

Vulnerable Attitude of Road user using Fuzzy Matrix Technique

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Abstract:

Road collision is one among the major cause of increase death toll around the world. An increasing heavy burden of traffic on roads thus lead to road accidents. The purpose of this study is to determine the age group of people who violates traffic rules and regulations to engage themselves and others in road traffic collision using fuzzy matrix technique. This paper is constituted into four division with introduction, procedure for combined effective time dependent data matrix, estimation of maximum age of the vulnerable road user, conclusion and suggestion based on the study.

Keyword: Road users – Vulnerable road user- combined effective time dependent data matrix

1.Introduction:

A recent survey on roads predicts that more number of populace has been killed by road traffic collision. Developing countries have more fatality rates rather than developed ones. Economically, most backward families lose their bread winner in the form of road traffic accidents. Also, many studies tell us that in almost all the crashes human beings are to be blamed and only a minority of crash can be attributed to roads and vehicles. The road crashes are caused by poor human behavior and that the causes are dominated by intentional errors only, such as violations and traffic offences.. This means road casualties are to be considered as a very serious public health problem. An attempt is made to follow up with peak age of vulnerable road user who creates menace in roads bringing damage to public properties and their health.

by finding its average and its standard deviation. Using average (μ_j) and standard deviation (σ_j) for j^{th} column of the matrix calculated, a parameter α -cut is chosen from the interval [0,1] to produce a matrix named as Refined Time Dependent Matrix (RTD) is manipulated using the following relation.

$$\begin{aligned} \text{if } \alpha_{ij} \leq (\mu_j - \alpha * \sigma_j) & \quad \text{then } e_{ij} = -1 \\ & \text{else} \\ \text{if } \alpha_{ij} \in (\mu_j - \alpha * \sigma_j, \mu_j + \alpha * \sigma_j) & \quad \text{then } e_{ij} = 0 \\ & \text{else} \\ \text{if } \alpha_{ij} \geq \mu_j + \alpha * \sigma_j & \quad \text{then } e_{ij} = 1 \end{aligned}$$

2. Procedure for Combined Effective Time Dependent Data Matrix

2.1. In the first stage, an initial raw data matrix representation is formed on basis of expert opinion related to the nature of the problem. The collected initial raw data matrix need not be uniform, is of the form with different ranges of age groups in row direction and their vulnerable attitudes along column direction. .

2.2 In the second stage, to make initial raw data matrix as an unbiased uniform one, the transformation is made from initial raw data matrix to Average Time Dependent Data (ATD) Matrix (e_{ij}) by dividing each entry of the of the raw data matrix by the number of years that is the time period along rows.

2.3 At final stage, we refine each column of ATD matrix

The RTD matrix is redefined process of ATD matrix whose entries are { -1, 0,1}. The row sum of RTD matrix gives the peak age group of people who deliberately violates traffic rules. Different RTD matrix are obtained for various values of parameter α -cut chosen between the interval [0,1] using the above relation. We combine each of RTD matrix to get a Combined Effective Time Dependent Data (CETD) matrix whose row sum gives the combined effect of RTD matrix. Graphs are plotted against age groups in x-direction and row sum in y-direction for easy understanding.

3. Estimation of Peak age of vulnerable road user using fuzzy matrix with order 4 X 7

People have different kinds of opinion about road accidents and its causes. To find out what is in their minds 50 peoples are interviewed and their opinions are recorded to collect several attributes. Among them seven major attributes are

limited to the study

X1: Using Mobile Phones while driving

X2: Exceeding the speed limit

X3: Disobeying Traffic Rules

X4: Lack of Experience

X5: Distracted while driving

X6: Sleep Deficit

X7: Driving Under the influence of Alcohol

Table 1: Initial Raw data matrix of order 4 X 7

	X1	X2	X3	X4	X5	X6	X7
15-24	19	10	11	17	18	3	11
25-35	18	11	8	9	15	8	19
36-45	11	7	5	5	12	13	13
46-60	10	6	4	3	12	21	13

Table 2: Average Time Dependent matrix(ATD) for order 4 X 7

	X1	X2	X3	X4	X5	X6	X7
15-24	1.9	1	1.1	1.7	1.8	0.3	1.1
25-35	1.64	1	0.73	0.82	1.36	0.73	1.73
36-45	1.1	0.7	0.5	0.5	1.2	1.3	1.3
46-60	0.67	0.4	0.27	0.2	0.8	1.4	0.87

