

## A STUDY ON SMOKING PROBLEM USING FUZZY MATRIX METHOD

<sup>1</sup>\*IFTIKHAR, <sup>1</sup>MUSHEER AHMAD, <sup>2</sup>ANWAR SHAHZAD SIDDIQUI

<sup>1</sup>Department of Applied Sciences & Humanities, Jamia Millia Islamia, New Delhi-110025, India.

<sup>2</sup>Department of Electrical Engineering, Jamia Millia Islamia, New Delhi-110025, India.

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### ABSTRACT

*In this paper, the maximum age-group of cigarette smokers who have started smoking due to various reasons have been investigated. The authors have divided and defined four types of matrices which are called initial raw data matrix (IRD matrix), average time dependent data matrix (ATD matrix), refined time dependent data matrix (RTD matrix), and combined effect time dependent data matrix (CETD matrix), and apply an algebraic applications of fuzzy matrix theory to deal smoking problem.*

*Keywords: fuzzy matrix, IRD matrix, ATD matrix, RTD matrix, CETD matrix, smoking problem.*

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### 1. INTRODUCTION

Cigarette smoking is one of the dangerous problems in our society. The most people start smoking as teens, those people whose friends or parents are smoker are more likely to start smoking than those who don't. The tobacco industry's ads, price breaks, and other promotions for its products are a big influence in our society. The tobacco industry spends billions of dollars each year to create and market ads that show smoking as an exciting, glamorous and safe. Studies show that anyone who starts using tobacco can become addicted to nicotine. Many of the mathematicians have been worked on real world problems using the concept of fuzzy matrices. In 2005, El. W.B. Vasantha Kandasamy umalai, Victor Devadoss, and Mary John have studied the social and psychological problems faced by rag pickers using CETD matrix. Majority of rag pickers whom they have interviewed were children below the age of 15, most of them were runaways from home, school dropouts or orphans. They collected information from 200 rag pickers in Chennai and have studied the problem using CETD matrix. This type of problem was tackled first time using an algebraic application, the solution is obtain as a column matrix which gives the associated numbers which is transformed into graph which will depict the highest age-group in which they take up the profession of rag picking, a complete grading of age-group is also given by this method. From the fuzzy CETD matrix analysis they have observed that age-group 16-20 are most hypersensitive as they land up in streets even for small problems and become rag pickers. In 2011, A. Kalaichelvi, S. Gnanamalar have identified the various types of problems encountered by coffee cultivators and to ascertain the group of coffee cultivators (based on landholding) that are worst affected by such problems. In 2012, A. Victor Devadoss, M. Clement Joe Anand have investigate the peak age of women gets anger in Chennai, they have classified dimensions of personality of women into five factors such as Openness, Conscientiousness, Extraversion, Agreeableness, and Negative Emotion. In 2013, William, A. Victor Devadoss and J. Janet Sheeba have studied that breast cancer occurs as a result of mutations, or abnormal changes in genes. They have investigated the peak age of a women getting breast cancer in Chennai by the method of unsupervised questionnaire. In this paper, the authors have investigated maximum age group of cigarette smoker using fuzzy matrix methods. This paper is organized as follow: In Section 2, some basic definitions and arithmetic operations on the entries of initial raw data matrix are discussed. In Section 3, define the nine attributes for linguistics questionnaire to collect the data on the basis of age-groups. In the last section conclusions and results are discussed.

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**Corresponding Author: <sup>1</sup>Iftikhar**

**<sup>1</sup>Department of Applied Sciences & Humanities, Jamia Millia Islamia, New Delhi-110025, India.**

## 2. PRELIMINARIES

This section contains some basic definitions and preliminaries related to fuzzy matrix method.

**Definition 2.1: Average time dependent data matrix (ATD matrix)** The average time dependent data matrix is obtained by dividing each entry in the initial raw data matrix by length of the respective class interval (or time period), the data so obtained are uniform.

**Definition 2.2: Refined time dependent data matrix (RTD matrix)** Using the average ( $\mu_j$ ) and standard deviation ( $\sigma_j$ ) techniques and taking a parameter  $\alpha$  in the unit interval  $[0, 1]$ , form the different refined time dependent data matrices (RTD matrices) by using the formula:

If  $a_{ij} \leq \mu_j - \alpha\sigma_j$  then  $e_{ij} = -1$

else if  $a_{ij} \in (\mu_j - \alpha\sigma_j, \mu_j + \alpha\sigma_j)$  then  $e_{ij} = 0$

else if  $a_{ij} \geq \mu_j + \alpha\sigma_j$  then  $e_{ij} = 1$ , Where  $a_{ij}$  are entries of ATD Matrix.

