A Solution to Control Suicide in the Domestic Violence using Combined Disjoint Block Fuzzy Cognitive Maps (CDBFCM)

A. Victor Devadoss, M. Clement Joe Anand

Abstract— Suicide is one of the leading causes of death in the world. An imperative reason for suicide is happening in the Domestic Violence using Combined Disjoint Block Fuzzy Cognitive Maps (CDBFCM). This method is introduced by W.B. Vasantha Kandasamy and A. Victor Devadoss, is analyzed in this paper. The Combined Disjoint Block FCM is defined in this method becomes effective when the number of concepts can be grouped and are in large numbers. In this paper we analyzed the problems and find out the major reason for suicide in the domestic violence using neutrosophic tool. This paper has five sections. First section gives the information about development of Fuzzy Cognitive Maps and Suicide in Domestic Violence. Second Section gives preliminaries of Fuzzy Cognitive maps and Combined Disjoint Block Fuzzy Cognitive Maps. In Section three, we explain method of determining the hidden pattern. In the fourth section, we give the concepts of problem. Final section gives the conclusion based on our study.

Index Terms— Combined Disjoint Fuzzy Cognitive Maps, Domestic Violence, Fuzzy Cognitive Maps, Suicide.

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1 INTRODUCTION

IN 1965, L.A. Zadeh has introduced a mathematical model called Fuzzy Cognitive Maps. After a decade in the year 1976, Political scientist R. Axelord [6] used this fuzzy model to study decision making in social and political systems. Then B. Kosko [1], [2], [3] enhanced the power of cognitive maps considering fuzzy values for the concepts of the cognitive map and fuzzy degrees of interrelationships between concepts. FCMs can successfully represent knowledge and human experience, introduced concepts to represent the essential elements and the cause and effect relationships among the concepts to model the behavior of any system. It is a very convenient simple and powerful tool, which is used in numerous fields such as social economical and medical etc. Suicide, a social problem is one of the leading causes of death in the world. The purpose of of study is to identify the risk groups. Suicide is defined as deliberate killing of oneself. Suicides are most likely to occur during the periods of socioeconomic, family and individual crisis. WHO (World Health Organisation) reports that 1.5 percentages of all deaths worldwide are due to suicide. The risk factors for suicide include female gender, low socioeconomic status, lack of education, unemployment, increasing age, being married, not working outside of the home and domestic violence. As WHO's recently released World Report onViolence and Health notes: "One of the most common forms of violence against women is that performed by a husband or male partner". In which factors here we are discuss about what are the problems to promote to the suicide though in the domestic violence.

- *Dr. A. Victor Devadoss, Head and Associate Professor, PG and Research Department of Mathematics, Loyola College, Chennai-34, India.*
  E-mail : hanivictor@ymail.com
- *M. Clement Joe Anand, Ph.D Research Scholar, PG and Research Department of Mathematics, Loyola College, Chennai-34, India.*
  E-mail: arjoemi@gmail.com

Suicide prevension is an umbrella term for the collection of efforts of local citizen organizations, mental health practitioners and related professional to reduce the incidence of suicide through the preventive and proactive measures. More over the data in an unsupervised one and also there is uncertainly in the concepts. Hence Fuzzy tool alone has the capacity to analyze these concepts. Hence it is chosen here.

2 PRELIMINARIES

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. FCMs model the world as a collection of classes and causal relations between classes.

2.1 Definition

When the nodes of the FCM are fuzzy sets then they are called as fuzzy nodes.

2.2 Definition

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

2.3 Definition

An FCMs is a directed graph with concepts like policies, events etc, as nodes and causalities as edges, It represents causal relationships between concepts.

2.4 Definition

Consider the nodes/concepts C_1, C_2,…, C_n of the FCM. Suppose the directed graph is drawn using edge weight $e_{ij} \in$ {-1, 0, 1}. The matrix E be defined by E = (e_{ij}) where e_{ij} is the weight of the directed edge C_iC_j. E is called the adjacency matrix of FCM, also known as the connection matrix of the FCM. It is important to note that all matrices associated with an FCM are always square matrices with diagonal entries as zero.

2.5 Definition

Let C_1, C_2,…, C_n be the nodes of an FCM. $A=(a_1, a_2,…,a_n)$ where $e_{ij} \in \{-1, 0, 1\}$. A is called the instantaneous state vector and it denotes the on-off position of the node at an instant. $a_i = 0$ if a_i is off and $a_i = 1$ if a_i is on for i = 1, 2,…, n.

