this situation. Here an additional degree can be used to model hesitation and ambiguity. In this paper, we researched TAIFM and presented an algorithm to test it, and by making use the notion of IFM from Triangular Atanassov, we apply the intuitionistic fuzzy set software from Triangular Atanassov for medical diagnosis, and we demonstrate the technique with case study of Thyroid disease. Thyroid gland is a part of the endocrine system, producing hormones that regulate key body functions and processes of metabolism. Increased or decreased tests of thyroid hormone suggest that animal equilibrium occurs between the requirements and supply of the body. There are several hormones released by thyroid; two of them are significant: triiodothyronine and thyroxine . To assist cells convert into strength to calories and oxygen, each must be produced in a normal range by the thyroid. It's almost focused to measure the blood level of thyroid hormone. Therefore, it's there natural levels of When dealing with patient data, doctors faced many challenges, such as big patient data needed, misdiagnosis, lack of evidence when applying records of patientsand human actions . Based on previous work, different neural network methods, includes Multi-Layer awareness with phase of Back-Propagation, Function of the radial Basis and Neural Network Feature of the Adaptive Conic Section, use to aid in the determination of thyroid disease; their identification accuracy is 87.53%, 80.97% and 84.98%. Five different approaches, includes Analysis of Linear Discriminant, T4.5 with default learning parameters (T4.5-1), T4.5 with parameter T equal to 5 (T4.5-2), T4.5 with parameter c equal to 95 (T4.5-3) and with two layers are covered and Required learning conditions for classification, and accuracies are higher than 80.54%, 92.76%, 92.71%, 92.84% and 92.93%. In addition, the implementation of the Artificial System for Immune regulation obtained an accuracy of 81 percent. In addition, thyroid disorders are diagnosed with a group of experts called ESTDD (expert system for thyroid disease diagnosis), 94.33 percent accuracy.

As a result of this, all in use at the moment diagnostic algorithms depend on various kinds for heuristics in which the resulting files contain missing bases due to differences that may misclassify the diseases. A constant data set is also discovered because of the measurement range, and our application determines a good and effective device for dealing with thyroidism hormones. In the case of ongoing information to be discreet, ueness, Information is missing and unclear. The intuitionistic fuzzy set by Triangular Atanassov deals with tables of data classification and focuses on functional interactions in data sets. The intuitive fuzzy theory of Triangular Atanassov maintains a framework to induce minimum rules to make decisions. The primary objective of that intuitionistic fuzzy set study of the Triangular Atanassov is to look for concrete decision rules for large databases and eventually acquire new information. The intuitionistic fuzzy set of Triangular Atanassov, it was applied efficiently in many different area, especially in the physician sector.

II. PRELIMINARIES

Definition 2.1.

A fuzzy matrix in order $m\times n$ is defined as follows $\tilde{A}$ = <a_{ij}, a_{ij}>where a_{ij} is the a_{ij}^{th} element membership merit in the $\tilde{A}$. Let $F_{m\times n}$denotes the collection of everything order $m\times n$ fuzzy matrices.

Let $F_{m\times n}$ denotes the collection of everything fuzzy matrices in order $m\times n$. If you have $m = n$, In short, we're writing Fn, the array of all these order n square FMs.

Fuzzy set wasn't sufficient to investigate then uncertainty about the class of degree membership of one element in set. Atanassov introduced intuitionistic fuzzysets, which are defined below, to deal with this situation.

Definition2.2.

An AIFS A is specified like an object of the form $\tilde{A}$ = {< x, $\mu_A(x)$, $\vartheta_A(x)$>/ xϵ X} where therole is concerned $\mu_{\tilde{A}}: X \to [0,1]$ and $\vartheta_{\tilde{A}} : X \to [0,1]$ set the class of degree membership and the class of degree non-membership of an object $x\in X$ respectively and $0 \le \mu_{\tilde{A}}(x) + \vartheta_{\tilde{A}}(x) \le 1$, for every $x\in X$.

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The valuation of $\Phi_{\tilde{A}}(x) = 1 - \mu_{\tilde{A}}(x) - \vartheta_{\tilde{A}}(x)$ is referred to the level of non-determinated of the gradients $x \in X$ to the AIFS $\tilde{A}$. Also let delineate of $<F> = \{< x, y> : x, y \in [0,1] \text{ and } 0 \le x + y \le 1\}$.

Definition2.3.

Let $[\mathbf{a}_{ij}, \lambda_j]$, $[\mathbf{b}_{ij}, \lambda_j']$ $\in$ AIFM $_{m\times n}$ then AIFM$[c_{ij}, d_j]$is called intersection of $[\mathbf{a}_{ij}, \lambda_j]$ and $[\mathbf{b}_{ij}, \lambda_j']$dented $[\mathbf{a}_{ij}, \lambda_j] \tilde{\cap} [\mathbf{b}_{ij}, \lambda_j']$ if $c_{ij} = \min\{ a_{ij}, b_{ij} \}$ and $d_j = \max\{ \lambda_j, \lambda_j' \}$ for all i, j .

Definition2.3.

