A Study on Divorce Problem using Combined Overlap Block Neutrosophic Cognitive Maps

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Abstract

In this article we study to find out the vital reason for divorce using Combined Overlap Block Neutrosophic Cognitive Maps (COBNCMs) defined by Smarandache Florentin and W.B. Vasantha kandasamy [1] , [2] , [3]   . The Combined Overlap Block Neutrosophic Cognitive Maps was defined in this method becomes effective when the number of concepts can be grouped and are large in numbers. This paper has four sections. In the first section we recall the following fundamentals of Neutrosophic Cognitive Maps (NCMs) and Combined Block Neutrosophic Cognitive Maps (CBNCMs). In section two, we recall Combined Overlap NCMS. In the third Section we give the adaptation of Overlap NCM to the problem. In the last section we give the conclusion based on our study.

Keywords: NCMs, CBNCMS, Divorce.

Preliminary definitions

We just recall that the fundamentals of Neutrosophic cognitive maps and Overlap NCM.

Definition 1. Neutrosophic Cognitive Map is the generalization of Fuzzy Cognitive Map [1] , [2]. A Neutrosophic Cognitive Map (NCM) is a neutrosophic directed graph with concepts like policies, events etc. as nodes and causalities or indeterminate as edges. It represents the causal relationship between concepts.

Definition 2. NCMs with edge weight from {-1, 0, 1, I} are called simple NCMs.

Definition 3. Let C_1, C_2,., C_n be nodes of a NCM. Let the neutrosophic matrix N (E) be defined as N (E) = (e_{ij}) where e_{ij} is the weight of the directed edge C_i C_j, where e_{ij} $\in$ {0, 1, -1, I}. N(E) is called the neutrosophic adjacency matrix of the NCM.

Definition 4. Let C_1, C_2, ., C_n be the nodes of the NCM. Let A = $(a_1, a_2,., a_n)$ where a_i $\in$ {0, 1, I }. A is called the instantaneous state neutrosophic vector and it denotes the on, off, indeterminate state position of the node at an instant

   $a_i = 0$ if a_i is off (no effect)

   $a_i = 1$ if a_i is on (has effect)

   $a_i = I$ if a_i is indeterminate(effect cannot be determined) ,for i = 1, 2,., n.

Definition 5. Let C_1, C_2, ., C_n be the nodes of the FCM. Let C_1C_2 ,C_2C_3 ,…,$C_{n-1}C_n$, be the directed edges of the NCM. Then the edges form a directed cycle. An NCM is said to be cyclic if it possesses a directed cycle. An NCM is said to be acyclic if it does not possess any directed cycle.

Definition 6. An NCM with cycles is said to have a feedback. When there is a feedback in the NCM i.e. when the causal relations flow through a cycle in a revolutionary manner , then NCM is called a dynamical system.

Definition 7. Let C_1C_2 ,C_2C_3 ,…..,$C_{n-1}C_n$ be the directed cycle, when C_i is switched on and if the causality flow through the edges of a cycle and if it again causes C_i, we say that the dynamical system goes 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.

Definition 8. If the equilibrium state of a dynamical system is a unique state vector, then it is called a fixed point. Consider the NCM 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 NCM settles down with C_1 and C_n on, i.e. the state vector remain as (1, 0,…..0, 1).This neutrosophic state vector (1, 0,…..0, 1) is called the fixed point.

Definition 9. If the NCM settles with a neutrosophic 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 of the NCM.

Definition 10. Let P be the problem under investigation. Suppose let {C1, C2, ...,Cn} be n concepts associated with P (n very large) .

   Now divide the number of concepts {C1, C2, ...,Cn} into classes S1,...,St where the classes are such that

         $S_i \cap Si+1 \neq \emptyset$ where (i = 1,2,...,t-1)

         U Si = { C1, C2, ...,Cn }

         |Si| ≠ |Sj| if i ≠ j in general.

   Now we obtain the NCM associated with each of the classes S1 ,. . .St. We determine the relational matrix associated with each Si, Using these matrices we

obtain a n × n matrix. This n × n matrix is the matrix associated with the Combined Overlap Block NCM (COBNCM) of blocks of same sizes.

Definition 11. Finite number of NCMs can be combined together to produce the joint effect of all NCMs. If $N(E1)$, $N(E2)$,., $N(Ep)$ be the neutrosophic adjacency matrices of a NCM with nodes C_1, C_2, ., C_n then the combined NCM is got by adding all the neutrosophic adjacency matrices $N(E_1)$,., $N(E_p)$. We denote the combined NCMs adjacency neutrosophic matrix by $N(E) = N(E_1) + N(E_2) + \ldots + N(E_p)$.

Problem definition and Justification for using Overlap Block NCM Model

Divorce, the word that was taboo till sometime back, has today become the easiest solution for people having problems in marital life. Slightest tensions, slightest arguments make married couples ready to go in their separate ways. Till now, people have concentrated on the recent upsurge in the divorce rates in India as well as in the world. However, very few have gone beyond the facts and tried to know what the causes for the surging divorce rates are. Above all the data is only an unsupervised one and also there is uncertainty and indeterminacy in the concepts, since no other statistical tool can be applied and only Neutrosophic tool alone has the capacity to analyze the structure and give the hidden pattern. Hence it is chosen here.