2.6 Definition

Let C_1, C_2,…, C_n be the nodes of and FCM. Let $\overrightarrow{C_1C_2}, \overrightarrow{C_2C_3}, \overrightarrow{C_3C_4},…,\overrightarrow{C_iC_j}$ be the edges of the FCM (i≠j).

Then the edges form a directed cycle. An FCM is said to be cyclic if it possesses a directed cycle. An FCM is said to be acyclic if it does not possess any directed cycle.

2.7 Definition

An FCM is said to be cyclic is said to have a feedback.

2.8 Definition

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 a dynamical system.

2.9 Definition

Let $\overrightarrow{C_1C_2}, \overrightarrow{C_2C_3}, \overrightarrow{C_3C_4},…,\overrightarrow{C_{n-1}C_n}$ be a cycle. When C_i is switched on and if the causality flows through the edges of a cycle and if it again causes C_i, we say that the dynamical system ges round and round. This is true for any node C_i for i =1,2,…,n. The equilibrium state for this dynamical system is called the hidden pattern.

2.10 Definition

If the equilibrium state of a dynamical system is a unique state vector, then it is called a fixed point. Consider a FCM with C_1, C_2,…, C_n as nodes. For example let us start the dynamical system by switching on C_1. Let us assume that the FCM settles down with C_1 and C_n on i.e., in the state vector remains as $(1, 0, 0,…, 0)$ is called fixed point.

2.11 Definition

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

2.12 Definition

Finite number of FCMs can be combined together to produce the point effect of all the FCMs. Let E_1, E_2,…,E_p be the adjacency matrices of the FCMs with nodes C_1, C_2,…, C_n then the combined FCM is got by adding all the adjacency matrices E_1, E_2,…, E_p. We denote the combined FCM adjacency matrix by $E = E_1+E_2+…+E_p$.

2.13 Definition

Let C_1, C_2,…, C_n be n distinct attributes of a problem n very large and a non prime. If we divide n into k equal classes i.e., k/n=t which are disjoint and if we find the directed graph of each of there k classes of attributes with t attributes each, then their corresponding connection matrices are formed and these connection matrices are joined as blocks to form a n x n matrix. This n x n connection matrix forms the combined disjoint block FCM of equal classes. If the classes are not divided to have equal attributes but if they are disjoint classes we get a n x n connection matrix called the combined disjoint block FCM of unequal classess/size.

2.14 Definition

Suppose A = $(a_1, a_2,…,a_n)$ is a vector which is passed into a dynamical system E. Then AE = $(a_1', a_2',…, a_n')$ after thresholding and updating the vector suppose we get $(b_1, b_2,…,b_n)$ we denote that by $(a_1', a_2',…, a_n') \mapsto (b_1, b_2,…,b_n)$. Thus the symbol '$\mapsto$' means the resultant vector has been thresholded and updated.

FCMs have several advantages as well as some disadvantages. The main advantages of this method it is simple. It functions on expert's opinion. When the data happens to be an unsupervised one the FCM comes handy. This is the only known fuzzy technique that gives the hidden pattern of the situation. As we have a very well known theory, which states that the strength of the data depends on, the number of experts's opinions. At the same time the disadvantages of the combined FCM is when the weightages are 1 and -1 for the same C_iC_j, we have the sum adding to zero thus at all times the connection matrices $E_1,E_2,…,E_k$ may not be conformable for addition.

Combined conflicting opinions tend to cancel out and assisted by the strong law of large numbers, a consensus emerges as the sample opinion approximates the underlying population opinion. This problem will be easily overcome if the FCM entries are only 0 and 1.

3 METHOD OF DETERMINING THE HIDDEN PATTERN

Let C_1, C_2,…, C_n be the nodes of an FCM, with feedback, Let E be the associated adjacency matrix. Let us find the hidden pattern when C_1 is switched on. When an input is given as the vector $A_1 = (1, 0,…, 0)$, the data should pass through the relation matrix E. This is done by multiplying A_i by the matrix E. Let $A_iE = (a_1, a_2,…, a_n)$ with the threshold operation that is by replacing a_i by 1 if $a_i > k$ and a_i by 0 if $a_i < k$ (k is a suitable positive integer). We update the resulting concept; the concept C_1 is included in the updated vector by making the first coordinate as 1 in the resulting vector. Suppose $A_iE \rightarrow A_2$ then consider A_2E and repeat the same procedure. This procedure is repeated till we get a limit cycle or a fixed point.

4 CONCEPTS OF THE PROBLEM

Using the Domestic Violence linguistic questionnaire and the expert's opinion we have taken the following twenty five attributes {C_1, C_2,…, C_{25}}.

