ISSN: 0975-766X
CODEN: IJPTFI
Research Article

Available Online through
www.ijptonline.com

AN IMPROVED FUZZY DEMATEL TECHNIQUE AND ITS APPLICATIONS

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Received on 09-08-2016 *Accepted on 05-09-2016*

Abstract

The decision making trial and evaluation laboratory (DEMATEL) method is used for separating the cause and effect of any problem. The Combined Effect Time Dependent matrix (CETD) is used to determine the maximum age or the peak factor of any problem. Therefore, instead of finding the peak factor of cause-effect group separately using CETD matrix, a new model could be formulated by integrating the salient features of DEMATEL in CETD matrix so that the peak factor of the problem of cause-effect group can be found out simultaneously. The validity of the model is verified by applying in the problem of aggressive behavior and involvement in violence.

Key words: Fuzzy Number**,** DEMATEL, CETD matrix, Converting of Fuzzy data into Crisp Scales (CFCS), causal analysis

1. Introduction

An effective decision-making is always preferred, when the environment is getting complicated. Decision-makers will always indebt to assess a complex and vague situations to identify the causal relationship of a problem to take meaningful and effective decision. In order to make a meaningful decision or action, it is essential to understand the cause-effect relationship of the problem when it is full of uncertain. It is not easy task to capture the cause and effect relationship. The DEMATEL method is a powerful tool, originated from the Geneva research centre of battle memorial institute for capturing the cause and effect relationship by Fontela and Gabus in 1972[4,5]. Especially, it is useful for visualizing the complicated structure with matrices or digraphs. The classical DEMATEL method only deals crisp values {0,1} to provide the correlations among factors. In real-life situations, correlated factor analysis problem may involve uncertainty of fuzzy data. Thus, fuzzy DEMATEL method was extended using fuzzy numbers by Lin(2008), Lin(2004), Tseng(2009) [7,8,14]. Tamura et.al, (2005, 2006) developed stochastic DEMATEL method to solve the correlated factor[11, 12]. In many practical decision problems, experts may provide uncertain linguistic term to express their opinion when they have no clear idea or inadequate experience. The uncertain linguistic term is frequently used as form of inputs in decision analysis activities. Promising researchers have focused on uncertain linguistic term in group decision making processes. Lin2008, Lin 2004 proposed a Fuzzy extension of the DEMATEL method where uncertain linguistic terms converted in to triangular fuzzy number [7,8]. Wei 2009 used trapezoidal fuzzy number to develop an extension of a DEMATEL method in an uncertain linguistic environment [20]. Victor Devadoss & Felix (2013) have extended DEMATEL method by representing linguistic variable into hexagonal, heptagonal, octagonal fuzzy number [18,19]. On the another aspects, many other hybrid models have been constructed by merging the DEMATEL method with analytic network process (ANP), goal programming and technique for order preference by similarity to an ideal solution (TOPSIS), Bidirectional Associative memories (BAM) to solve problems of core competency analysis by Shieh, (2010) [10] , choosing emotional music composition by Aseer, (2015) [1], impact of Periyar's philosophy in the society byChristopher et.al [3]. Combined Time Dependent matrix (CETD) was proposed by Kandasamy, WBV and V. Indira to study the passenger transportation problem [6]. Victor Devadoss et.al (2012, 2013, 2014) used this model to find the peak age of personality of both men and women separately and together [15, 16, 17]. Though DEMATEL is well opted model to divide the criteria into cause and effect group, it is difficult task to find the peak factor of both cause effect group simultaneously. Hence, an attempt is made by integrating the salient features of DEMATEL in CETD matrix and CFCS method to improve the fuzzy DEMATEL technique to solve the task.

The rest of the paper is structured as follows. Section 2 presents the definition of fuzzy number and its arithmetic operation, linguistic variable. Section 3 proposes an improved fuzzy DEMATEL and Section 4 illustrates the proposed model with a problem of aggressive behavior in youth. Conclusion is derived in the final section.

2. Theoretical Background

In this section, basic definition of fuzzy sets, fuzzy number and its arithmetic operations are recalled.

2.1 Fuzzy Set theory

Fuzzy theory deals with vagueness of human thoughts and language in the process of making decisions. Decision makers opine, evaluate and resolve situations using their knowledge and experiences from the past. Their assessments are often delivered in a muddled way with linguistic slips. In order to integrate various experiences, opinions and impetus of an individual decision maker, it is better to convert the linguistic estimation into fuzzy numbers. Thus, it is the need for fuzzy logic to employ.

