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AGE GROUP ANALYSIS OF DIABETIC PATIENTS THROUGH RTD AND CETD FUZZY MATRIX MODELS

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Abstract

The primary objective of this study is to identify the most prevailing or frequently age group among patients affected by both Diabetes and Blood Pressure(BP) in the Ranipet District .Utilizing the (Refined-Time Dependent) RTD and (Combined-Effective Time Dependent) CETD fuzzy matrix models ,the data were collected from 100 individuals cases at rural hospital across the district .By applying fuzzy Matrix modeling methodologies we systematically analysed the collected data to detect patterns of health deterioration across different age groups

.The study ultimately highlights the peak age group that experiences the most significant health hazards related to diabetes and BP, offering critical insights for targeted Healthcare interventions and preventive strategies in rural communities.

INTRODUCTION

In 1965,Prof.Lofti A.Zadeh was introduced and explained by theory of fuzzy set is defined by generalization of classical set theory for infinite values it is based on Fuzzy logic Soft Computing, Computing with words, Fuzzy Set theory research developed by Computational theory, Neural

networks and AI.We Calculated the Membership function datas which is lies between from 0.1 to 1.0 based on fuzzy logic theory. In this paper completely depend on the field work in the hospital .

We analyse the high age group of people affected by diabetics and BP by using RTD matrix. In this paper the first section we discuss about the ATD, CETD and RTD matrix. Section two is description of the problem. Section three is Formulation of problem by using mean and standard deviation. Final section is research methodology of maximum age group of the problems of diabetic and BP Patients, we give the conclusion and some suggestions

DEFINITION : 1.1 ATD MATRIX

We Consider the age group a row and the time period with the columns then when calculating raw data into a corresponding data matrix. Then, we divide each data in the unstructed matrix by the number of years, or the time period, to create the Average - Time Dependent Data (ATD) matrix (r_{ij}).This matrix shows data that is completely consistent. We determine each column's Mean ($\overline{X}$) and standard deviation (σ^*.) in the ATD matrix in the third step.

DEFINITION : 1.2 RTD MATRIX

Consider μ_j is the average of j^{th} column and $\sigma_j{}^*$ if the standard deviation of each j^{th}column we choose a parameter β from the interval [0,1] and form the Refined -Time Dependent Matrix (RTD matrix), substitute in the Constraints

If $r_{ij} \leq (\mu_j - \beta * \sigma_j{}^*)$ then e_{ij} = -1 else

If $r_{ij} \in (\mu_j - \beta * \sigma_j{}^*, \mu_j + \beta * \sigma_j{}^*)$ then e_{ij} = 0

If $r_{ij} \geq (\mu_j + \beta * \sigma_j{}^*)$then e_{ij} = 1

The Refined –Time Dependent fuzzy matrix is created by redefining the ATD matrix, and in this case, the entries are either 0 or 1. The most age group may now be obtained from the sum of the rows in this matrix.

DEFINITION : 1.3 COMBINED -EFFECTIVE TIME DEPENDENT MATRIX

The (Combined -Effective Time Dependent Matrix) CETD is obtained by combining the aforementioned RTD matrices by altering the $\beta \in$ [0,1]. Once we found adding the rows for the CETD matrix, we draw inferences from the data. Graphs are used to illustrate all of these, and they are essential for presenting the data in the most straightforward way possible even for the average casual observer**.**

2.THE MAXIMUM AGE GROUP OF DIABETICS PATIENTS IN RANIPET USING CETD MATRIX USING 5× 6 MATRIX.

DEFINITION : 2.1

An nxm matrix R= (r_{ij}) ,if $r_{ij} \in$[0,1] for 1≤i≤n and 1≤j≤m where R is said to be fuzzy matrix. In other words, if the elements of any (n x m) matrix R are inside the range [0, 1]

DEFINITION: 2.2

(Intuitionstic fuzzy matrices) Let R = $[r''_{ij}]$nxm be two fuzzy matrices , r' +r'' ≤1 for every i≤ m, j≤ n. The pair[r' ,r''] is said an intuitionistic fuzzy matrix and is denoted by r and then we may write r = [$r_{ij} = \{r'_{ij}, r''_{ij}\}$] matrix

DEFINITION: 2.3

The process of collecting preliminary data and organizing it into a matrix, with age groups as rows and assumptions as columns, is referred to as the Initial Raw Data Matrix (IRDM).

