Adaptation of SFCMs to Study the Causes and Effect of Youth Violence

R. Anbarasi

Assistant Professor
Department of Mathematics
KG College of Arts and Science, Coimbatore-641035, Tamil Nadu, India.

ABSTRACT: This paper gives the clear view of the existence of Fuzzy Cognitive Maps (FCMs) and the various approaches of fuzzy maps. The main use of these maps is applied to bringing out the expert's knowledge resulting in the analysis of the causes and effect of youth violence. Controllability concepts are used to find out the reason for youth violence and results are derived and tabulated in the form of matrix. The matrix form is obtained with the help of fuzzy cognitive technique.

INTRODUCTION

Kosko, B (1986), has introduced Fuzzy cognitive maps [FCM]. Gotoh, J, Murakami,J, Yamaguchi,T and Yamanaka (1989), adapted FCM in plant control. Craiger,J.P., and Coovert, M.D (1994), wrote a paper on Modeling Dynamic Social and Psychological process with Fuzzy Cognitive Maps. In 1996, Tsadiras,A.K, and Margaritis, K.G, published a paper entitled 'Using certainty Neurons in Fuzzy Cognitive Maps (FCM)'. Vasantha Kandasamy.W.B,(2000), published a paper on FCM to determine the Maximum Utility of a Route. Fuzziness prevents logical certainty at the level of black – white axioms. Hence we have taken fuzzy to analyze the causes and effects of youth violence.

FUZZY COGNITIVE MAPS (FCMS)

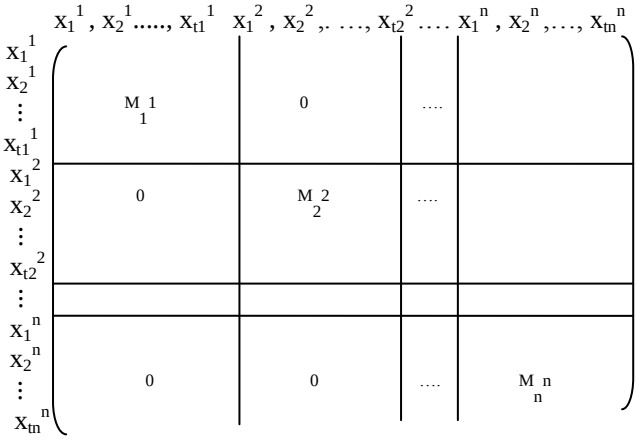
Here the basic definitions of the Fuzzy Cognitive Maps (FCMs) and its properties are given to make the dissertation a self-contained one. Fuzzy Cognitive Maps (FCMs) are more applicable when the data in the first place, is an unsupervised one. The FCMs work on the opinion of experts. It is more suited when the data under investigation is an unsupervised one. FCMs model the world as a collection of concepts and causal relations between concepts. Suppose that C_1, C_2, …, C_n denote attributes related with the problem under investigation. FCMs are fuzzy signed directed graphs with feedback. The directed edge e_{ij} from causal function C_i to function C_j measures how much C_i causes C_j. FCMs are used to model several types of problems. FCMs are also used to model in robotics like plant control. The edges e_{ij} take values in the fuzzy causal interval [–1, 1].

SUPER FUZZY COGNITIVE MAPS (SFCMS)

Suppose n experts want to work with a problem P using a FCM model, then how to form an integrated dynamical system which can function simultaneously using the n experts opinion.

Suppose the first experts spells out the attributes of a problem as x_1^1, x_2^1……..., x_{t1}^1 ,the second expert gives the attributes as x_1^2 , x_2^2 ,……, x_{t2}^2 and so on. Thus the expert gives the attributes with which he wishes to work as x_1^i,x_2^i,……,x_{ti}^i; i=1,2,3,…….,n. Now consider the model problem using the special diagonal super fuzzy matrix.

The special feature of this special super diagonal fuzzy matrix would be all the diagonal matrices are square matrices then the main diagonal of each of these sub matrices is zero. The special diagonal super fuzzy matrix for the problem P takes the following form and is denoted by M_p.



Here M_1^i is a fuzzy with main diagonal elements to be zero i.e

$$M_i^1 = \begin{pmatrix} 0 & m^i_{12} & \cdots\cdots & m^i_{1ti} \\ m^i_{21} & 0 & \cdots\cdots & m^i_{2ti} \\ \cdots & \cdots & \cdots\cdots & \cdots \\ m^i_{t1} & m^i_{t2} & \cdots\cdots & 0 \end{pmatrix}$$

where $i = 1,2,3,\ldots\ldots,n$.

This model will be known as the multi expert super fuzzy cognitive maps model and the associated fuzzy super matrix would be known as the special diagonal fuzzy super matrix.

Definition 1

An Fuzzy Cognitive Map is a directed graph with the concepts like policies, events etc. Nodes and causalities are edges. It represents causal relationship between concepts.

Definition 2

The nodes of the Fuzzy Cognitive Map are fuzzy sets so that they are called as fuzzy nodes.