Let $[\mathbf{a}_{ij}, \rho_j, \gamma_j]$, $[\mathbf{b}_{ij}, \rho_j', \gamma_j']$ $\in$ TAIFM $_{m\times n}$ then TAIFM$[c_{ij}, d_j, e_j]$is called **union** of $[\mathbf{a}_{ij}, \rho_j, \gamma_j]$ and $[\mathbf{b}_{ij}, \rho_j', \gamma_j']$ denoted $[\mathbf{a}_{ij}, \rho_j, \gamma_j]$ $[\mathbf{b}_{ij}, \rho_j', \gamma_j']$ if $c_{ij} = \min\{ a_{ij}, b_{ij} \}$ and $d_j = \max\{ \rho_j, \rho_j' \}$ $e_j = \max\{ \gamma_j, \gamma_j'' \}$ for all i, j .

Definition2.4.

Let $[c_{ij}, d_j] \in \tilde{A} \tilde{\cap} \tilde{B}$ where $\tilde{A}$ and $\tilde{B}$ and are two **Atanassov's intuitionistic** fuzzy matrices. Then the set $W(u_i) = \{U_i \in U \mid \sum C_{ij} \}$ is called **weight** for each $U_i \in U$.

Triangular Fuzzy Number

Sometimes, due to the mistake of the measuring methods or devices, etc., A few data or numbers cann't be specificated accurately and clear. Assume a person's altitude is 175 cm. But this is practically insolvent to be accurate measure the height; in fact, this altitude is about 160 cm; it's all about 175 cm or less so. This person's altitude may be more accurately written ain the form (175 – x, 175, 175+y) where the left side and right side spreads are 175. This equations is can be written as (a-x, a, a + y), where x and y are respectively the left sde and right side spreads of a. This is the figure forms are referred to as triangular fuzzy numbers (TFNs) and represented additionally as (a, x, y). ATFN's definition of mathematics is given below.

Definition2.5.

An TAIFS $\tilde{A}$ is defined as like an artifact of the shape $\tilde{A} = \{< x, \mu_{\tilde{A}}(x), \vartheta_{\tilde{A}}(x), \lambda_{\tilde{A}}(x)>/ x \in X\}$ where the function is $\mu_{\tilde{A}} : X \to [0,1]$ and $\vartheta_{\tilde{A}} : X \to [0,1]$ and $\lambda_{\tilde{A}} : X \to [0,1]$ define the class of degree membership and the class of degree non-membership of a value $x \in X$ respectively and $0 \le \mu_{\tilde{A}}(x) + \vartheta_{\tilde{A}}(x) + \lambda_{\tilde{A}}(x) \le 1$, for every $x \in X$. The value of $\Phi_{\tilde{A}}(x) = 1 - \mu_{\tilde{A}}(x) - \vartheta_{\tilde{A}}(x) - \lambda_{\tilde{A}}(x)$ is referred to the level of non-determinate of the gradients $x \in X$ to the TAIFS A . Let it be delineate $<F> = \{< x, y, z > : x, y, z \in [0,1] \text{ and } 0 \le x + y + z \le 1\}$.

III. APPLICATION OF TAIFM IN HUMAN DISEASE

In this section, we are put forwarding the problem which is based upon TAIFM in Human disease.

3.1Procedure of solving problem:

A dinkum life problem can be solved by using different Mathematical methods. The conclusion maker can choose the easiest method from the alternative. After taking decision by the conclusion makers that, they solve a particular problem by using the operation of Triangular Atanassov's intuitionisticfuzzymatrices, the decision makers go through the following algorithm.

Algorithm:

***Step* 1**:

Create the IFM of the Triangular Atanassov in relation to the decision-makers ' features of the own choosing.

***Step* 2:**

To calculate union of the IFM of Triangular Atanassov.

***Step* 3**:

To calculate the weight of each entity (Oi) by adding the membership merit for their entries respective row (ith-row) of Triangular Atanassov's IFM union.

***Step* 4**:

The demur with the highest weight becomes the optimaldemur of choice.

To highlight the fundamental idea of the AIFM algorithm, we use it now for the IFM decision-making based problems from the following Triangular Atanassov.

Case Study:

A person with a disease may have several symptoms, of course, in medical science. It is also noted that certain symptoms may be specific to more than one disease contributing to a particular dilemma. Now, when a area is heavily affected by new disease, the doctor has to face several problems. Then the doctor identified the disease beginning with the patients ' common symptoms.

Let $M = \{ P_1, P_2, P_3, P_4, P_5 \}$ be the setting of patients and

$S = \{ C_1, C_2, C_3, C_4, C_5 \}$ be the setting of definition of symptoms of Thyroid.

where

C_1 = Elevated fever ,

C_2 = headache,

C_3= extreme fatigue

C_4 = Red eyes, and eye pain,

C_5 = The lymph nodes are swollen,

Suppose the patients were tested by two Dr. A an Dr. B based on the same set of parameters.

