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# A New DEMATEL with CETD Matrix Approach to Study Cause and Effect Relationship of Youth Violence

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**Abstract-**

The decision making trial and evaluation laboratory (DEMATEL) method is used to build and analyse a standard model with casual relationships between criteria. In this paper, we introduced a New DEMATEL with CETD matrix to analyse the peak factor of cause and effect of aggressive behavior andinvolving in violence as this model gives clear picture which could be understood even by the layperson.

***Index Terms-*** FCM, Decision Making Trial and Evaluation Laboratory (DEMATEL),CETD matrix, causal analysis

## 1. Introduction

Cognitive map were initially introduced by Robert Axelrod [1] in 1976 and applied in political science. Bart Kosco [9] in 1986enhances power of cognitive maps considering fuzzy values for the concepts of the cognitive map and fuzzy degrees of interrelationships between concepts. FCM can successfully represent the knowledge and human experience, introduced concepts to represent the essential elements and the cause and effect relationship among the concepts to the model the behavior of any system. It is very convenient and simple and powerful too, which was used in numerous fields such as analysis of electrical circuits, medicine, supervisory system, organization and strategy planning, economical etc. Astheenvironmentis gettingmorecomplicated,effective decision-makingismore desired. Decision-makers are always obliged to assess a complex and confusing situation, identify the causal relationship of a problem, decide the appropriate solution, and ensure an effective action plan. Their effectiveness depends largely on the ability to think logically about the cause- effect relationship 1and make decisions according to this analysis. That is, to take meaningful decisions or actions in a problem with complex situation requires an essential understanding of the cause-effect relationship within the problem. The DEMATEL method is a potent system analysis tool, originated from the Geneva research center of battle memorial institute (Fontela & Gabus 1976, 1973) [5,6]. It is especially practical and useful for visualizing the structure of complicated causal relationship with matrices or digraphs. In recent years, DEMATEL method has been applied successfully in many fields to analyze correlation among factors and service or requirements in the background software system design (Hori and Schimizu 1999)[13] semiconductor – intellectual property (SIP), mall construction (Li and Tzeng 2009)[22]. On the other hand, The DEMATEL method has also been combined with analytic network process (ANP), goal programming and technique for order preference by similarity to an ideal solution (TOPSIS) to solve problems of core competency analysis (Shieh et.al 2010) [20]and preference evaluation (Chen et.al 2010; Hsu et.al 2010)[3,14 ]. The Decision-Making Trial and Evaluation Laboratory (DEMATEL) method, as a sort of structural modeling approach, can separate the involved criteria of a system in to the cause group and effect group. The DEMATEL method is then a good technique for making decisions. In this paper we analyzed the risk factors of youth violence and what makes them more aggressive. Since there are more risk factors of youth violence, to relate each other more complex to construct FCM and analyze them. For that we used CETD matrix in DEMATEL method to find out what creates more aggressiveness in them. Moreover the data is an unsupervised one obtained from survey as well as interviews. Hence fuzzy alone has the capacity to analyses these concepts. The rest of this paper is organized as follows: In section2, theoretical background of Fuzzy Cognitive maps (FCMs) and DEMATEL are reviewed. In section3, A new DEMATEL with CETD is proposed. In section 4, Adaptation of the problem to the proposed method. Finally, conclusionsarepresented.

## 2. Theoretical background

### 2.1 Fuzzy cognitive maps

1. A Fuzzy Cognitive map F is 4 tuple $(N, W, C, f)$ [17] where
2. $N = \{N_1, N_2, \ldots, N_n\}$ is the set of n concepts forming the nodes oaf a graph
3. $W: (N_i, N_j) \rightarrow w_{ij}$ is a function of $N \times N$ to $K$ associating $w_{ij}$ to a pair of concepts $(N_i, N_j)$, with $w_{ij}$ denoting a weight of directed edge from $N_i$ to $N_j$, if $i \neq j$ and $w_{ij}$ equal to zero if $i = j$. Thus $W(N \times N) = w_{ij} \in K^{n \times n}$ is a connection matrix.
4. $C: N_i \rightarrow C_i$ is a function that at each concept $N_i$ associates the sequence of its activation degree such as for $t \in N$, $C_i(t) \in L$ given its activation degree at the moment t. $C(0) \in L^n$ indicates the initial vector and specifies initial values of all concepts node and $C(t) \in L^n$ is a state vector at certain iteration *t*.

5. $f: R \rightarrow L$ is a transformation function, which includes recurring relationship on $t \geq 0$ between $C(t+1)$ and $C(t)$.

The calculation rule that was initially introduced to calculate the value of each concept is based only on the influence of the interconnected concepts

$$C_j(t+1) = f\left(\sum_{\substack{i=1 \\ i \neq j}}^{n} C_i(t) w_{ij}\right)$$

Where n is the number of concepts, $C_j(t+1)$ is the value of concept $C_j$ at time step $t+1$, $C_i(t)$ is the value of concept $C_i$ at time step $t$, and $w_{ij}$ is the weight of the causal interconnection from concept $i^{th}$ toward concept $j^{th}$.