Definition 2.1.[21]A fuzzy set $\tilde{A}$ is a subset of a universe of discourse *X*, which is characterized by a membership function $\mu_{\tilde{A}}(x)$ representing a mapping $\mu_{\tilde{A}} : X \to [0,1]$. The function value of $\mu_{\tilde{A}}(x)$ is called the membership value, which represents the degree of truth that *x* is an element of fuzzy set $\tilde{A}$.

Definition 2.2.A fuzzy set $\tilde{A}$ defined on the set of real numbers R is said to be a fuzzy number and its membership function $\tilde{A} : R \to [0,1]$ has the following characteristics,

(i) $\tilde{A}$ is convex.

$$\mu_{\tilde{A}}(\lambda x_1 + (1-\lambda)x_2) \geq \min(\mu_{\tilde{A}}(x_1), \mu_{\tilde{A}}(x_2)),\ \forall x \in [x_1, x_2], \lambda \in [0,1].$$

(ii) $\tilde{A}$ is normal if $\max \mu_{\tilde{A}}(x) = 1$.

(iii) $\tilde{A}$ is piecewise continuous.

Definition 2.3. The α-cut of the fuzzy set $\tilde{A}$ of the universe of discourse X is defined as $\tilde{A}_\alpha = \{x \in X / \mu_{\tilde{A}}(x) \geq \alpha\}$, where $\alpha \in [0,1]$.

Definition 2.4.A triangular fuzzy number $\tilde{N}$ can be defined as a triplet (*l, m, u*), and the Membership function $\mu_{\tilde{N}}(x)$ is defined as:

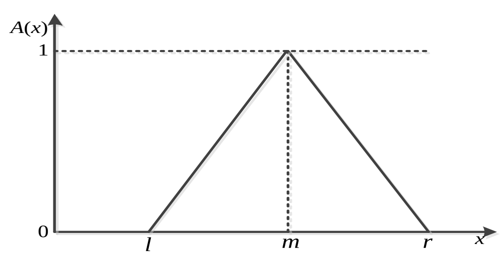

Figure-1: A triangular Fuzzy number $\tilde{N}$

$$\mu_{\tilde{N}}(x) = \begin{cases} 0, & x < l \\ (x-l)/(m-l), & l \leq x \leq m \\ (r-x)/(r-m), & m \leq x \leq r \\ 0, & x > r \end{cases}$$

Where l, m and r are real numbers and $l \le m \le r$.

Theorem 2.5. Let $\tilde{N}_1 = (l_1, m_1, r_1)$ and $\tilde{N}_2 = (l_2, m_2, r_2)$ be two triangle fuzzy numbers. The addition, subtraction, multiplication operations of $\tilde{N}_1$ and $\tilde{N}_2$, denoted by $\tilde{N}_1 \oplus \tilde{N}_2$, $\tilde{N}_1 \Theta \tilde{N}_2$ and $\tilde{N}_1 \otimes \tilde{N}_2$ respectively, yield another triangular fuzzy number.

$$\tilde{N}_1 \oplus \tilde{N}_2 = (l_1 + l_2, m_1 + m_2, r_1 + r_2)$$

$$\tilde{N}_1 \Theta \tilde{N}_2 = (l_1 - r_2, m_1 - m_2, r_1 - l_2)$$

$k \otimes \tilde{N}_1 = (kl_1, km_1, kr_1)$, $k > 0$ a crisp number

$$\tilde{N}_1 \otimes \tilde{N}_2 = (l_1 \times l_2, m_1 \times m_2, r_1 \times r_2)$$

Definition2.6. A Linguistic variable / term is variable whose value is not crisp number but word or sentence linguistic in a natural language. (Zadeh, 1975) [30].

Table 1: The Fuzzy linguistic scale.

Linguistic terms	Triangular fuzzy numbers
Very Low influence	(0, 0, 0.25)
Low Influence	(0, 0.25, 0.50)
Medium	(0.25, 0.50, 0.75)
High Influence	(0.50, 0.75, 1)
Very High Influence	(0.75, 1, 1)

Experts may provide their judgment in the linguistic term when they have no clear idea about it. This uncertain linguistic term is used as an input in decision analysis. Linguistic values are represented as fuzzy number [22]. Triangular fuzzy numbers are commonly used. In the fuzzy expert system, finally fuzzy value is converted into crisp value. The converting of Fuzzy data into Crisp Scales (CFCS) method was proposed by Opricovic, et.al (2003) [9].