**Definition 2.3: Combined effect time dependent data matrix (CETD matrix)** On combining the RTD matrices by varying, we get the combined effect time dependent data matrix (CETD matrix), which gives the cumulative effect of all the entries of RTD matrices.

## 3. ESTIMATION OF MAXIMUM AGE-GROUP OF CIGARETTE SMOKER ON THE BASIS OF GIVEN ATTRIBUTES

The authors have defined the following nine attributes ( $A_1, A_2, \dots, A_9$ ) for the linguistics questionnaire in order to collect the information for initial raw data matrix.

$A_1$ -Parental influences

$A_2$ -Stress Relief

$A_3$ -Social rewards

$A_4$ -Risk-taking Behavior

$A_5$ -Misinformation

$A_6$ -Genetic Prediction

$A_7$ -Self- medication

$A_8$ -Advertising/Media Influences

$A_9$ -Peer Pressure

## 4. DESCRIPTION OF THE ATTRIBUTES

**$A_1$ -Parental influences:** The relationship between parents smoking and their children smoking is blunt. In general Children of active smokers are more likely to start smoking than children of non smokers, according to some studies, a parent's choice to smoke can more than double the odds that the child will smoke.

**$A_2$ -Stress Relief:** Smokers who are addicted to tobacco report a range of positive sensations that come from smoking a cigarette. These range from reduced tension or appetite to a heightened sense of well-being. Researchers trace these sensations back to the flood of chemicals released into the nervous system by nicotine. Just like any prescription or illicit drug, it changes the body's chemistry and functioning when it enters the system.

**$A_3$ -Social rewards:** Social rewards are the "gifts" people feel they receive when participating in a group activity, most often, this means some form of acceptance Smokers at an office building who take cigarette breaks at similar times may bond while they smoke. Social rewards are more complex and have the potential to affect more than just peer pressure-sensitive tween and teens.

**$A_4$ -Risk-taking Behavior:** Most of the Adults in a country where smoking is frowned upon are familiar with the no-signs, designated smoking areas and general restrictions on their ability to smoke when and where they wish. But these rules legal, physical and social can offer tempting lines to cross for young people who tend toward risk-taking behavior.

**$A_5$ -Misinformation:** In some developed countries, in fact, misinformation about smoking runs very deep and works directly against public health efforts to curb tobacco use.

**$A_6$ -Genetic Prediction:** Medical genetic research is beginning to suggest, too, that addictions including addiction to nicotine, the effective ingredient in tobacco products may have a genetic component.

**A<sub>7</sub>-Self- medication:** For people not suffering from severe mental illness, cigarettes may still become a form of self-medication. For example, from decades, soldiers have taken up smoking on the battlefield to deal with wartime stress.

**A<sub>8</sub>-Advertising/Media Influences:** Media can exert a significant influence on viewers’ decision-making. One only has to look at how hairstyles or clothing fashions can be launched by a single movie or TV episode to see the extent of this power in many parts of the world.

**A<sub>9</sub>-Peer Pressure:** The Peer pressure that’s by most of the people start smoking comes under scrutiny is that one of the groups most likely to begin smoking.

On the basis of above mentions 9 attributes, we have surveyed 100 peoples in our surroundings, and have obtained the following responds.

Age-group	Number of respondents
16-20	30
21-25	30
26-30	30
31-35	10
	<b>100</b>

**Table-1:** Number of peoples responds based on age group

The attributes **A<sub>1</sub>, A<sub>2</sub>, ..., A<sub>9</sub>** are taken as columns of the initial raw data matrix, and the age-group in years 16-20, 21-25, 26-30, and 31 -35 are taken as the rows of the matrix.

Age-group	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>	A <sub>6</sub>	A <sub>7</sub>	A <sub>8</sub>	A <sub>9</sub>
16-20	30	14	13	12	11	14	12	27	28
21-25	30	16	25	25	22	27	22	25	29
26-30	30	17	28	26	29	28	23	27	28
31-35	10	4	6	5	6	5	5	6	8

**Table-2:** Initial Raw Data Matrix of Cigarette smokers of order 4 - 9

Now, we convert this initial raw data matrix (IRD-matrix) into average time dependent data matrix (ATD-matrix), (a<sub>ij</sub>) by dividing each entry of the initial raw data matrix with the width of corresponding class-interval.