The transformation function is used to confine (clip) the weighted sum to a certain range, which is usually set to [0, 1]. The normalization hinders quantitative analysis, but allows for comparisons between nodes, which can be defined as active (value of 1), inactive (value of 0), or active to a certain degree (value between 0 and 1). Four most commonly used transformation functions are shown below:

1. Bivalent : $f(x) = \begin{cases} 0, & x \leq 0 \\ 1, & x \geq 0 \end{cases}$
2. Trivalent: $f(x) = \begin{cases} -1, & x \leq -0.5 \\ 0, & 0.5 < x < 0.5 \\ 1, & x \geq 0.5 \end{cases}$
3. Sigmoidal: $f(x) = \dfrac{1}{1 + e^{-\lambda x}}$
4. Hyperbolic tangent: $f(x) = \tanh(\lambda x) = \dfrac{e^{\lambda x} - e^{-\lambda x}}{e^{\lambda x} + e^{-\lambda x}}$

Where $\lambda$ is a parameter used to determine proper shape of the function.

## 2.2 DEMATEL method

The Battelle Memorial Institute conducted the DEMATEL method project through its Geneva Research Centre (1973) [6]. In recent years, the DEMATEL method has become very popular, because it is especially practical and useful for visualizing the structure of complicated causal relationships with matrixes or digraphs. The matrixes or digraph shows relations between the components of the system. This model distinguishes the causes and effects between components and construct a structure presenting these two groups separately. The DEMATEL method has been successfully applied in many fields. DEMATEL method is designed to find not only direct relations but also indirect relations in a graph. Besides finding the undirected relations, this method defines the cause and effect groups of elements. A complex system contains a set of elements $C = \{C_1, C_2 \ldots C_n\}$, which have relations with each other. These relations can be modeled in a graph. The initial direct relation expressed with matrix X, connection matrix. The elements of this matrix normalized with Eq. 1:

$$X = k.A$$

$$k = \frac{1}{\max\limits_{1 \le i \le n} \sum_{j=1}^{n} a_{ij}} \tag{1}$$

It was proven that the elements of the other matrixes like ($X^1$ $X^2$ ... $X^t$) are normal too. When $\underset{t\to\infty}{X^t} = 0$ and I identity matrix, equation 2 can be proved (Goodman 1988; Papoulis and Pillai 2002) [7,18]

$$I + X + X^2 + X^3 + ... + X^t = (I - X)^{-1}$$

Because

$S = X + X^2 + X^3 + ... + X^t = X(I - X^t)/(I - X)$ and if $\underset{t\to\infty}{X^t} = 0$ then

$$X(I - X^t)/(I - X) = X/(I - X) = X(I - X)^{-1}$$

Therefore $S = X(I - X)^{-1}$ (2)

Matrix S shows the directed and undirected relations between FCM elements $C=\{C_1, C_2, ...Cn\}$. If only the undirected relations are considered, then the first element of Eq. 2 (X) must be omitted and the equation will be written like:

$$S = X^2 + X^3 + ... + X^t = X^2(I - X)^{-1}$$

This matrix presents the undirected relations or the hidden relations, which had not been considered before. The equivalent FCM with this matrix is considered and the related rules discovered from this new FCM. In DEMATEL, method cause and effect criteria are recognized and separated from each other. Sum of rows $\sum_{i=1}^{n} R_i$ and the sum of columns $\sum_{j=1}^{n} C_j$ of matrix $X$are computed and these two parameters are calculated for causal diagram. $\left(\sum_{i=1}^{n} R_i + \sum_{j=1}^{n} C_j \text{ and} \sum_{i=1}^{n} R_i - \sum_{j=1}^{n} C_j\right)$ Max of $\sum_{i=1}^{n} R_i$ is an element which affect on the other elements and is a *dispatcher element* and Max of $\sum_{j=1}^{n} C_j$ is an element which the other elements affect on it and is a *receiver element.* Then a diagram is constructed with the horizontal axis $\left(\sum_{i=1}^{n} R_i + \sum_{j=1}^{n} C_j\right)$and the vertical axis$\left(\sum_{i=1}^{n} R_i - \sum_{j=1}^{n} C_j\right)$.The vertical axis separates the elements into cause and effect groups if the value $\left(\sum_{i=1}^{n} R_i - \sum_{j=1}^{n} C_j\right)$ is positive, it belongs to the cause group, if the value is $\left(\sum_{i=1}^{n} R_i - \sum_{j=1}^{n} C_j\right)$ negative, it belongs to the effect group. The horizontal axis shows the important of each element.