DEFINITION : 2.4

We define the (Initial Raw Data Matrix) IRDM where generated with the (Average –Time Dependent Data Matrix) ATDM by normalizing each row through division by the corresponding class interval length.

DEFINITION: 2.5

In Refined -Time Dependent Data Matrices is used to identify the mean & standard deviation then to capture results very easily this indicators where generated varying a parameter $\beta \epsilon$ [0, 1] . Central tendency and Standard deviation datas used in the (RTDM) refined time dependent data matrice entries are -1, 0 or 1.

DEFINITION: 2.6

Consider mathematical formulation of the unstructed matrix into Average -Time Dependent Data Matrix by dividing each class datas by the range of the class intervals.

If $r_{ij} \leq (\mu_j - \beta * \sigma_j^*)$ then e_{ij} = -1 else

If $r_{ij} \in (\mu_j - \beta * \sigma_j^*, \mu_j + \beta * \sigma_j)$ then e_{ij} = 0else

If $r_{ij} \geq (\mu_j + \beta * \sigma_j^*)$then e_{ij} = 1

DEFINITION: 2.7

We define a (Combined -Effect Time Dependent Data Matrix) CETDM it performed are combination of many Refined Time-Dependent Data matrices by adjusting $\beta \epsilon$ [0, 1], to capture the effects in cumulative impact of all the entries.

MATHEMATICAL FORMULATION OF PROBLEM : 3.1

A total of 300 people have diabetes, of whom 150 are male and 150 are female. 50 male and 52 female patients were randomly choosen for the research from the data gathered. The Primary Determinants are classified as columns and the age groups as rows in the IRD Matrix. Starting at age 25, when separated the sample into five age groups, with a class interval of 10 to 80 years.

Below are the main elements that we take into account for this study:

$\mathbb{F}_1$- bmi

$\mathbb{F}_2$- sys_bp

$\mathbb{F}_3$-Smoking habit

$\mathbb{F}_4$- Level of Alcohol Consumption

$\mathbb{F}_5$- Range Hemoglobin level A 1 c (HBA 1 c)

$\mathbb{F}_6$-Low-density lipoprotein (LDL)

Construction matrix for Maximum Age Group of People Mostly Affected in Diabetics by 5×6 order matrix.

5×6 order of IRDM Matrix

Age Group	$\mathbb{F}_1$	$\mathbb{F}_2$	$\mathbb{F}_3$	$\mathbb{F}_4$	$\mathbb{F}_5$	$\mathbb{F}_6$
25 – 34	2	1	0	0	2	1
35 -44	15	10	3	2	10	3
45 – 54	42	32	5	10	35	12

55 -64	30	15	2	5	20	10
65 – 74	5	3	0	1	3	1

The ATD matrix of order 5× 6

Age Group	F1	F2	F3	F4	F5	F6
25 – 34	0.2	0.1	0.0	0.0	0.2	0.1
35 – 44	1.5	1.0	0.3	0.2	1.0	0.3
45 – 54	4.2	3.2	0.5	1.0	3.5	1.2
55 – 64	3.0	1.5	0.2	0.5	2.0	1.0
65 – 74	0.5	0.3	0.0	0.1	0.3	0.1

MEAN: 3.2

Calculate the mean is computed by taking the sum of all datas and dividing that total number of datas.