Age-group	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>	A <sub>6</sub>	A <sub>7</sub>	A <sub>8</sub>	A <sub>9</sub>
16-20	6.00	2.80	2.60	2.40	2.20	2.80	2.40	5.40	5.60
21-25	6.00	3.20	5.00	5.00	4.40	5.40	4.40	5.00	5.80
26-30	6.00	3.40	5.60	5.20	5.80	5.60	4.60	5.40	5.60
31-35	2.00	0.80	1.20	1.00	1.20	1.00	1.00	1.20	1.60

**Table-3:** Average Time Dependent Matrix

Average	5.00	2.55	3.60	3.40	3.40	3.70	3.10	4.25	4.65
Standard deviation (S.D.)	1.73	1.03	1.78	1.77	1.80	1.91	1.48	1.78	1.76

**Table-4:** Average and Standard deviation

**RTD Matrix for  $\alpha = 0.25$**

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

**Row Sum Matrix**

$$\begin{pmatrix} -4 \\ 9 \\ 9 \\ -9 \end{pmatrix}$$

**RTD Matrix for  $\alpha = 0.5$**

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

**Row Sum Matrix**

$$\begin{pmatrix} -5 \\ 9 \\ 9 \\ -9 \end{pmatrix}$$

**RTD Matrix for  $\alpha = 0.75$**

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

**Row Sum Matrix**

$$\begin{pmatrix} -2 \\ 6 \\ 7 \\ -9 \end{pmatrix}$$

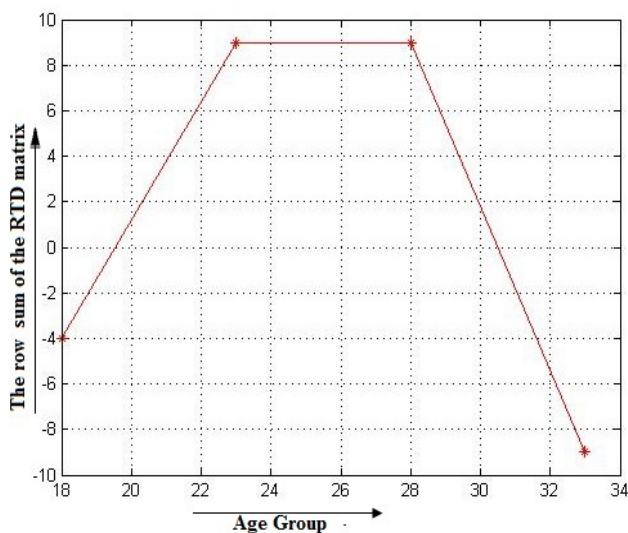


Fig.-1: Graph depicting the maximum age group of cigarette smoker for  $\alpha = 0.25$

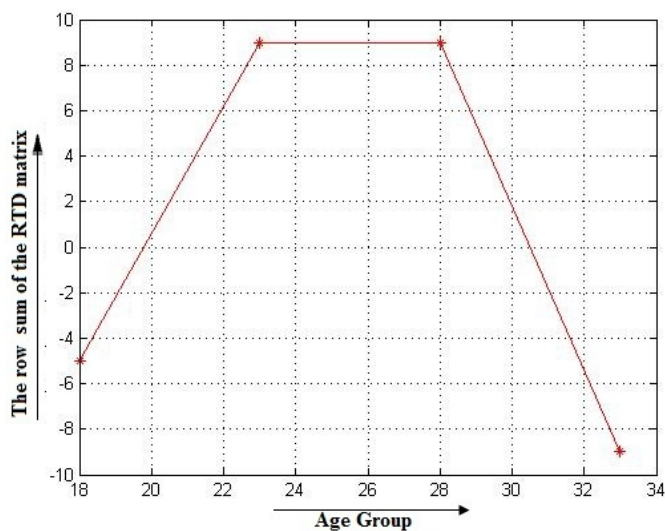


Fig.-2: Graph depicting the maximum age group of cigarette smoker for  $\alpha = 0.50$

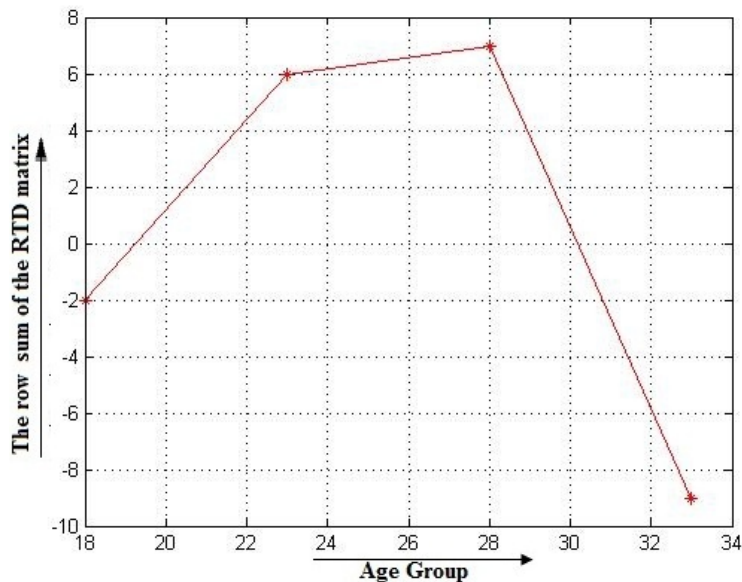


Fig.-3: Graph depicting the maximum age group of cigarette smoker for  $\alpha=0.75$