### 2.3 Hybrid MCDM DEMATEL

DEMATEL technique has combined with the other MCDCM methods such as AHP, ANP, VIKOR and TOPSIS. As fallow some of this hybrid models are reviewed in recent years. (Table1)

**Table 1:**Review of Hybrid models

| Year | Hybrid Model | Tittle | Objective | Authors |
|---|---|---|---|---|
| 2011 | DEMATEL,ANP, TOPSIS under fuzzy | A Novel hybrid MCDM approach based on Fuzzy DEMATEL, Fuzzy ANP and Fuzzy TOPSIS to evaluate green supplier | Evaluating green supplier | Gulein and Grizem |
| 2011 | DEMATEL ANP | An integrated MCDM technique combined with DEMATEL with ANP method | Using average method (equal-cluster-weighted) to obtain the weighted super matrix | Jiann and Gwo-Hshiung |
| 2011 | DEMATE, ANP, VIKOR | Brand marketing for creating brand value based on a MCDCM model combining DEMATEL with ANP and VIKOR methods | Evaluating brand marketing | Yuang-Lan and Gwo-Hshiung |
| 2011 | DEMATE, ANP, VIKOR | A VIKOR technique based on DEMATEL and ANP for information security risk control assessment | Information security risk control assessment | Yu-Ping et.al |
| 2011 | DEMATEL, TOPSIS | A fuzzy multi-criteria decision making model for supplier selection | supplier selection | Doraid et.al |
| 2010 | DEMATEL, ANP, BSC | Enhancing the performance of a SOC Design Service Firm by using a Novel DANP Based MCDCM Framework on the Balanced scorecard | Improving the performance of a SOC design service | Chi-Yo et.al |
| 2009 | DEMATEL, ANP, ZOGP | Slecting management systems for sustainable development in SMEs: A novel hybrid model based on DEMATEL, ANP and ZOGP | sustainable development | Wen-Hsien and Wen-Chin |

## 3. The proposed a new DEMATEL with CETD method

**Step1**: *Generatingtheaverage direct-relationmatrix.*
In this study, we deal with $H$ experts (five people) and $n$ factors (twelve factors). Each expert is asked: "To what degree does factor $i$ affect factor $j$?" these pairwise comparisons between all the factors are made two by two and are represented with $a$. It is noteworthy that integers 0 and 1 are ascribed to these comparisons. zero indicates "no influence" of $i$ factor on $j$ factor, one represents "influence", Scores given by the experts are ascribed to each of the factors in a matrix with nonnegative $n \times n$ answers, $X^k = [x_{ij}^k]$ in a way that, $1 \le k \le H$ . Therefore, $X^1, X^2 ..., X^H$ is the answer matrix of each of the experts, and each $X^k$ elements is an integer which is represented by $x_{ij}^k$. The diagonal elements of each answer matrix $X^k$ are all set to zero. Then, by calculating (Lin& Lin, 2008) for all the experts opinion by obtaining the mean of H scores as follows:

$$a_{ij} = \frac{1}{H} \sum_{k=1}^{H} x_{ij}^k \quad (3)$$

It is noteworthy that the average matrix $A = [a_{ij}]$ is also called initial direct relation matrix (Lin & Wu, 2008) [10]. Matrix $A$ presents the initial direct effects that one factor has on the other or the way it is affected by other factors. Furthermore, we can depict the causal relation between each pair of factors by drawing an influence map within a system. Table 1 presents the average matrix for strategic decisions. It should be mentioned here that this matrix is the result of interviewing five experts.

**Step2:***Normalizingthedirectrelationmatrix.*
Normalizationis performedusingthefollowing,

$$K = \max\left\{\max \sum_{j=1}^{n} a_{ij}, \max \sum_{i=1}^{n} a_{ij}\right\}$$

$$X = A/K \quad (4)$$

**Step3:***Attaining the total-relation matrix*
The total relation matrix $S$ can be acquired by using the equation, where I denoted as the identity matrix $S = X(1-X)^{-1}$

**Step 4:***Find the average and Standard Deviation (S.D) of every column in the total direct –relation fuzzy matrix S matrix*

**Step 5:***Obtaining Refined Time Dependent (RTD) Matrix*
Using the average $\mu_j$ of each $j^{th}$ column and $\sigma_j$ the S.D of the each $j^{th}$ column we chose a parameter $\alpha$ from the interval [0, 1] and form the Refined time dependent Matrix (RTD matrix),

Using the formula

$$\text{if } a_{ij} \le (\mu_j - \alpha * \sigma_j) \text{ then } e_{ij} = -1 \text{ else}$$
$$\text{if } a_{ij} \in (\mu_j - \alpha * \sigma_j, \mu_j + \alpha * \sigma_j) \text{ then } e_{ij} = 0 \text{ else}$$
$$\text{if } a_{ij} \ge (\mu_j + \alpha * \sigma_j) \text{ then } e_{ij} = 1. \quad (5)$$

We redefine the total relation matrix into the Refined time dependent (RTD) fuzzy matrix for here the entries are = -1,0 or 1. Now the row sum of this matrix gives the peak of factor.

**Step 6:** *Combined Effective Time Dependent Data (CETD) Matrix*
Combine the above RTD matrices by varying the $\alpha \in [0,1]$, so that we get the Combined Effective Time Dependent Data (CETD) matrix. The row sum is obtained for CETD matrix and conclusions are derived based on the row sums. All these are represented by graphs and graphs play a vital role in exhibiting the data by the simplest means, which can be even understood by a layman.