A formula to determine the

$$\textbf{Mean} = \frac{(\boldsymbol{Sum\ of\ all\ datas})}{(\boldsymbol{Total\ nos\ of\ datas})}$$

3.3 STANDARDDEVIATION:

Calculate the Standard deviation in the ATD matrix for the every column

The formula for the standard deviation $\boldsymbol{\sigma}^* = \frac{\sqrt{\sum(\boldsymbol{xi}-\boldsymbol{\mu})^2}}{\boldsymbol{n}}$

Average and SD of order 5 × 6 of ATD matrix

Mean	1.88	1.22	0.2	0.36	1.4	0.52
Standard deviation	0.2	1.2	0.0	0.1	1.6	0.2

To find the RTD matrix for the Parameters β = 0.25, 0.50, 0.75. 0.90 for CETD matrix.

PARAMETER β = 0.25

$$\begin{bmatrix} -1 & -1 & -1 & -1 & -1 & -1 \\ 0 & 0 & 1 & -1 & 0 & -1 \\ 1 & 1 & 1 & 1 & 1 & -1 \\ -1 & 0 & 0 & 1 & 1 & -1 \\ -1 & -1 & -1 & 1 & -1 & -1 \end{bmatrix}$$

Adding the row matrix

$$\begin{bmatrix} -6 \\ -1 \\ 4 \\ 0 \\ -4 \end{bmatrix}$$

Adding the Column sum matrix

$$[-2 \quad -1 \quad 0 \quad 1 \quad 0 - 5]$$

PARAMETER β = 0.50

$$\begin{bmatrix} -1 & -1 & -1 & -1 & -1 & -1 \\ -1 & 0 & 1 & -1 & 0 & -1 \\ 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & -1 & 1 \\ -1 & 1 & -1 & -1 & -1 & -1 \end{bmatrix}$$

$$\begin{bmatrix} -6 \\ -2 \\ 6 \\ 2 \\ -5 \end{bmatrix}$$

$$[-1 \quad 0 \quad 0 \quad -1 \quad -2 \quad -1]$$

PARAMETER β = 0. 75

$$\begin{bmatrix} -1 & -1 & -1 & -1 & -0 & -1 \\ -1 & 0 & 1 & -1 & 0 & -1 \\ 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 0 & 1 \\ -1 & -1 & -1 & -1 & 0 & -1 \end{bmatrix}$$

$$\begin{bmatrix} -5 \\ -2 \\ 6 \\ 3 \\ -5 \end{bmatrix}$$

$$[\mathbf{-1} \quad \mathbf{-1} \quad \mathbf{0} \quad \mathbf{-1} \quad \mathbf{1} \quad \mathbf{-1}]$$

PARAMETER β = 0. 90

$$\begin{bmatrix} -1 & -1 & -1 & -1 & -1 & -1 \\ -1 & 0 & 1 & 1 & -1 & -1 \\ 1 & 1 & 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & -1 & -1 & -1 \\ -1 & 0 & -1 & 1 & -1 & -1 \end{bmatrix} \qquad \begin{bmatrix} -6 \\ -1 \\ 5 \\ -2 \\ -3 \end{bmatrix}$$

Adding the Column matrix $[-1 \quad 0 \quad -1 \quad 1 \quad -3 \quad -3]$

PARAMETER $\beta = 0.25, 0.50, 0.75, 0.90$

CETD matrix for sum matrix

$$\begin{bmatrix} -6 & -6 & -5 & -6 \\ -1 & -2 & -2 & -1 \\ 4 & 6 & 6 & 5 \\ 0 & 2 & 3 & -2 \\ -4 & -5 & -5 & -3 \end{bmatrix}$$