Definition 3

FCMs with edge weights or causalities from the set {–1, 0, 1}, are called simple FCMs.

Definition 4

Let $C_1, C_2, \ldots, C_n$ be the nodes of an FCM. $A = (a_1, a_2, \ldots, a_n)$, where $a_i \in \{0, 1\}$. A is called the instantaneous state vector and it denotes the on-off position of the node at an instant.

$$a_i = \begin{cases} 0 & \text{if } a_i \text{ is OFF} \\ 1 & \text{if } a_i \text{ is ON, where i= 1, 2, ..., n.} \end{cases}$$

Definition 5

When there is a feedback in an FCM, i.e., when the causal relations flow through a cycle in a revolutionary way, the FCM is called as dynamical system.

Definition 6

If the equilibrium state of a dynamical system is a unique state vector, then the vector is called a fixed point.

Definition 7

If the FCM settles down with a state vector repeating in the form $A_1 \to A_2 \to \ldots \to A_i \ldots \to A_n$, then this equilibrium is called a limit cycle.

Adaptation of SFCMs to Study the Causes and Effect of Youth Violence

Youth violence is a devastating public health problem worldwide. According to the World Health Organization, over 540 adolescents and young adults die every day from interpersonal violence. Approximately, anywhere from 4 to 7.5 million young people experience injuries from violence requiring hospital treatment per annum. Indeed, the health consequences of violence are

server, including death, permanent physical disabilities, high costs of medical care and rehabilitation, and immeasurable grief and suffering.

To analyze the causes and effect of youth violence, we have interviewed and collected a data from 30 youth in and around saravanampatti, Coimbatore. We list out briefly the main attributes given below. Suppose we have 3 experts who wish to work with a problem using FCM. All of them choose to use the FCM model.

The first expert wishes to work with the following four nodes

A_{11} – Dropping out of School/College

A_{12} - Family situation

A_{13} – Poverty

A_{14} - Media influences (Mass Media)

The second expert wishes to work with the following three nodes

A_{21} – Parental criminality

A_{22} - Ill treatment by school (or) college teacher

A_{23} – Bad Company

The third expert wishes to work with the following six nodes

A_{31} – Run away from home

A_{32} – Audit for drugs

A_{33} – Media

A_{34} – poverty

A_{35} – Freedom from parents

A_{36} – opportunities are denied

The Directed Graph is given by the First Expert.

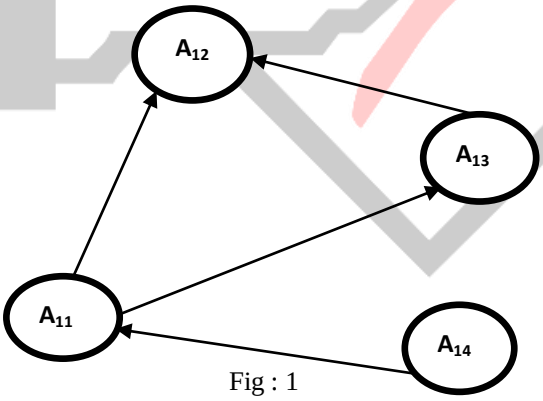


Fig : 1

The associated relational matrix of the First Expert's opinion got from the directed graph given in Figure .1

	A_{11}	A_{12}	A_{13}	A_{14}
A_{11}	0	1	0	1
A_{12}	1	0	0	0
A_{13}	1	1	0	0
A_{14}	1	0	0	0

The Directed Graph is given by the Second Expert.

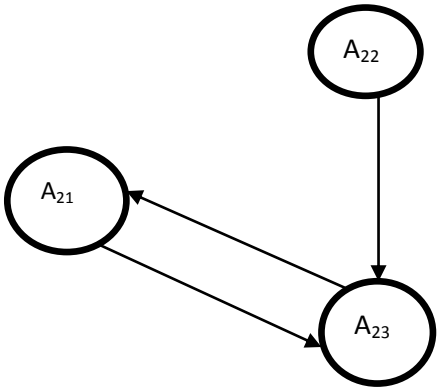


Fig: 2

The associated relational matrix of the second expert opinion got from the directed graph given in Figure 2.

	A_{21}	A_{22}	A_{23}
A_{21}	0	0	1
A_{22}	0	0	1
A_{23}	1	0	0

The Directed Graph is given by the Third Expert.