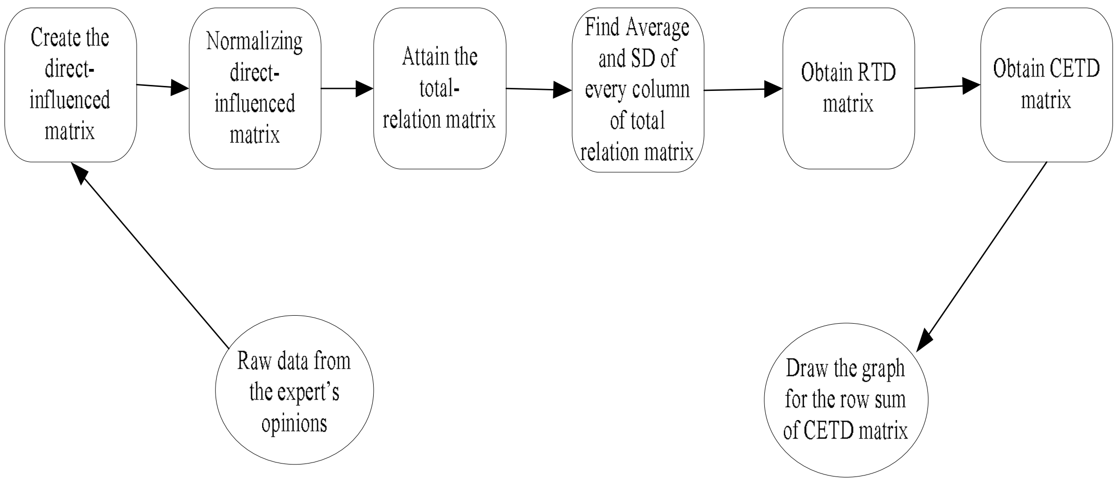



Fig 1. Steps of DEMATEL with CETD

## 4. Adaptation of the problem to the model

Violence is a common event occurring on streets, at homes, schools, workplace and institutions, which affects day today life in a severe way. Even though human beings have been struggling to create civilized societies for many years, they have not been able to get free from the influence of violence and aggression. Therefore, it is of utmost interest to analyze the cause and effects of violence and the group of people responsible for it. It is reported that in most cases of the violence the active participants are the youth. Aggressiveness among the youth is considered to be a socially unhealthy developmental problem in many families and countries. The youth are the easy target and more vulnerable section of the society to be misused by anyone. To analyse this problem the risk factors of youth violence that stimulate aggressive behavior in them are chosen based on youth perception. The following twelve attributes of risk factor for youth violence is chosen by interviewing the 100 youths in Chennai at the different ages. $C_1$-Hyperactivity, $C_2$ - Poor monitoring and supervision of children by parents or Harsh, lax or inconsistent parental disciplinary practices. $C_3$- Impulsiveness or poor behavioral control,$C_4$- Seeking recognition, $C_5$- Poverty and unemployment, $C_6$- Delinquent peers or gang membership,$C_7$- Academic failure and dropping out of school, $C_8$- Concentration problem, restlessness and risk taking, $C_9$- Parental criminality or Parental attitudes favorable to substance use and violence,$C_{10}$-Anti social beliefs and attitudes, $C_{11}$-Early involvement with alcohol drugs and tobacco, $C_{12}$-Castisem or inequality.

Then, five expert's sociologist, psychologist and three victims of the youth from different places are called to give their judgements on the existences and intensities of the correlation among the risk factors and the opinion provided by the experts are collected by the questionnaires. For example, one of the experts revealed that when parents are failed to monitor and supervise of their children, children's will get the relationship with the bad gang membership so there is a relation. Nowadays, most of the youths are involving robbery, terrorism… etc., because of poverty and the job opportunities are denied with very high intensities.

The following six steps were conducted.

*Step1:*Once the relationships between each pair of criteria were measured, through the use of FCM scale, the data from each individual assessment may be obtained. We get the initial direction-relation fuzzy matrix A.