3. The proposed an Improved DEMATEL method

In this section, an improved DEMATEL method is proposed using CFCS method and RTD matrix.

Step1 Set up the linguistic initial direct- relation matrix $\hat{X}_k = [\hat{x}_{kij}]_{n \times n}$, k =1,2, …, n

Let C={C_1, C_2,..., C_n}be a finite set of attributes and E={E_1, E_2,..., E_m} be the finite set of experts. Then, Experts provides their opinion on the correlation among the attributes in terms of their vocal language from the linguistic set

L={*Very Low, Low Influence, Medium, High Influence, Very High Influence*}. Let $\hat{x}_{kij}$ represent the opinion on the intensity of the correlation between the attributes C_i and C_j. Here, $\hat{x}_{kij}='-'$ denotes there is no relation.

$\hat{X}_k=[\hat{x}_{kij}]_{n\times n}$ provided by expert E_k can be set up, i.e.,

$$\hat{X}_k=[\hat{x}_{kij}]_{n\times n}=\begin{array}{c} \\ C_1 \\ C_2 \\ \vdots \\ C_n \end{array}\begin{array}{c} C_1\ C_2\ \dots\ C_n \\ \begin{bmatrix} - & \hat{x}_{k12} & \cdots & \hat{x}_{k1n} \\ \hat{x}_{k21} & - & \cdots & \hat{x}_{k2n} \\ \vdots & \vdots & \ddots & \vdots \\ \hat{x}_{kn1} & \hat{x}_{kn2} & \cdots & - \end{bmatrix} \end{array}, \text{k=1,2,…,m}$$

Step 2: Transform uncertain linguistic matrix $\hat{X}_k=[\hat{x}_{kij}]_{n\times n}$ into triangular fuzzy matrix $\tilde{X}_k=[\tilde{x}_{kij}]_{n\times n}$.

Step 3: Set up the crisp value direct-relation matrix $\tilde{X}_i,(i=1,2,...,m)$ using the CFCS method.

Let $A_{ij}=(l_{ij}^k,m_{ij}^k,r_{ij}^k)$ mean the degree of criteria *i* affects criteria *j* and experts m (i=1, 2, 3…m).

- Normalization

$$zr_{ij}^k=(r_{ij}^k-\min l_{ij}^k)/\Delta_{\min}^{\max}$$

$$zm_{ij}^k=(m_{ij}^k-\min l_{ij}^k)/\Delta_{\min}^{\max}$$

$$zl_{ij}^k=(l_{ij}^k-\min l_{ij}^k)/\Delta_{\min}^{\max}$$

Where $\Delta_{\min}^{\max}=\max r_{ij}^k-\min l_{ij}^k$

- Compute right side and left side normalized values:

$$zrs_{ij}^k=zr_{ij}^k/(1+zr_{ij}^k-zm_{ij}^k)$$

$$zls_{ij}^k=zm_{ij}^k/(1+zm_{ij}^k-zl_{ij}^k)$$

- Compute total normalizes crisp values:

$$z_{ij}^k=[zls_{ij}^k(1-zls_{ij}^k)+zrs_{ij}^k\times zrs_{ij}^k]/[1-zls_{ij}^k+zrs_{ij}^k]$$

- Compute crisp values:

$$x_{ij}^k=\min l_{ij}^k+z_{ij}^k\times\Delta_{\min}^{\max}$$

Step 4: Construct the group direct relation matrix $\tilde{X}_k = [\tilde{x}_{kij}]_{n \times n}$.

$$\tilde{X}_k = \frac{1}{m}(\tilde{X}_1 + \tilde{X}_2 + \ldots + \tilde{X}_m)$$

Step 5: Construct normalized relation matrix $\tilde{Z}_k = [\tilde{z}_{kij}]_{n \times n}$.

$$z_{ij} = x_{ij} / \max_{1 \le i \le n} \left\{ \sum_{j=1}^{n} x_{ij} \right\}, \; i, j = 1, 2, \ldots, n$$

Step 6: Construct the overall-relation matrix $\tilde{T}$.