Let $F : S \to [0, 1]$ .They consider the function on the parameters as follows:

Step 1:

Based on these functions the two doctors construct Triangular Atanassov's intuitionistic fuzzy matrices given as follows:

$$\tilde{T} = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \end{array} \begin{array}{c} C_1 \quad\quad C_2 \quad\quad C_3 \quad\quad C_4 \quad\quad C_5 \\ \begin{pmatrix} (0.3,0.33,0.37) & (0.15,0.35,0.5) & (0.2,0.28,0.52) & (0.3,0.34,0.3) & (0.2,0.4,0.4) \\ (0.1,0.4,0.5) & (0.3,0.3,0.4) & (0.2,0.2,0.6) & (0.1,0.3,0.4) & (0.2,0.3,0.5) \\ (0.10,0.13,0.6) & (0.3,0.35,0.35) & (0.0,5,0.5) & (0.2,0.35,0.3) & (0.3,0.34,0.36) \\ (0.25,0.3,0.45) & (0.3,0.33,0.37) & (0.2,0.35,0.45) & (0.2,0.3,0.5) & (0.1,0.2,0.65) \\ (0.3,0.34,0.36) & (0,0.4,05) & (0.2,0.25,0.55) & (0.3,0.33,0.3) & (0,0.3,0.35) \end{pmatrix} \end{array}$$

$$\tilde{S} = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \end{array} \begin{array}{c} C_1 \quad\quad C_2 \quad\quad C_3 \quad\quad C_4 \quad\quad C_5 \\ \begin{pmatrix} (0.3,0.32,0.36) & (0.2,0.33,0.47) & (0,0.5,0.5) & (0.29,0.35,036) & (0.3,0.30,0.36) \\ (0.2,0.3,0.5) & (0.1,0.35,053) & (0.2,0.28,0.52) & (0.3,0.35,0.35) & (0.2,0.4,0.4) \\ (0.2,0.2,0.55) & (0.3,0.34,0.36) & (0.2,0.3,0.45) & (0.2,0.3,0.5) & (0.2,0.3,0.4) \\ (0.25,0.3,0.45) & (0.29,0.35,036) & (0.2,0.25,0.55) & (0.1,0.25,0.45) & (0,0.3,0.7) \\ (0.1,0.3,0.4) & (0.2,0.3,0.45) & (0.1,0.2,0.6) & (0.2,0.3,0.4) & (0.3,0.3,35) \end{pmatrix} \end{array}$$

***Step* 2:**

$$\tilde{T} \cap \tilde{S} = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \end{array} \begin{array}{c} C_1 \\ \begin{pmatrix} (0.3,0.33,0.37) \\ (0.2,0.3,0.5) \\ (0.2,0.2,0.6) \\ (0.25,0.3,0.45) \\ (0.3,0.3,0.4) \end{pmatrix} \end{array} \begin{array}{c} C_2 \\ \begin{pmatrix} (0.2,0.33,0.47) \\ (0.3,0.3,0.4) \\ (0.3,0.34,0.36) \\ (0.3,0.33,0.37) \\ (0.2,0.30,0.5) \end{pmatrix} \end{array} \begin{array}{c} C_3 \\ \begin{pmatrix} (0.2,0.28,0.52) \\ (0.2,0.2,0.6) \\ (0.2,0.30,0.5) \\ (0.2,0.25,0.55) \\ (0.2,0.2,0.6) \end{pmatrix} \end{array} \begin{array}{c} C_4 \\ \begin{pmatrix} (0.3,0.34,0.36) \\ (0.3,0.3,0.4) \\ (0.20,0.3,0.5) \\ (0.2,0.25,0.45) \\ (0.3,0.3,0.4) \end{pmatrix} \end{array} \begin{array}{c} C_5 \\ \begin{pmatrix} (0.3,0.3,0.4) \\ (0.2,0.3,0.4) \\ (0.3,0.3,0.4) \\ (0.1,0.20,0.7) \\ (0.3,0.3,0.35) \end{pmatrix} \end{array}$$

***Step* 3**:

$W(P_1) = 0.37+0.47+0.52+0.36+0.4 =2.12$
$W(P_2) =0.5+0.4+0.6+0.4+0.5 = 2.4$
$W(P_3) =0.6+0.36+0.5+0.5+0.4 =2.36$
$W(P_4) =0.45+0.36+0.55+0.45+0.7 =2.52$
$W(P_5) =0.4+0.5+0.6+0.4+0.35 =2.25$
Hence the patient's maximum weight (2.52) obtain is P_4.
Therefore, in Thyroid the patient P_4 suffered heavily.

IV. RESULT

In this effort. Elevated fever, headache, fatigue, eye pain, swollen are taken as important parameter of Thyroid disease diagnosis based on a decision making problem with operation of triangular Atanassovs Intuitionistic Fuzzy Matrix(AIFM).this method is used to determination of Thyroid disease with high accuracy.

V. CONCLUSION

We are discussing in this report an algorithm to solve the problem of thyroid disease diagnosis by using the intuitionist fuzzy matrices of Triangular Atanassov. The decision-making approach of the TAIFM multi-criteria has tremendous performance changes for various parameters issue with decision-making due to high confidence in coping with knowledge about uncertainty. In the future, the innovative approach can be used in a number of various parameters issue with decision making to cope with uncertainty. It may be applied efficiently in many different areas especially in physician sector.

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