**Table 2:** The initial direct –relation Average fuzzy matrix A

| | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | $C_7$ | $C_8$ | $C_9$ | $C_{10}$ | $C_{11}$ | $C_{12}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $C_1$ | 0 | 0 | 1 | 0.6 | 0.6 | 0.6 | 0.2 | 0.6 | 0.6 | 0.8 | 1 | 0.8 |
| $C_2$ | 0.8 | 0 | 0.8 | 0.6 | 1 | 1 | 1 | 0.2 | 0 | 0.6 | 0.8 | 0.6 |
| $C_3$ | 1 | 0.2 | 0 | 0.8 | 0.6 | 1 | 0 | 0.4 | 0.2 | 0.4 | 0.8 | 0.8 |
| $C_4$ | 0.4 | 0.4 | 1 | 0 | 0.4 | 0.8 | 0.4 | 0.6 | 0.6 | 0.8 | 1 | 0.8 |
| $C_5$ | 0.8 | 0.8 | 0.4 | 0 | 0 | 1 | 1 | 0.6 | 0.8 | 0.6 | 1 | 0.8 |
| $C_6$ | 0.8 | 0.6 | 0.8 | 0.8 | 1 | 0 | 0.4 | 0.6 | 0.4 | 1 | 1 | 1 |
| $C_7$ | 0.6 | 0.6 | 0 | 0 | 1 | 0.8 | 0 | 1 | 0.8 | 0.8 | 0.2 | 0.4 |
| $C_8$ | 0.6 | 0.2 | 0 | 1 | 0.6 | 0.8 | 1 | 0 | 0.2 | 0.4 | 0.2 | 0.6 |
| $C_9$ | 1 | 0.4 | 0.6 | 0.8 | 1 | 1 | 1 | 0.2 | 0 | 0.8 | 1 | 0.4 |
| $C_{10}$ | 0.6 | 0.2 | 0 | 0.8 | 0.6 | 0.8 | 1 | 0.6 | 0.2 | 0 | 0.2 | 0.8 |
| $C_{11}$ | 0.8 | 0.6 | 1 | 1 | 1 | 1 | 1 | 0.4 | 0.2 | 0 | 0 | 1 |
| $C_{12}$ | 1 | 0.6 | 1 | 1 | 1 | 1 | 1 | 0.2 | 0 | 0.6 | 0.6 | 0 |

*Step 2*:From the initial direct- relation fuzzy matrix A, the normalized direct-relation fuzzy matrix X obtained by formula (4).

**Table 3:** The normalized direct –relation fuzzy matrix X

| | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | $C_7$ | $C_8$ | $C_9$ | $C_{10}$ | $C_{11}$ | $C_{12}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $C_1$ | 0.00 | 0.00 | 0.10 | 0.06 | 0.06 | 0.06 | 0.02 | 0.06 | 0.06 | 0.08 | 0.10 | 0.08 |
| $C_2$ | 0.08 | 0.00 | 0.08 | 0.06 | 0.10 | 0.10 | 0.10 | 0.02 | 0.00 | 0.06 | 0.08 | 0.06 |
| $C_3$ | 0.10 | 0.02 | 0.00 | 0.08 | 0.06 | 0.10 | 0.00 | 0.04 | 0.02 | 0.04 | 0.08 | 0.08 |
| $C_4$ | 0.04 | 0.04 | 0.10 | 0.00 | 0.04 | 0.08 | 0.04 | 0.06 | 0.06 | 0.08 | 0.10 | 0.08 |
| $C_5$ | 0.08 | 0.08 | 0.04 | 0.00 | 0.00 | 0.10 | 0.10 | 0.06 | 0.08 | 0.06 | 0.10 | 0.08 |
| $C_6$ | 0.08 | 0.06 | 0.08 | 0.08 | 0.10 | 0.00 | 0.04 | 0.06 | 0.04 | 0.10 | 0.10 | 0.10 |
| $C_7$ | 0.06 | 0.06 | 0.00 | 0.00 | 0.10 | 0.08 | 0.00 | 0.10 | 0.08 | 0.08 | 0.02 | 0.04 |
| $C_8$ | 0.06 | 0.02 | 0.00 | 0.10 | 0.06 | 0.08 | 0.10 | 0.00 | 0.02 | 0.04 | 0.02 | 0.06 |
| $C_9$ | 0.10 | 0.04 | 0.06 | 0.08 | 0.10 | 0.10 | 0.10 | 0.02 | 0.00 | 0.08 | 0.10 | 0.04 |
| $C_{10}$ | 0.06 | 0.02 | 0.00 | 0.08 | 0.06 | 0.08 | 0.10 | 0.06 | 0.02 | 0.00 | 0.02 | 0.08 |
| $C_{11}$ | 0.08 | 0.06 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.04 | 0.02 | 0.00 | 0.00 | 0.10 |
| $C_{12}$ | 0.10 | 0.06 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.02 | 0.00 | 0.06 | 0.06 | 0.00 |

*Step 3*: The total-relation matrix *S* is acquired usingequ (2) from the generalized direct-relation matrix. The total-relation matrix is shown below as table 3