The overall-relation matrix $\tilde{T}$ is defined as $\tilde{T} = \lim_{\tau \to \infty} \left((\tilde{Z})^1 + (\tilde{Z})^2 + \ldots + (\tilde{Z})^\tau \right)$

Step 4: Find the average (μ_j) and Standard Deviation (S.D) (σ_j)for each column of the overall-relation matrix $\tilde{T}$.

Step 5: Obtain Refined Time Dependent (RTD) Matrix

The RTD matrices by varying α from the interval [0, 1] are obtained,using the formula

if $a_{ij} \le (\mu_j - \alpha * \sigma_j)$ 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 $a_{ij} \ge (\mu_j + \alpha * \sigma_j)$ then $e_{ij} = 1$.

The row sum of this matrix gives the peak of factor.

Step 6: Combined Effective Time Dependent Data (CETD) Matrix

The above RTD matrices are combined by varying $\alpha \in [0,1]$ to get the Combined Effective Time Dependent Data (CETD) matrix. The row sum is obtained for CETD matrix. All these matrices are represented by graphs.

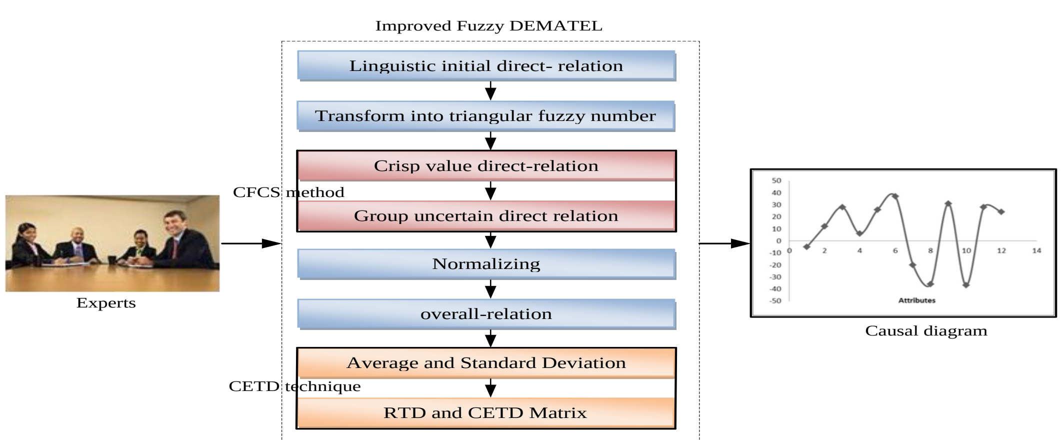

Figure-2: Procedure of Improved Fuzzy DEMATEL.

4. Numerical Illustration

To illustrate this model, the problem of aggressive behaviour of youth is taken. The major reasons for the youth violence have been chosen as the attributes. C_1-Academic failure/dropping out of school,C_2-Involvement in other forms of antisocial behaviour, C_3-Castisem / inequality, C_4 -Poverty/unemployment,C_5-Delinquent peers / Gang membership, C_6-Aggressive behaviour,C_7-Poor monitoring and supervision of children by parents, C_8-Parental substance or criminality, C_9-Depression,C_{10}-Addiction to drugs and alcohol.

Then, two experts – a psychiatrist and a victim of the youth violence - are called to give their judgments on the existence and intensities of the correlation among the factors from S= {Very Low, Low, Medium, High, Very High}. The Initial uncertain direct-relation matrices are given below in table-2 and table-3, which are then transformed into triangular fuzzy numbers using table 1.

Table 2: Initial uncertain direct-relation matrix provided by E_1.

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}
C_1		VH	VH	H	H	L	H	VL	VL	M
C_2	M		VH	VH	H	VH	H	H	VL	L
C_3	L	H		H	VH	VH	H	H	L	H
C_4	H	H	H		M	VH	H	L	H	VH
C_5	VH	L	VH	L		H	VH	H	L	VL
C_6	M	L	H	VH	VH		VH	H	L	VH
C_7	L	H	M	VH	H	VH		H	VH	VH
C_8	VL	H	VH	H	M	VH	H		VH	H
C_9	H	H	VH	H	VH	VH	H	L		M
C_{10}	M	L	H	VH	M	VH	H	VH	H	

Table 3: Initial uncertain direct-relation matrix provided by E_2.