Adaptation of Overlap Block NCM to the problem

Using the linguistic questionnaire and the experts opinion we have taken the following eight concepts {C1, C2, ...,C8}. The following concepts are taken as the main nodes for our problem.

C_1 – Lack of commitment towards the marriage.
C_2 - Abandonment
C_3 - Torture due to Physical, Sexual, and Mental Abuses.
C_4 – Interference from Parents or in-laws.
C_5 – Sexual Incompatibility.
C_6 – Mental Instability or Mental Illness.
C_7 – Illegal Affairs.
C_8 – Lack of family counseling.

Now we proceed on to apply the effect of combined overlap block NCM of equal length. Let us consider the eight concepts {C1, C2, ...,C8}. We divide these concepts into cyclic way of classes, each having just four concepts in the following way.

$S_1 = \{ C_1, C_2, C_3, C_4 \}$, $S_2 = \{C_3, C_4, C_5, C_6\}$, $S_3 = \{C_5, C_6, C_7, C_8 \}$, $S_4 = \{ C_7, C_8, C_1, C_2\}$.

The directed graph and the relation matrix for the class $S_1 = \{ C_1, C_2, C_3, C_4 \}$ given by the expert is as follows.
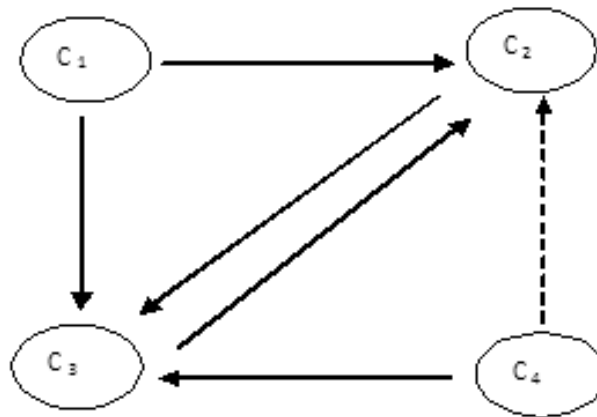
Figure 1

$$
\begin{array}{c}
 \\
C_1 \\
C_2 \\
C_3 \\
C_4
\end{array}
\begin{array}{cccc}
C_1 & C_2 & C_3 & C_4 \\
\begin{pmatrix}
0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 \\
0 & I & 1 & 0
\end{pmatrix}
\end{array}
$$

The directed graph and the relation matrix for the class $S2 = \{ C3, C4, C5, C6\}$, given by the experts is as follows:
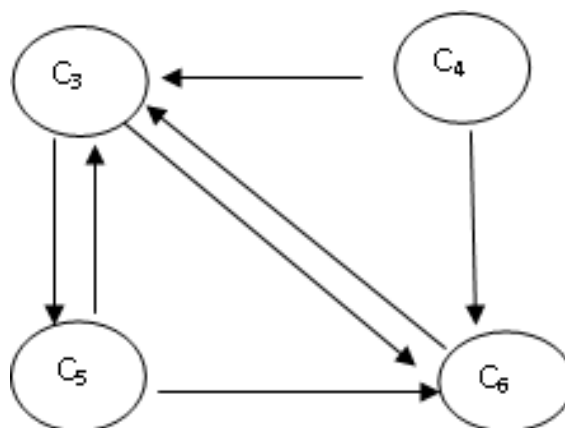

Figure 2

$$
\begin{array}{c} \\ C_3 \\ C_4 \\ C_5 \\ C_6 \end{array}
\begin{array}{cccc}
C_3 & C_4 & C_5 & C_6 \\
0 & 0 & 1 & 1 \\
1 & 0 & 0 & 1 \\
1 & 0 & 0 & 1 \\
1 & 0 & 0 & 0
\end{array}
$$

The directed graph and the relation matrix for the class $S_3 = \{C_5, C_6, C_7, C_8\}$ given by the expert is as follows.

Figure 3
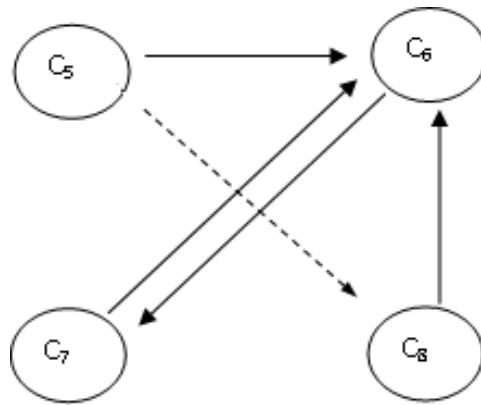
$$
\begin{array}{c} \\ C_5 \\ C_6 \\ C_7 \\ C_8 \end{array}
\begin{array}{cccc}
C_5 & C_6 & C_7 & C_8 \\
0 & 1 & 0 & I \\
0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0
\end{array}
$$

The directed graph and the relation matrix for the class $S_4 = \{C_7, C_8, C_1, C_2\}$ given by the expert is as follows.