**Table 4:**The total direct –relation fuzzy matrix S

| | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | $C_7$ | $C_8$ | $C_9$ | $C_{10}$ | $C_{11}$ | $C_{12}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $C_1$ | 0.188 | 0.110 | 0.249 | 0.226 | 0.251 | 0.272 | 0.193 | 0.184 | 0.153 | 0.227 | 0.271 | 0.262 |
| $C_2$ | 0.277 | 0.121 | 0.243 | 0.230 | 0.306 | 0.325 | 0.278 | 0.163 | 0.110 | 0.226 | 0.268 | 0.259 |
| $C_3$ | 0.268 | 0.122 | 0.152 | 0.232 | 0.238 | 0.292 | 0.160 | 0.157 | 0.110 | 0.183 | 0.246 | 0.252 |
| $C_4$ | 0.238 | 0.154 | 0.257 | 0.177 | 0.246 | 0.303 | 0.222 | 0.191 | 0.157 | 0.236 | 0.280 | 0.272 |
| $C_5$ | 0.291 | 0.203 | 0.214 | 0.190 | 0.229 | 0.339 | 0.297 | 0.205 | 0.187 | 0.235 | 0.295 | 0.285 |
| $C_6$ | 0.303 | 0.191 | 0.265 | 0.276 | 0.330 | 0.262 | 0.252 | 0.213 | 0.156 | 0.280 | 0.309 | 0.320 |
| $C_7$ | 0.227 | 0.158 | 0.134 | 0.149 | 0.273 | 0.270 | 0.166 | 0.212 | 0.167 | 0.220 | 0.179 | 0.205 |
| $C_8$ | 0.208 | 0.113 | 0.127 | 0.225 | 0.218 | 0.251 | 0.237 | 0.111 | 0.106 | 0.172 | 0.166 | 0.209 |
| $C_9$ | 0.316 | 0.172 | 0.242 | 0.267 | 0.328 | 0.350 | 0.300 | 0.178 | 0.121 | 0.263 | 0.308 | 0.262 |
| $C_{10}$ | 0.214 | 0.116 | 0.130 | 0.211 | 0.224 | 0.257 | 0.243 | 0.171 | 0.107 | 0.137 | 0.169 | 0.232 |
| $C_{11}$ | 0.295 | 0.189 | 0.279 | 0.282 | 0.323 | 0.346 | 0.292 | 0.191 | 0.138 | 0.187 | 0.212 | 0.311 |
| $C_{12}$ | 0.309 | 0.185 | 0.274 | 0.278 | 0.318 | 0.341 | 0.288 | 0.173 | 0.119 | 0.239 | 0.265 | 0.216 |

*Step 4*:The average and Standard Deviation (S.D) of every column in the total direct –relation fuzzy matrix S matrix is

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average | 0.261 | 0.153 | 0.214 | 0.229 | 0.274 | 0.301 | 0.244 | 0.179 | 0.136 | 0.217 | 0.247 | 0.257 |
| SD | 0.044 | 0.035 | 0.060 | 0.043 | 0.044 | 0.038 | 0.050 | 0.028 | 0.027 | 0.040 | 0.053 | 0.037 |

Step 5:
Using the equs (5), we derived theRefined Time Dependent (RTD)matrix

The RTD matrix for α=0.2

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

The row sum matrix

$$\begin{bmatrix} -1 \\ 6 \\ -7 \\ 2 \\ 7 \\ 10 \\ -5 \\ -10 \\ 8 \\ -9 \\ 8 \\ 7 \end{bmatrix}$$

The RTD matrix for α=0.35

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

The row sum matrix

$$\begin{bmatrix} -1 \\ 3 \\ -7 \\ 2 \\ 7 \\ 9 \\ -5 \\ -10 \\ 8 \\ -10 \\ 7 \\ 6 \end{bmatrix}$$

The RTD matrix for α=0.4

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

The row sum matrix

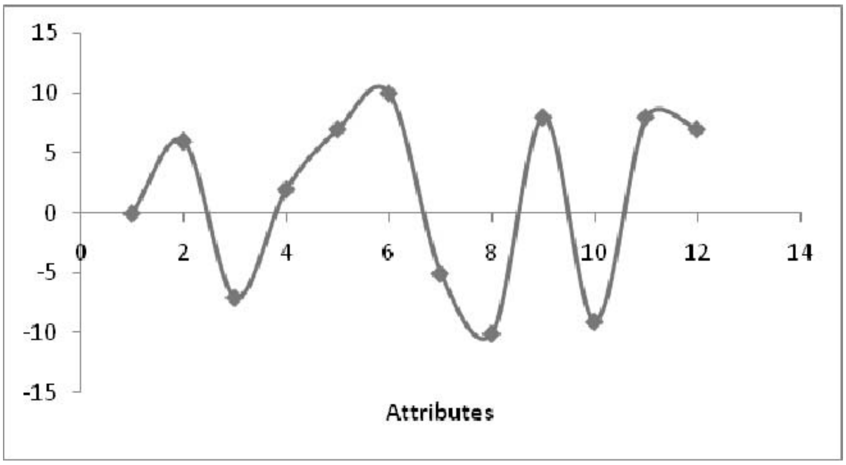
$$\begin{bmatrix} -2 \\ 2 \\ -7 \\ 0 \\ 6 \\ 9 \\ -5 \\ -8 \\ 8 \\ -10 \\ 7 \\ 6 \end{bmatrix}$$