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}
C_1		VH	VH	M	L	H	VH	VL	H	M
C_2	VL		VH	L	H	VH	H	M	H	M
C_3	M	VH		M	VH	H	H	VH	M	L
C_4	L	H	VH		L	VH	H	H	VH	H
C_5	H	M	H	M		H	VH	H	VH	M
C_6	VH	L	VH	VH	H		VH	L	VH	VH

C_7	H	M	L	H	VH	VH		VH	H	VH
C_8	VL	VH	VH	VH	H	H	VH		VH	H
C_9	L	H	VH	H	VH	H	VH	VL		VL
C_{10}	VL	M	H	H	L	VH	H	M	H	

Using the CFCS method, the group uncertain direct relation matrix $\tilde{X}_k$ are obtained in table-4. With the aid of step -5 and 6, normalized overall-relation matrix $\tilde{Z}_k$, overall-relation matrix $\tilde{T}$ are obtained.

Table-4: the group direct relation matrix $\tilde{X}_k$.

	C_1	**C_2**	**C_3**	**C_4**	**C_5**	**C_6**	**C_7**	**C_8**	**C_9**	**C_{10}**
C_1	0.000	0.960	0.960	0.617	0.500	0.500	0.847	0.033	0.383	0.500
C_2	0.267	0.000	0.960	0.613	0.733	0.960	0.733	0.617	0.383	0.383
C_3	0.383	0.847	0.000	0.617	0.960	0.847	0.733	0.847	0.383	0.500
C_4	0.500	0.733	0.847	0.000	0.383	0.960	0.733	0.500	0.847	0.847
C_5	0.847	0.383	0.847	0.383	0.000	0.733	0.960	0.733	0.613	0.267
C_6	0.730	0.266	0.847	0.960	0.847	0.000	0.960	0.500	0.613	0.960
C_7	0.500	0.617	0.383	0.847	0.847	0.960	0.000	0.847	0.847	0.960
C_8	0.033	0.733	0.960	0.847	0.617	0.847	0.847	0.000	0.960	0.733
C_9	0.500	0.733	0.960	0.733	0.960	0.847	0.847	0.150	0.000	0.267
C_{10}	0.267	0.383	0.733	0.847	0.383	0.960	0.733	0.730	0.733	0.000

Table-5: the Normalized direct relation matrix $\tilde{Z}_k$

	C_1	**C_2**	**C_3**	**C_4**	**C_5**	**C_6**	**C_7**	**C_8**	**C_9**	**C_{10}**
C_1	0.000	0.126	0.126	0.081	0.066	0.066	0.111	0.004	0.050	0.066
C_2	0.035	0.000	0.126	0.081	0.096	0.126	0.096	0.081	0.050	0.050
C_3	0.050	0.111	0.000	0.081	0.126	0.111	0.096	0.111	0.050	0.066
C_4	0.066	0.096	0.111	0.000	0.050	0.126	0.096	0.066	0.111	0.111
C_5	0.111	0.050	0.111	0.050	0.000	0.096	0.126	0.096	0.081	0.035
C_6	0.096	0.035	0.111	0.126	0.111	0.000	0.126	0.066	0.081	0.126
C_7	0.066	0.081	0.050	0.111	0.111	0.126	0.000	0.111	0.111	0.126
C_8	0.004	0.096	0.126	0.111	0.081	0.111	0.111	0.000	0.126	0.096
C_9	0.066	0.096	0.126	0.096	0.126	0.111	0.111	0.020	0.000	0.035
C_{10}	0.035	0.050	0.096	0.111	0.050	0.126	0.096	0.096	0.096	0.000

Table-6: the overall-relation matrix $\tilde{T}$.

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}
C_1	0.209	0.386	0.463	0.388	0.372	0.429	0.453	0.266	0.327	0.334
C_2	0.261	0.290	0.492	0.415	0.424	0.509	0.470	0.354	0.354	0.345
C_3	0.289	0.411	0.407	0.438	0.470	0.524	0.497	0.398	0.377	0.377
C_4	0.309	0.410	0.520	0.378	0.419	0.551	0.509	0.365	0.437	0.427
C_5	0.329	0.347	0.484	0.393	0.340	0.486	0.500	0.365	0.383	0.334
C_6	0.349	0.374	0.537	0.506	0.484	0.458	0.554	0.381	0.429	0.456
C_7	0.326	0.416	0.498	0.503	0.491	0.580	0.451	0.424	0.464	0.461
C_8	0.266	0.422	0.549	0.493	0.462	0.559	0.539	0.320	0.467	0.428
C_9	0.302	0.393	0.509	0.440	0.465	0.513	0.500	0.311	0.316	0.342
C_{10}	0.264	0.347	0.476	0.451	0.391	0.520	0.479	0.370	0.404	0.306

Table-6: the average (μ_j) and S.D (σ_j) for each column of $\tilde{T}$.

