Int. J. of Mathematical Sciences and Applications,
Vol. 1, No. 3, September 2011

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APPLICATION OF NEUTROSOPHIC COGNITIVE MAPS IN THE ANALYSIS OF THE PROBLEMS FACED BY GIRL STUDENTS WHO GOT MARRIED DURING THE PERIOD OF STUDY

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Abstract

In this article, the authors attempted to analyse the problems faced by girl students who got married during the period of study using Neutrosophic Cognitive Maps based on the data collected from 100 such students pursuing Under Graduate and Post Graduate courses in Arts and Science colleges located in Coimbatore city, TamilNadu, India.

Introduction

India still continues to be one of the countries in Asia having the lowest female literacy rate. This low rate of female literacy not only has negative impact on the welfare of the women but also on the female welfare and the economy of the country as a whole. Thanks to the government's commitment to improve literacy rates, there has been progress in educational attainment of both sexes over the past several decades. As per 1971 censes only 22 per cent of women were literate but the rate improved to 39 per cent (1991 census) (Register General and Census Commissioner (RGCC), 1993) . Despite such growth in female literacy rates, there are many barriers to female education in India. Poverty, lack of adequate educational institutions, illiterate parents and early marriage are some of such barriers.

The authors attempted to analyse the problems faced by girl students who got married during the period of study using Neutrosophic Cognitive Maps based on the data collected from 100 such students pursuing Under Graduate and Post Graduate courses in Arts and Science colleges located in Coimbatore city, TamilNadu, India.

Basic Definitions [2]

A **Neutrosophic Cognitive Map (NCM)** is a neutrosophic directed graph (A neutrosophic directed graph is a directed graph in which atleast one edge is an indeterminancy denoted by dotted lines) with concepts like policies, events etc., as nodes and causalities or indeterminates as edges. It represents the causal relationship between concepts.

Let $C_1, C_2, \ldots\ldots, C_n$ denote n nodes, further each node is a neutrosophic vector from neutrosophic vector space V. So a node C_i will be represented by $(x_1, x_2, \ldots, x_n)$ where x_k's are zero or one or I (I is the indeterminate) and $x_k = 1$ means that the node C_k is in the on state and $x_k = 0$ means that the node is in the off state and $x_k = I$ means the nodes state is an indeterminate at that time or in that situation.

Let C_i and C_j denote the two nodes of the NCM. The directed edge from C_i to C_j denotes the causality of C_i on C_j called connections. Every edge in the NCM is weighted with a number in the set {-1, 0, 1, I}. Let e_{ij} be the weight of the directed edge C_iC_j , e_{ij} □ {-1, 0, 1, I}. $e_{ij} = 0$ if C_i does not have any effect on C_j , $e_{ij} = 1$ if increase (or decrease) in C_i causes increase (or decrease) in C_j , $e_{ij} = -1$ if increase (or decrease) in C_i causes decrease (or increase) in C_j. $e_{ij} = I$ if the relation or effect of C_i on C_j is an indeterminate.

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

Let $C_1, C_2, \ldots, C_n$ 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_iC_j, where e_{ij} □ {- 1, 0, 1, I}. N(E) is called the **neutrosophic adjacency matrix** of the NCM.

Let $C_1, C_2, \ldots, C_n$ be the nodes of the NCM. Let A = ($a_1, a_2, \ldots, a_n$) where a_i □ { 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.

Let $C_1, C_2, \ldots, C_n$ be the nodes of the FCM. Let $\overrightarrow{C_1C_2}$, $\overrightarrow{C_2C_3}$, $\overrightarrow{C_3C_4}$, ... ,$\overrightarrow{C_iC_j}$ be the edges of the NCM. Then the edges form a directed cycle. An NCM is said to be **cyclic** if it possesses a directed cyclic. An NCM is said to be **acyclic** if it does not possess any directed cycle.

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 the NCM is called a **dynamical system**.