A_1 - Did not permit to meet/interact with female friends.
A_2 - Restricted interaction with your family members.
A_3 - did not permit to handle money.
A_4 - Did not permit to choose/buy a things.
A_5 - Irritated/suspecious/angry if you talking to other man.
A_6 - Accused you of being unfaithful.
A_7 - Insisted on knowing where you were always.
A_8 - Treated you like a servant.
A_9 - Dis not allow you to partake in decision making.
A_{10} - He kept away from home for days or weeks without

informing you/giving you money.

A_{11} - He was unfaithful to you/ had extra-marital relationships.

A_{12} - Did not react against his relatives/agreed with his relatives, when they insulted you.

A_{13} - Insulted you infront of others.

A_{14} – Threatened to harm you physically.

A_{15} -Slapped you

A_{16} - Beat you on other body parts.

A_{17} -Twisted you are/pulled your hair.

A_{18} - Pushed you with fist or some object.

A_{19} - Punched you with fist or some object.

A_{20} - Kicked you/dragged you.

A_{21} - Chocked you or inflicted burns on you

A_{22} -Attacked you with knife or some other weapon.

A_{23} - Ignored you purposely, by not having sexual intercourse with you for weeks.

A_{24} - Had sexual intercourse with you forcibly, when you wer not interested.

A_{25} - Forced you to engage in un-natural sexual practices, which you hated.

These 25 attributes are divided into 5 classes $C_1, C_2,..., C_5$ with 5 in each class.

Let $C_1 = \{A_1, A_3, A_9, A_{13}, A_{21}\}$, $C_2 = \{A_2, A_7, A_{11}, A_{15}, A_{20}\}$, $C_3 = \{A_5, A_6, A_{16}, A_{17}, A_{24}\}$, $C_4 = \{A_4, A_8, A_{10}, A_{18}, A_{23}\}$ and $C_5 = \{A_{12}, A_{14}, A_{19}, A_{22}, A_{25}\}$.

Now we take the expert opinion for each of these classes and take the matrix associated with the combined disjoint block FCMs. The experts opinion for the class $C_1 = \{A_1, A_3, A_9, A_{13}, A_{21}\}$ in the form of the directed graph.
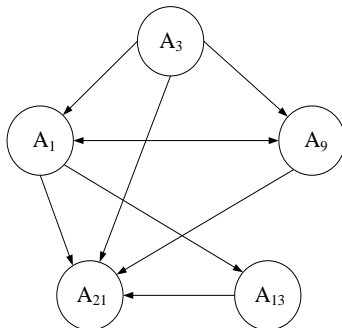

Fig. 1

The related connection matrix is given by

$$M_1 = \begin{bmatrix} 0 & 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

The directed graph is given by the expert on A_2, A_7, A_{11}, A_{15}, A_{20} which forms the class C_2.
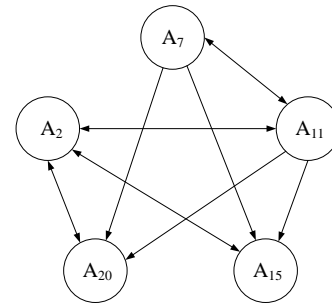

Fig. 2

According to this expert, the attribute insisted on knowing where you were always is interrelated to with he/she was unfaithful to you. The attribute restricted interaction with famil member is interrelated to with he/she was unfaithful to you, slapped you and kicked you/ dragged you/ The attribute insisted on knowing where you were always is interrelated to with he/she was unfaithful to you. Also most of the time they feel he/she was unfaithful to her/ him. The related connection matrix M_2 is given below:

$$M_2 = \begin{bmatrix} 0 & 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 & 1 \\ 1 & 1 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Now we give the directed graph for the class C_3 as given by the expert $C3 = \{A_5, A_6, A_{16}, A_{17}, A_{24}\}$.
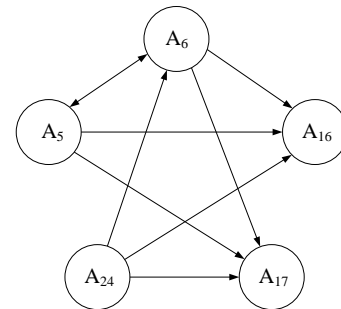

Fig. 3

According to this expert, husband getting irritated, suspecious, angry when you are always talking to other man, it will create a unfaithful thought on his wife. If you are include in this type of situation, there are many possible to happened twisted your arm/pulled your hair and beated you by her husband. The related connection matrix M_4 is given below:

$$M_3 = \begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 \end{bmatrix}$$