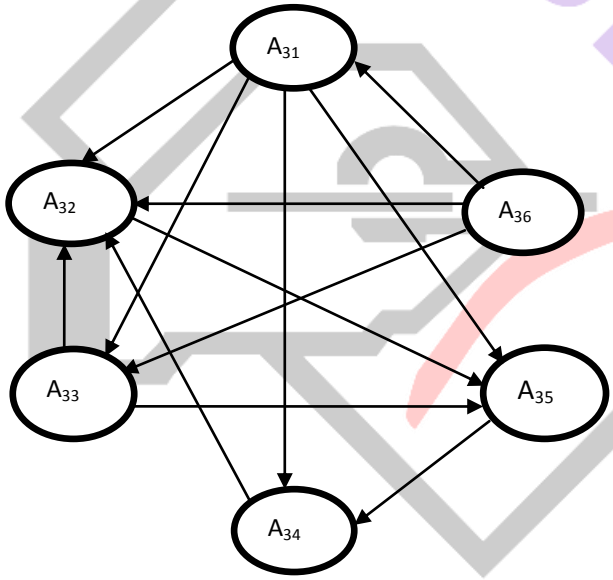


Fig: 3

The associated relational matrix of the Third expert's opinion got from the directed graph given in Figure 3.

	A_{31}	A_{32}	A_{33}	A_{34}	A_{35}	A_{36}
A_{31}	0	1	1	1	1	0
A_{32}	1	0	0	0	1	1
A_{33}	1	1	0	0	1	0
A_{34}	1	1	0	0	0	0
A_{35}	1	1	1	1	0	0
A_{36}	1	1	1	0	0	0

The Super Fuzzy Cognitive matrix is

	A_{11}	A_{12}	A_{13}	A_{14}	A_{21}	A_{22}	A_{23}	A_{31}	A_{32}	A_{33}	A_{34}	A_{35}	A_{36}
A_{11}	0	1	0	1									
A_{21}	1	0	0	0									
A_{13}	1	1	0	0									
A_{14}	1	0	0	0									
A_{21}					0	0	1						
A_{22}					0	0	1						
A_{23}					1	0	0						
A_{31}								0	1	1	1	1	0
A_{32}								1	0	0	0	1	1
A_{33}								1	1	0	0	1	0
A_{34}								1	1	0	0	0	0
A_{35}								1	1	1	1	0	0
A_{36}								1	1	1	0	0	0

Now let us see how the dynamical multi expert system M_d functions. Suppose the expert wishes to work with

$X = [(1\ 0\ 0\ 1) \mid (0\ 0\ 1) \mid (0\ 0\ 1\ 0\ 1\ 0)]$
$X = [(1\ 0\ 0\ 1) \mid (0\ 0\ 1) \mid (0\ 0\ 1\ 0\ 1\ 0)]$
$XA = [(1\ 1\ 0\ 1) \mid (1\ 0\ 0) \mid (2\ 2\ 1\ 1\ 1\ 0)]$
$\hookrightarrow [(1\ 1\ 0\ 1) \mid (1\ 0\ 1) \mid (1\ 1\ 1\ 1\ 1\ 0)] = X_1$
$X_1A = [(2\ 1\ 0\ 1) \mid (1\ 0\ 1) \mid (4\ 4\ 2\ 2\ 3\ 1)]$
$\hookrightarrow [(1\ 1\ 0\ 1) \mid (1\ 0\ 1) \mid (1\ 1\ 1\ 1\ 1\ 1)] = X_2$
$X_2A = [(2\ 1\ 0\ 1) \mid (1\ 0\ 1) \mid (5\ 5\ 3\ 2\ 3\ 1)]$
$\hookrightarrow [(1\ 1\ 0\ 1) \mid (1\ 0\ 1) \mid (1\ 1\ 1\ 1\ 1\ 1)] = X_2$

Let us consider another input vector

(i.e.,) $Y = [(0\ 0\ 1\ 0) \mid (0\ 1\ 0) \mid (0\ 1\ 0\ 0\ 0\ 0)]$
$Y = [(0\ 0\ 1\ 0) \mid (0\ 1\ 0) \mid (0\ 1\ 0\ 0\ 0\ 0)]$
$YA = [(1\ 1\ 0\ 0) \mid (0\ 0\ 1) \mid (1\ 0\ 0\ 0\ 1\ 1)]$
$\hookrightarrow [(1\ 1\ 1\ 0) \mid (0\ 1\ 1) \mid (1\ 1\ 0\ 0\ 1\ 1)] = Y_1$
$Y_1A = [(2\ 2\ 0\ 1) \mid (1\ 0\ 1) \mid (3\ 3\ 3\ 2\ 2\ 1)]$
$\hookrightarrow [(1\ 1\ 1\ 1) \mid (1\ 1\ 1) \mid (1\ 1\ 1\ 1\ 1\ 1)] = Y_2$
$Y_2A = [(3\ 2\ 0\ 1) \mid (1\ 0\ 2) \mid (5\ 5\ 3\ 2\ 3\ 1)]$
$\hookrightarrow [(1\ 1\ 1\ 1) \mid (1\ 1\ 1) \mid (1\ 1\ 1\ 1\ 1\ 1)] = Y_2$

CONCLUSION

Thus in this paper, the Fuzzy Cognitive Mapping technique is used to solve the growing violence's among the youth, which is one of the major day to day issues. Thus with the help of matrix form, the result for this problem has been derived using fuzzy cognitive techniques. Thus the obtained results can be used to bring a change in the young generations in a productive and meaningful way.

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