The RTD matrix for α=0.6

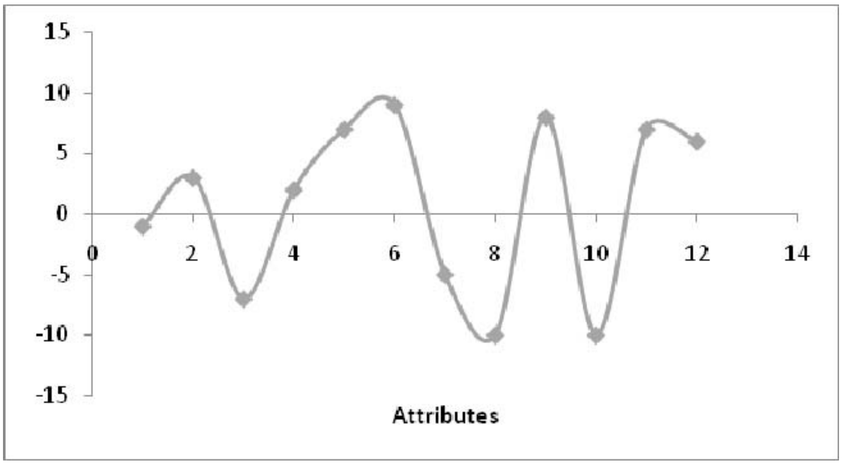
$$\begin{bmatrix} -1 & -1 & 1 & 0 & 0 & -1 & 0 & 0 & 1 & 0 & 0 & 0 \\ -1 & -1 & 1 & 0 & 1 & 1 & 1 & 0 & -1 & 0 & 0 & 0 \\ 0 & -1 & -1 & 0 & -1 & 0 & -1 & -1 & -1 & -1 & 0 & 0 \\ 0 & 0 & 1 & -1 & -1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & -1 & -1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & -1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

The row sum matrix

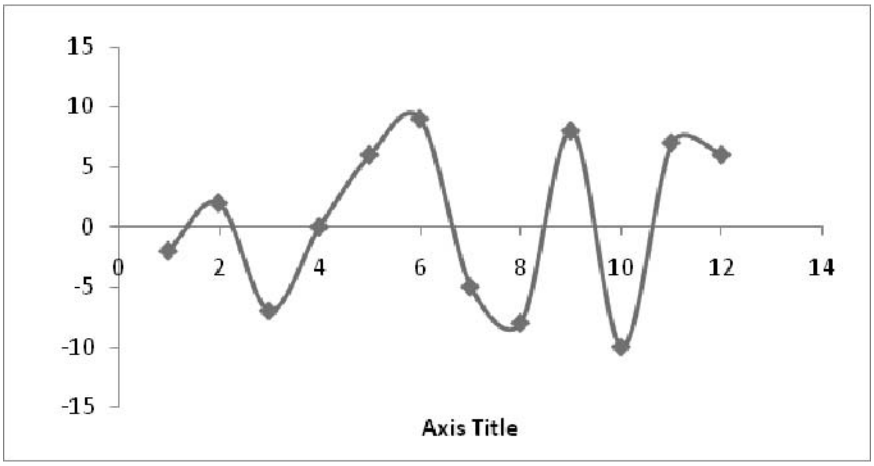
$$\begin{bmatrix} -1 \\ 1 \\ -7 \\ 2 \\ 6 \\ 9 \\ -5 \\ -8 \\ 7 \\ -8 \\ 6 \\ 5 \end{bmatrix}$$