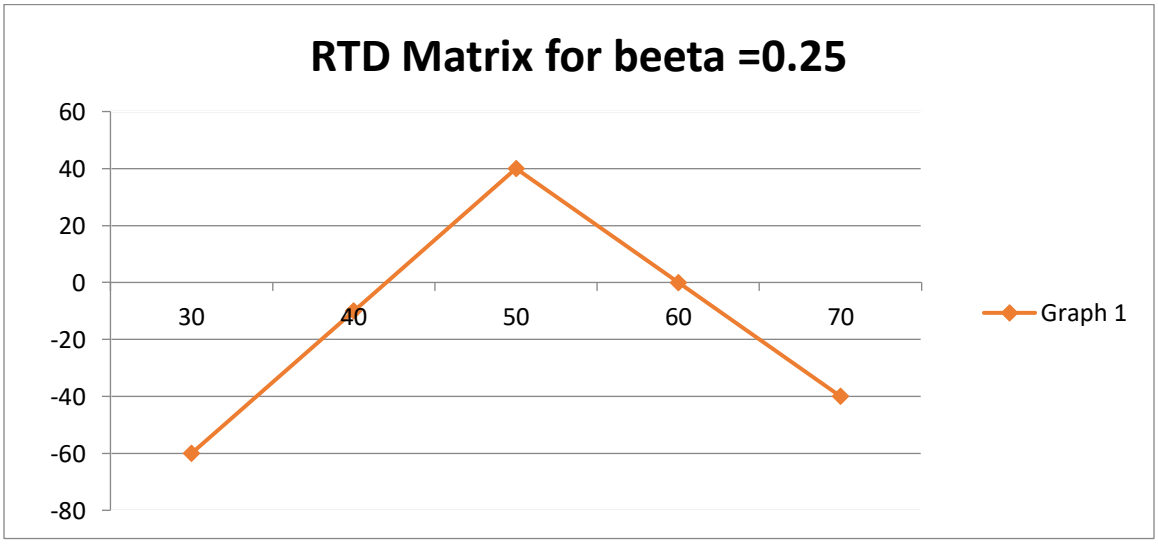
Adding the row matrix

$$\begin{bmatrix} -23 \\ -6 \\ 21 \\ 3 \\ -17 \end{bmatrix}$$

CETD matrix for column matrix

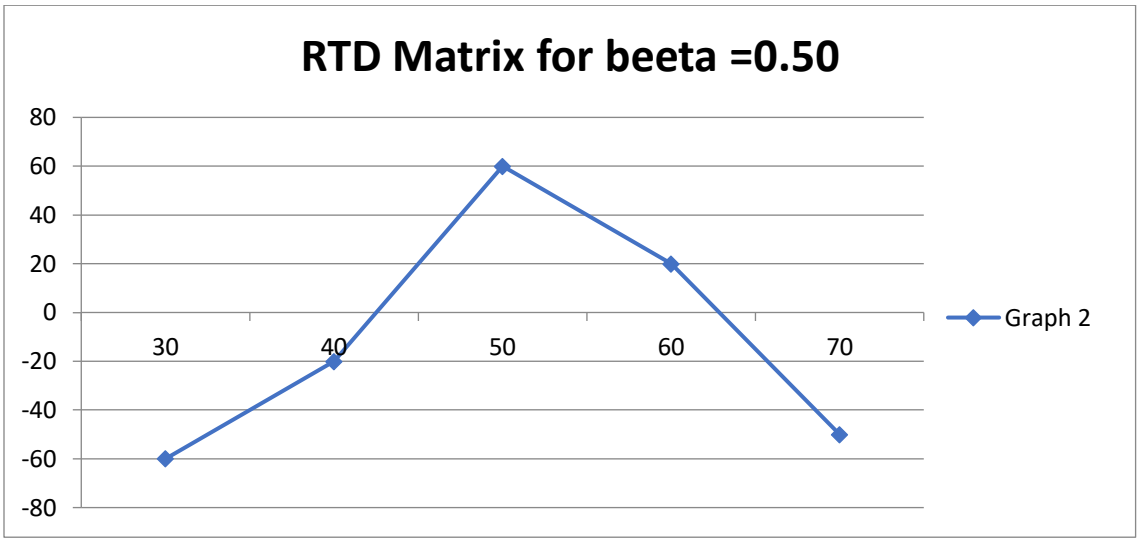
$$\begin{bmatrix} -2 & -1 & 0 & 1 & 0 & -5 \\ -1 & 0 & 0 & -1 & -2 & -5 \\ -1 & -1 & 0 & -1 & 1 & -1 \\ -1 & 0 & -1 & 1 & -3 & -3 \end{bmatrix}$$