Average	0.290	0.379	0.493	0.440	0.432	0.513	0.495	0.355	0.396	0.381
SD	0.042	0.041	0.041	0.048	0.051	0.046	0.034	0.046	0.054	0.057

The RTD matrix for $\propto = 0.5$The Row sum matrix

$$\begin{bmatrix} -1 & 0 & -1 & -1 & -1 & -1 & -1 & -1 & -1 & -1 \\ -1 & -1 & 0 & -1 & 0 & 0 & -1 & 0 & -1 & -1 \\ 0 & 1 & -1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & -1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 1 & -1 & 0 & -1 & 0 & -1 & 0 & 0 & 0 & -1 \\ 1 & 0 & 1 & 1 & 1 & -1 & 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 & 1 & 1 & -1 & 1 & 1 & 1 \\ -1 & 1 & 1 & 1 & 1 & 1 & 1 & -1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & -1 & -1 & -1 \\ -1 & -1 & 0 & 0 & -1 & 0 & 0 & 0 & 0 & -1 \end{bmatrix} \quad \begin{bmatrix} -9 \\ -6 \\ 2 \\ 4 \\ -3 \\ 7 \\ 7 \\ 6 \\ -2 \\ -4 \end{bmatrix}$$

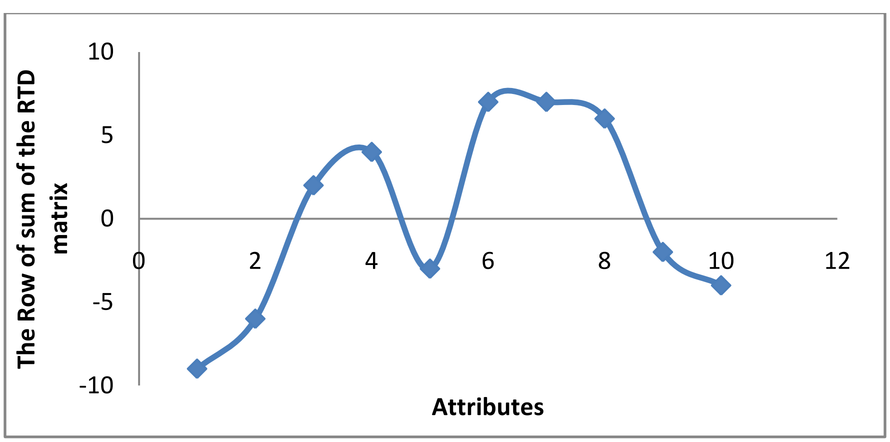

Figure 3: Depicting the peak factor of youth aggressiveness for α = 0.5

The RTD matrix for $\propto = 0.7$The Row sum matrix.

$$\begin{bmatrix} -1 & 0 & -1 & -1 & -1 & -1 & -1 & -1 & -1 & -1 \\ -1 & -1 & 0 & 0 & 0 & 0 & -1 & 0 & -1 & 0 \\ 0 & 1 & -1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & -1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 1 & -1 & 0 & -1 & -1 & 0 & 0 & 0 & 0 & -1 \\ 1 & 0 & 1 & 1 & 1 & -1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 & 1 & 1 & -1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & -1 & 1 & 1 & -1 & 1 & 1 \\ 0 & 0 & 0 & 0 & -1 & 0 & 0 & -1 & -1 & 0 \\ 0 & -1 & 0 & 0 & -1 & 0 & 0 & 0 & 0 & -1 \end{bmatrix} \qquad \begin{bmatrix} -9 \\ -4 \\ 2 \\ 3 \\ -3 \\ 5 \\ 7 \\ 5 \\ -3 \\ -3 \end{bmatrix}$$