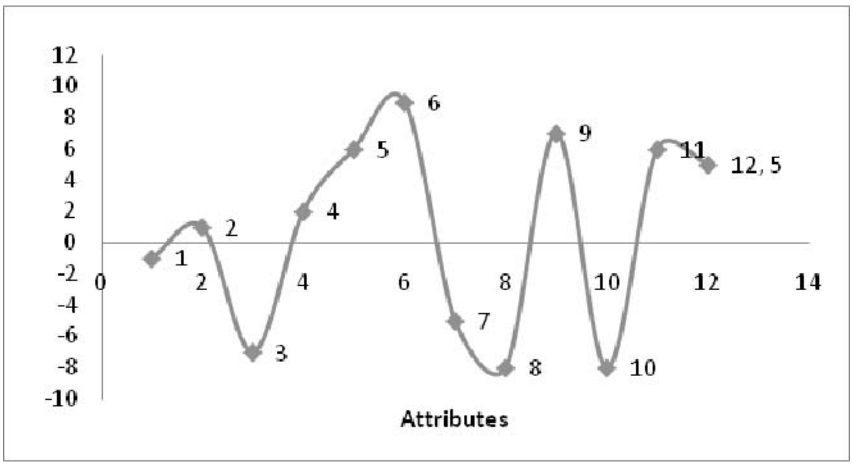

**Graph 1:** Depicting the peak factor of youth aggressiveness for α = 0.2




**Graph 2:** Depicting the peak factor of youth aggressiveness for α = 0.35




**Graph 3:** Depicting the peak factor of youth aggressiveness for α = 0.4



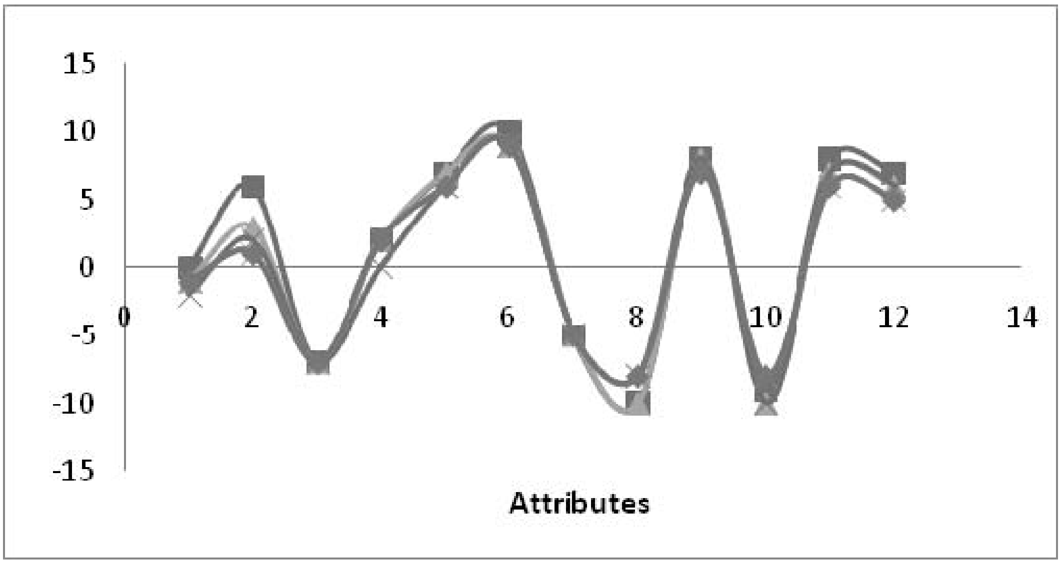

**Graph 4:** Depicting the peak factor of youth aggressiveness for α = 0.6

*Step 6:*Obtain Combined Effect Time Dependent Data (CETD) matrix

Combine the above four RTD matrices, we get CETD matrix. The row sum is obtained for CETD matrix and conclusions are derived based on the row sums.

CETD matrix / The row sum matrix

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | -4 | 4 | 0 | -2 | -4 | -3 | 0 | 4 | 1 | 3 | 0 | -5 |
| 1 | -4 | 4 | 0 | 4 | 4 | 4 | -1 | -3 | 1 | 2 | 0 | 12 |
| 0 | -4 | -4 | 0 | -4 | -1 | -4 | -4 | -3 | -4 | 0 | 0 | 28 |
| -3 | 0 | 4 | -4 | -4 | 0 | -3 | 3 | 4 | 3 | 3 | 3 | 6 |
| 4 | 4 | -1 | -4 | -4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 26 |
| 4 | 4 | 4 | 4 | 4 | -3 | 0 | 4 | 4 | 4 | 4 | 4 | 37 |
| 4 | 0 | -4 | -4 | 0 | -4 | -4 | 4 | 4 | 0 | -4 | -4 | 20 |
| 4 | -4 | -2 | 0 | -4 | -4 | 0 | -4 | -4 | -4 | -4 | -2 | 36 |
| 4 | 3 | 3 | 4 | 4 | 4 | 4 | 0 | -3 | 4 | 4 | 0 | 31 |
| 4 | -4 | -4 | -3 | -4 | -4 | 0 | 0 | -4 | -3 | -3 | -4 | 37 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 0 | -3 | -4 | 4 | 28 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0 | -4 | 3 | 1 | -4 | 24 |




**Graph 5:** Depicting the peak factor of youth aggressiveness for CETD matrix

We observed from the above graph that

The graphical representation (the prominence-causal diagram) and digraphical relationships are now constructed. This step will allow a clearer visualization of the structure and relationships amongst the attributes of youth violence. The evaluation criteria were visually divided into the cause group, including $C_2$ - Poor monitoring and supervision of children by parents / Harsh, lax or inconsistent parental disciplinary practices./ $C_4$- Seeking recognition.$C_5$- Poverty and unemployment /$C_6$- Delinquent peers / gang membership. / $C_9$- Parental criminality / Parental attitudes favorable to substance use and violence / $C_{11}$-Early involvement with alcohol drugs and tobacco. / $C_{12}$-Castisem / inequality andtheeffectgroup,including$C_1$-Hyperactivity /$C_3$-Impulsiveness / poor behavioral control. / $C_7$- Academic failure and dropping out of school. /$C_8$- Concentration problem, restlessness and risk taking. /$C_{10}$-Anti social beliefs and attitudes.

$C_6$- Delinquent peers / gang membership and $C_9$- Parental criminality / Parental attitudes favorable to substance use and violence are the maximum causes of youths are involving in violence.

$C_7$- Academic failure and dropping out of school and $C_{10}$-Anti social beliefs and attitudes are the maximum effect of youth violence.

The above three result also confirmed from the CETD matrix.

## 5. Conclusion

The DEMATEL with CETD method suitable for solving a group decision- making problem in a fuzzy environment, with this method, the interactions between criteria can be transformed into a visible structural model, making it easier to capture the complexity of a problem, whereby excellent decisions can be made even by the lay person as graphs played a vital role.

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