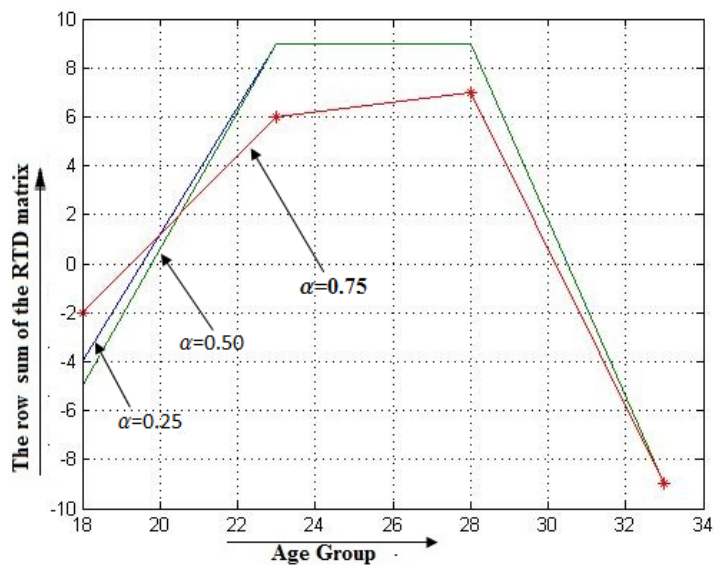


Fig.-4: Graphical comparison of the maximum age group of cigarette smoker

By combining all the above three RTD matrices for different values of  $\alpha$ , the Combined Effect Time Dependent Data Matrix (CETD Matrix)[1], with give the cumulative effect of all these entries which are as follows:

<b>CETD Matrix</b>	<b>Row Sum Matrix</b>
$\begin{pmatrix} 0 & 0 & -3 & -2 & -3 & -2 & -2 & 1 & 0 \\ 3 & 2 & 3 & 3 & 2 & 3 & 3 & 2 & 3 \\ 3 & 3 & 3 & 3 & 3 & 3 & 3 & 2 & 2 \\ -3 & -3 & -3 & -3 & -3 & -3 & -3 & -3 & -3 \end{pmatrix}$	$\begin{pmatrix} -11 \\ 24 \\ 25 \\ -27 \end{pmatrix}$

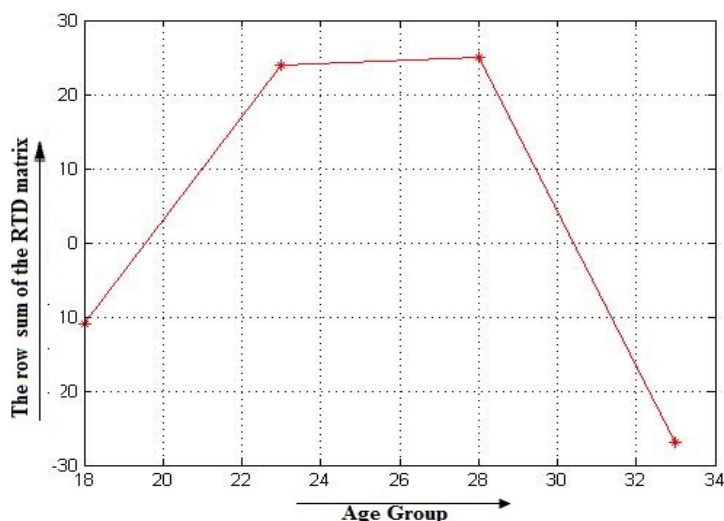


Fig.-5: Graph depicting the maximum age group of cigarette smoker for CETD matrix

## RESULTS AND CONCLUSIONS

From the above fuzzy matrix analysis and the fig. (1 to 5), it is clear that maximum age group of cigarette smokers has not changed with the change in the parameter  $\alpha$ ,  $0 \leq \alpha \leq 1$ . In the above figures it can be easily seen that maximum age-group when people start smoking lie between age of 22 to 28, because of stress, misinformation, self meditation, advertising etc. The CETD matrix also gives the same result. Also it can be seen that at the age group 31 to 35 the row sum matrix gives negative value, it means that very few peoples start smoking at this age due to the said reasons. The main motivation to work on this problem is that by knowing the maximum age group at which people start smoking, the government at least can take steps to resolve this problem.

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