Figure 4
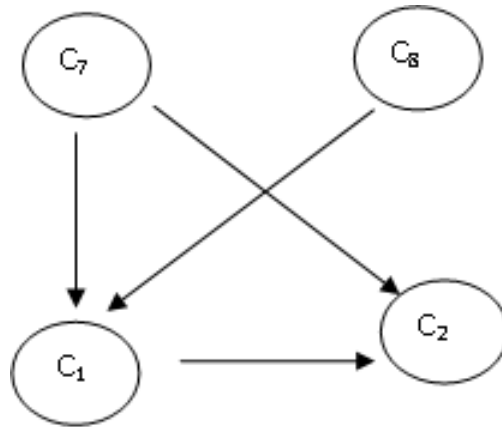
$$
\begin{array}{c}
\quad\quad C_7 \;\; C_8 \;\; C_1 \;\; C_2 \\
\begin{array}{c}
C_7 \\
C_8 \\
C_1 \\
C_2
\end{array}
\left(
\begin{array}{cccc}
0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0
\end{array}
\right)
\end{array}
$$

The combined directed graph and combined overlap block NCM of equal sizes is as follows:

Figure 5
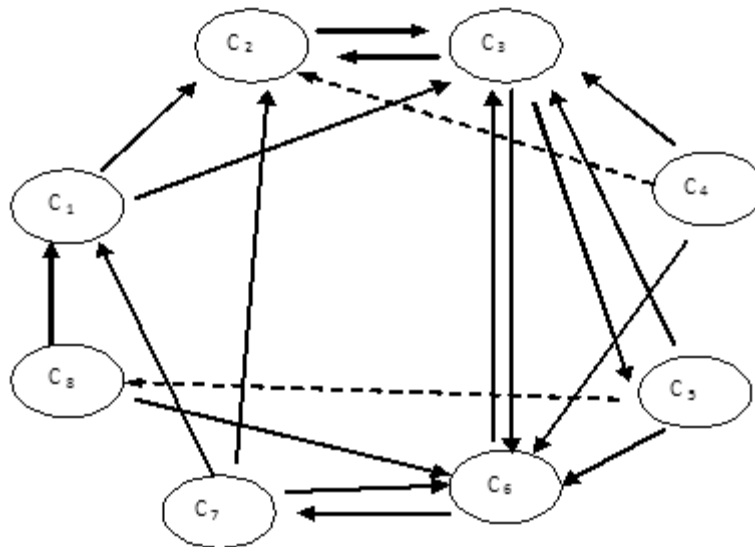
$$
A = \begin{array}{c} \\ C_1 \\ C_2 \\ C_3 \\ C_4 \\ C_5 \\ C_6 \\ C_7 \\ C_8 \end{array} \begin{pmatrix} C_1 & C_2 & C_3 & C_4 & C_5 & C_6 & C_7 & C_8 \\ 0 & 2 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & I & 2 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 2 & 0 & I \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}
$$

Now using the matrix A of the Combined overlap block NCM., we determine the hidden pattern. Suppose the concept C1 is in the ON state and all the nodes are in the OFF state. Let the initial input vector be X = (1 0 0 0 0 0 0 0), where lack of commitment towards the marriage is taken as the ON state and all other nodes are in the OFF state.

The effect of X on the dynamical system A is given by:

$XA = (0\ 2\ 1\ 0\ 0\ 0\ 0\ 0\ )$

$\hookrightarrow (1\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ ) = X_1$ (say)

$X_1 A = (0\ 3\ 2\ 0\ 1\ 1\ 0\ 0)$

$\hookrightarrow (1\ 1\ 1\ 0\ 1\ 1\ 0\ 0\ ) = X_2$ (say)

$X_2 A = (0\ 3\ 4\ 0\ 1\ 3\ 1\ I)$

$\hookrightarrow (1\ 1\ 1\ 0\ 1\ 1\ 1\ I\ ) = X_3$ (say)

$X_3 A = (1 +I\ 4\ 4\ 0\ 1\ 4+I\ 1\ I)$

$\hookrightarrow (1\ 1\ 1\ 0\ 1\ 1\ 1\ I\ ) = X_3$

(where $\hookrightarrow$ denotes the resultant vector after thresholding and updating) . X_3 is the hidden pattern, which is the fixed point.

Conclusion

While analyzing NCM, when C_1 , "Lack of commitment towards marriage ", is in the ON state, all the concepts C1, C2, C3, C5, C6, C7 are in the ON state , C4 is in the OFF state and C8 becomes indeterminate. ie. When there is Lack of commitment towards the marriage, there will be abandonment, torture due to physical, sexual, and mental Abuses, sexual incompatibility , mental illness, illegal affairs and also there may be lack of family counseling etc. Therefore " Lack of Commitment towards marriage" is the major reason for Divorce. Likewise one can work with one node or several nodes in the ON state and work with the problem.

References

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