Table 3: Average and Standard Deviation of ATD Matrix

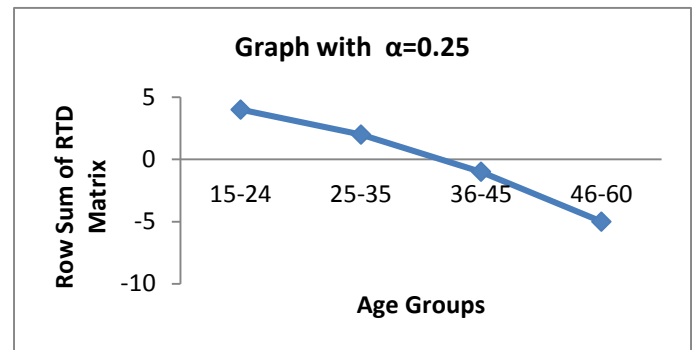
Avg	1.32	0.77	0.65	0.81	1.29	0.93	1.25
S.D	0.55	0.29	0.35	0.65	0.41	0.51	0.37

RTD for for $\alpha=0.25$

Row Sum

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

Graph1: Depicting of Maximum Age group with $\alpha = 0.25$

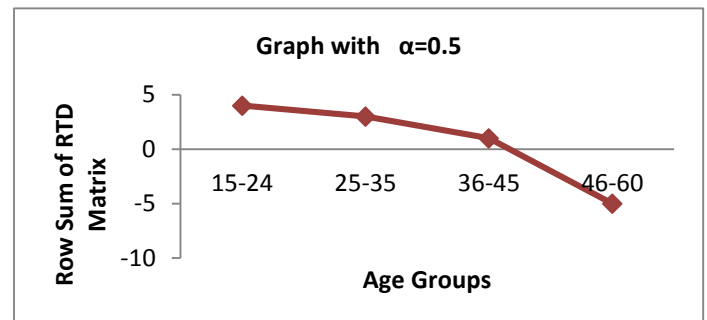


RTD for for $\alpha=0.25$

Row Sum

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

Graph 2: Depicting of Maximum Age group with $\alpha = 0.5$

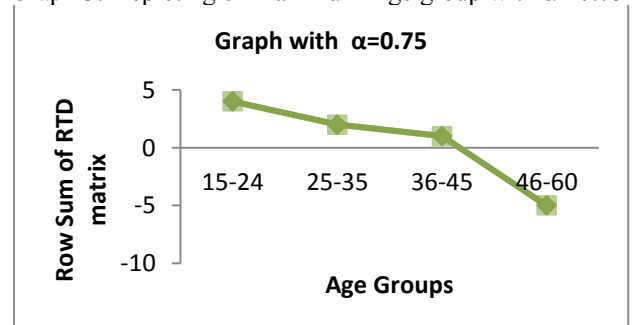


RTD for for $\alpha=0.75$

Row Sum

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

Graph 3: Depicting of Maximum Age group with $\alpha =0.75$

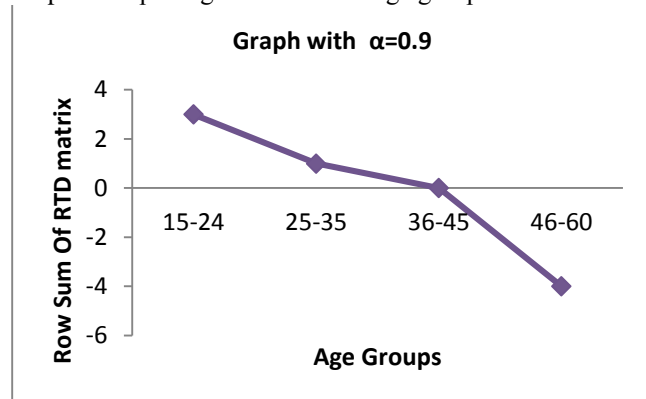


RTD for $\alpha=0.9$

Row Sum

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

Graph 4: Depicting of Maximum Age group with $\alpha =0.9$

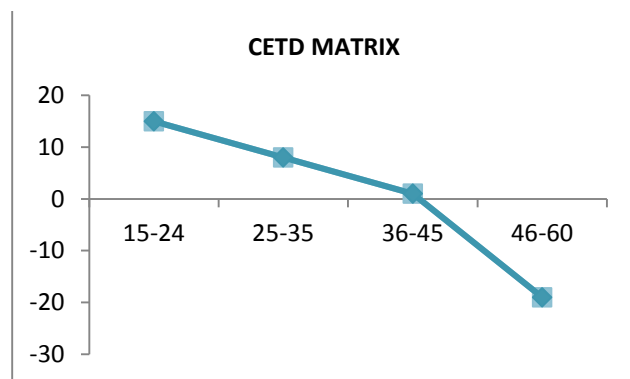


CETD Matrix

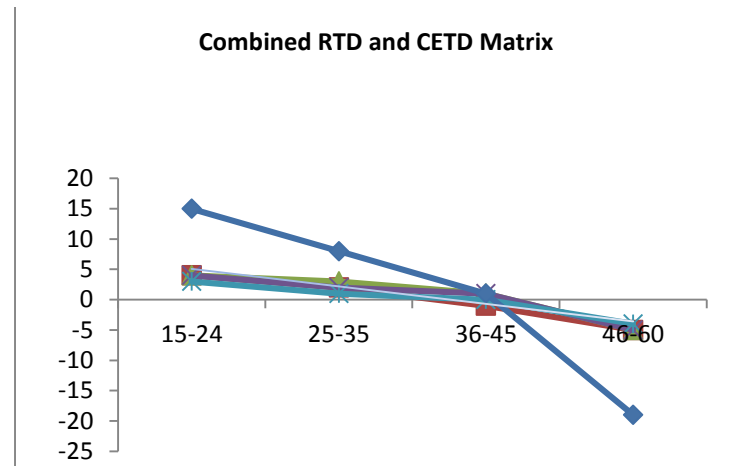
Row Sum

$$\begin{bmatrix} 4 & 3 & 4 & 4 & 4 & -4 & 0 \\ 2 & 3 & 0 & 0 & 0 & -1 & 4 \\ 0 & 0 & -1 & -1 & 0 & 3 & 0 \\ -4 & -4 & -4 & -4 & -4 & 4 & 3 \end{bmatrix} \quad \begin{bmatrix} 15 \\ 8 \\ 1 \\ -19 \end{bmatrix}$$

Graph 5: Depicting of Maximum Age group for CETD matrix



Graph 6: Depicting of Maximum Age group of combined RTD with parameter α between $[0,1]$ along with CETD matrix



4. Conclusion

The study clearly concludes that the vulnerable road users belongs to the age group of 15-24. Young people around the age 15 - 24 are becoming more victim towards road traffic accidents. As they commit more common mistakes on roads such as drinking and driving , using mobile phones, over speeding and overtaking at wrong place and violates traffic rules . The graph also suggest that there is a decline at the age group of 36 - 45,where people are more conscious while they drive on roads having an habit to stick to nature and obey traffic rules . People around the age group 46-60 rarely commits mistakes rarely on roads.

5. Suggestion:

The following measures are to be taken

- i) Policy makers on roads should ensure that digital cameras are placed on road sides to avoid its offences
- ii) Awareness Campaign should be conducted among drivers for wearing seat belts and helmets
- iii) Measures to be taken to control increasing number of vehicles on roads
- iv) Licence procedures are to be strictly followed
- v) Enforcement of Law for violating traffic rules.
- vi) Strict punishment to implement on drunken driving

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