GRAPH FOR THE PARAMETER $\beta = 0.25$



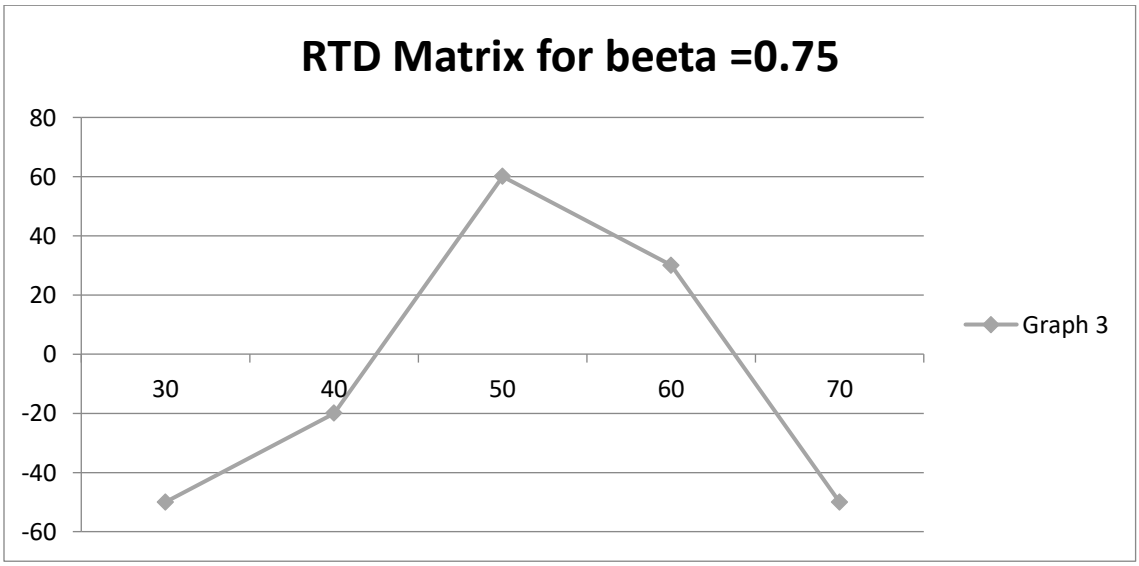
Graph 1: Depicting the mostly affected diabetic patients of parameter **β** = 0.25

GRAPH FOR THE PARAMETER $\beta = 0.50$



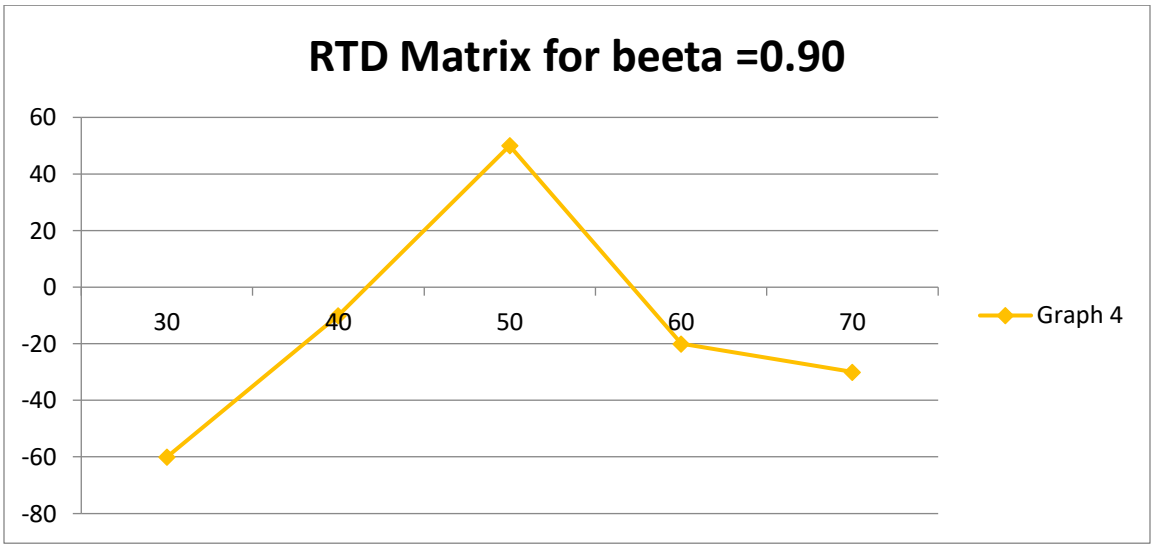
Graph 2: Depicting the mostly affected diabetic patients of parameter $\beta = 0.50$