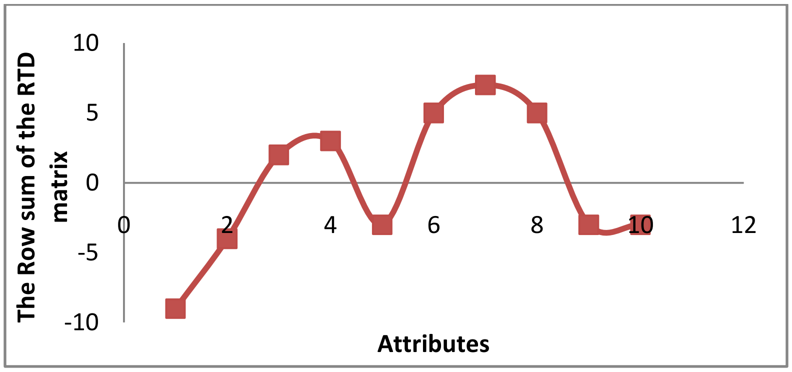

Figure 4: Depicting the peak factor of youth aggressiveness for α = 0.7 .

The CETD matrix The Row sum matrix

$$\begin{bmatrix} -2 & 0 & -2 & -2 & -2 & -2 & -2 & -2 & -2 & -2 \\ -2 & -2 & 0 & -1 & 0 & 0 & -2 & 0 & -2 & -1 \\ 0 & 2 & -2 & 0 & 2 & 0 & 0 & 2 & 0 & 0 \\ 0 & 2 & 1 & -2 & 0 & 2 & 0 & 0 & 2 & 2 \\ 2 & -2 & 0 & -2 & -1 & -1 & 0 & 0 & 0 & -2 \\ 2 & 0 & 2 & 2 & 2 & -2 & 2 & 1 & 1 & 2 \\ 2 & 2 & 0 & 2 & 2 & 2 & -2 & 2 & 2 & 2 \\ -1 & 2 & 2 & 2 & 0 & 2 & 2 & -2 & 2 & 2 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -2 & -2 & -1 \\ -1 & -2 & 0 & 0 & -2 & 0 & 0 & 0 & 0 & -2 \end{bmatrix} \qquad \begin{bmatrix} -18 \\ -10 \\ 4 \\ 7 \\ -6 \\ 12 \\ 14 \\ 11 \\ -5 \\ -7 \end{bmatrix}$$

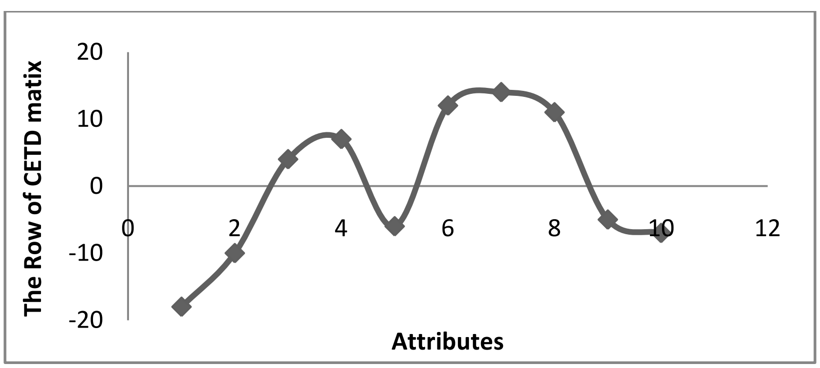

Figure 5: Depicting the peak factor of youth aggressiveness for CETD matrix.

The graphical representation (the prominence - causal diagram) and digraphical relationships are now constructed. This step will allow a clear visualization of the structure and relationships amongst the attributes of youth violence. The evaluation criteria were visually divided into the cause group, including C_3-Castisem / inequality, C_4 -

Poverty/unemployment, C_6-Aggressive behaviour,, C_7-Poor monitoring and supervision of children by parents, C_8-Parental substance or criminality and the effect group, including C_1-Academic failure / dropping out of school, C_2-Involvement in other forms of antisocial behaviour, C_5 - Delinquent peers / Gang membership, C_9-Depression, C_{10}-Addiction to drugs and alcohol,

- C_7-Poor monitoring and supervision of children by parents, C_8-Parental substance or criminality and the effect group are the maximum causes of youths are involving in violence.
- C_1-Academic failure / dropping out of school, C_2- Involvement in other forms of antisocial behaviour are the maximum effect of youth violence.

5. Conclusion

The proposed improved fuzzy DEMATEL method is suitable for solving a group decision- making problem in a fuzzy environment. In this method, the interactions between criteria can be transformed in to a visible structural model, by which the peak factor of cause-effect group of any problem can be determined. This method is easier to capture the complexity of a problem.

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