The directed graph is given by the expert on A_4, A_8, A_{10}, A_{18}, A_{23} which forms the class C_4.
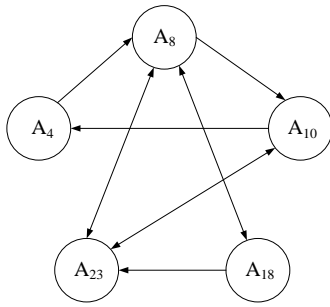
Fig. 4

According to this expert, the attribute treated you like a servent is interrelated to with pushed/shook you or throw something on you and ignored you purposely for sexual intercourse with you for weaks for months. The related connection matrix M_4 is given below:

$$M_4 = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 \end{bmatrix}$$

Now we give the directed graph for the class C_5 as given by the expert $C_5 = \{A_{12}, A_{14}, A_{19}, A_{22}, A_{25}\}$.
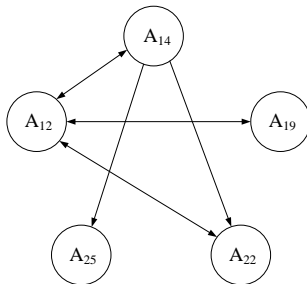
Fig. 5

According to the expert did not react against his relatives/agreed with his relatives when they insulted you, there is no possible to threatened to harm you physically, punched you with fist or some object and attacked you with some other weapon. If you are not willing to engage in un-natural practices you will be punished. Therefore these are all interacted. The related connection matrix M_4 is given below:

$$M_5 = \begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Now we combined disjoint block connection matrix of the fuzzy cognitive maps B is given by

$$B = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & \ldots & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & \ldots & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & \ldots & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & \ldots & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & \ldots & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & \ldots & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & \ldots & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & \ldots & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \ldots & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Suppose we consider the on state of the attribute did not permit to meet/interact with female friends and all other states are off the effect of X=(1000000000000000000000000) on the CDBFCM is given by

$XB \hookrightarrow$ (1000000010001000000010000)=X_1(say)

$X_1B \hookrightarrow$ ((1000000010001000000010000)=X_2= X_1

X_1 is a fixed point of the dynamical system. When state A_1 is on their wife will not allow partaking in decision making, insulted infront of others, chocked or inflicked burn her body.

Suppose we consider, the on state of the attributes did not permit to handle money, did not allow you to partaking in decision making, he was unfaithful to you/ had extra-marital relationships, slapped you, beat you on other body parts, twisted your arm/pulled your hair, had sexual intercourse with you forcibly, when you were not interested, forced you to

engage in un-natural sexual practices which you hated to be in the on stage and all other nodes are in off state. Now we study the effect of dynamical system B. Let T= (001000001010001110000011) state vector depicting the on state, the state vector T in to the dynamical system B.

$$T B \hookrightarrow (111000101010001110011 0011) = T_1 \text{ (say)}$$
$$T_1 B \hookrightarrow (111000101011011101100011) = T_2 \text{ (say)}$$
$$T_2 B \hookrightarrow (111000101011111101111011) = T_3 \text{ (say)}$$
$$T_3 B \hookrightarrow (111000101011111101111011) = T_4 = T_3$$

T_3 the fixed point of the dynamical system. Thus the attributes A_3, A_9, A_{11}, A_{15}, A_{16}, A_{17}, A_{24} and A_{25} are on states did not permit to choose/buy a things, irritated/suspicious/angry if you talked to othermen, accused you of being unfaithful, treated you like a servant, he kept away from home for days or weeks without informing you/giving you money, pushed you with fist or some other object, ignored you purposely, by not having sexual intercourse with you for weeks is in the off state all other states become on.

5 CONCLUSION

We analyzed what are the reasons promote to the suicide thought using CDBFCM model. The limit point of the dynamical system reveals that the attributes A_1, A_2, A_3, A_7, A_9, A_{11}, A_{12}, A_{13}, A_{14}, A_{15}, A_{16}, A_{17}, A_{19}, A_{20}, A_{21}, A_{22}, A_{24} and A_{25} are the main causes for their problems. This means, did not permit to meet/interact with female friends, restricted interaction with his family members, did not permit to handle money, insisted on knowing where you were always, did not allow you to partake in decision making,l he was unfaithful to you/ had extra marital relationships, did not react against his relatives/agreed with his relatives, when they insulted you, insulted you infornt of others, threatened to harm you physically, slapped you, beat you on other body parts, twisted you arm/pulled your hair, puched you with fist or some object, kicked you/dragged you, chocked or inflicted burns on you, attacked you with knife or some other weapon, had sexual intercourse with you forcibly, when you were not interested and forced you to engage in un-natural sexual practices, which you hated these are all the causes will create a suicide thought in the domestic.

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