GRAPH FOR THE PARAMETER $\beta = 0.75$



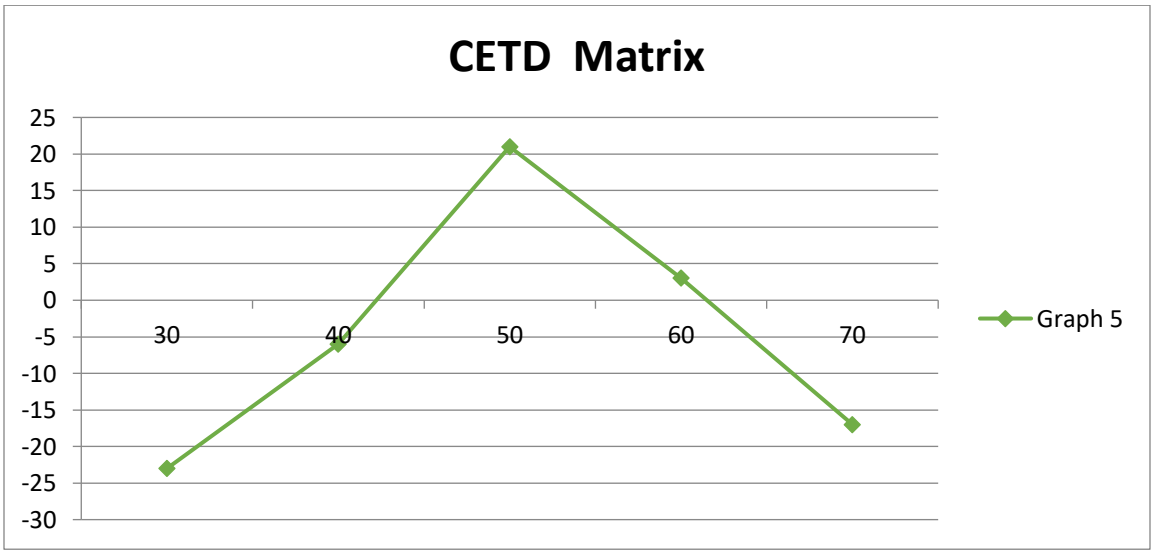
Graph 3:Depicting the mostly affected diabetic patients of parameter $\beta = 0.75$

GRAPH FOR THE PARAMETER $\beta = 0.90$



Graph 4: Depicting the mostly affected diabetic patients of parameter $\beta = 0.90$

GRAPH FOR THE PARAMETER $\beta = 0.25, 0.50, 0.75, 0.90$.



Graph 5: Depicting the mostly affected diabetic patients of parameter β = 0.25, 0.50, 0,75, 0.90.

CONCLUSION:

In summary, the utilization of the Combined Effects of Text Detection (CETD) and Automatic Text Detection (ATD) matrix for monitoring diabetic patients aged 50 and above shows great promise in enhancing healthcare results. By incorporating ATD technology to automatically extract and analyze textual data from medical records, test results, and patient reports, healthcare professionals can access real-time insights into the condition and care of diabetic patients. Moreover, integrating this with real-time data (RTD) streams like glucose and monitoring, vital signs tracking, and medication adherence data allows for proactive interventions and personalized treatment plans.

The CETD matrix and ATD matrix provides healthcare providers with the ability to identify early warning signs, optimize treatment strategies, and improve patient outcomes through timely interventions and well-informed decision-making. Consequently, diabetic patients aged 50 above can experience developed disease management, reduced complications, and enhanced quality of life.

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