Let $\overrightarrow{C_1C_2}$, $\overrightarrow{C_2C_3}$, $\overrightarrow{C_3C_4}$,...,$\overrightarrow{C_{n-1}C_n}$ be 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.**

If the equilibrium state of a dynamical system is a unique state vector, then it is called a fixed point. Consider the NCM with $C_1, C_2,\ldots, C_n$ 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,…, 1) this neutrosophic state vector (1,0,…, 0, 1) is called the **fixed point**.

If the NCM settles with a neutrosophic state vector repeating in the form

$A_1 \rightarrow A_2 \rightarrow \ldots \rightarrow A_i \rightarrow A_1$, then this equilibrium is called a **limit cycle** of the NCM.

Methods of determining the hidden pattern:

Let $C_1, C_2,\ldots, C_n$ be the nodes of an NCM, 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 $A_1 = (1, 0, 0,\ldots, 0)$, the data should pass through the neutrosophic matrix N(E), this is done by multiplying A_1 by the matrix N(E). Let $A_1N(E) = (a_1, a_2,\ldots,a_n)$ with the threshold operation that is by replacing a_i by 1 if $a_i \geq k$ and a_i by 0 if $a_i < k$ (k – a suitable positive integer) and a_i by I if a_i is not a 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 $A_1N(E) \rightarrow A_2$ then consider $A_2N(E)$ and repeat the same procedure. This procedure is repeated till we get a limit cycle or a fixed point.

Application Of Neutrosophic Cognitive Maps

In order to analyse the problems faced by girl students who got married during the period of study, data were collected from 100 such students pursuing Under Graduate and Post Graduate courses in Arts and Science colleges located in Coimbatore city, TamilNadu, India. Based on the opinion given by the majority of respondents , the following factors were identified:

M_1 - Changes on routine study hours

M_2 – Changes in family environment

M_3 – Changes in conveyance and travel time

M_4 – Changes in health condition

M_5 – Changes in economic condition

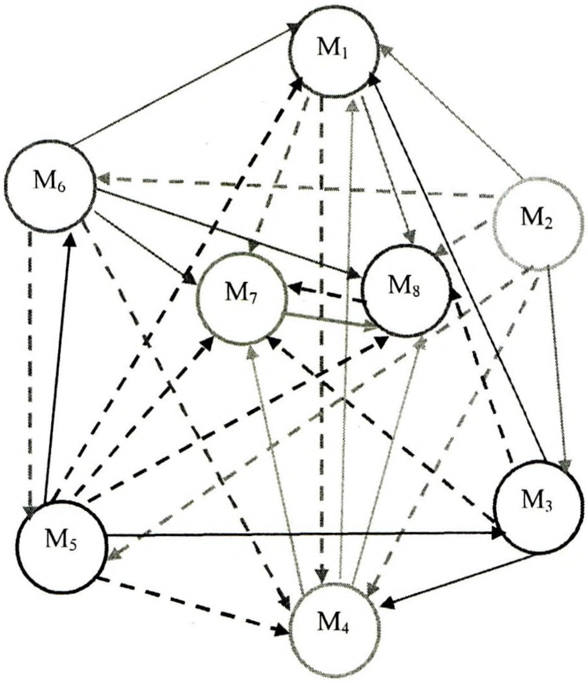
M_6 – Burdened with family responsibility

M_7– Lack of concentration in studies

M_8 – Changes in academic performance

Based on the opinion about the existence of causal relationship between two nodes, weightage was assigned. When majority of the respondents opined the existence of casual relationship, weightage between two nodes was assigned as 1, otherwise the weightage was assigned as 0. In case, if the majority of the respondents were uncertain about the existence (or) non existence of casual relationship between two nodes, then weightage was assigned as I, which denotes "Indeterminant".

The Neutrosophic Cognitive Maps and the NCM adjacency matrix are presented below:



N =

	M_1	M_2	M_3	M_4	M_5	M_6	M_7	M_8
M_1	0	0	0	I	0	0	I	1
M_2	1	0	1	I	I	I	I	I
M_3	1	0	0	1	0	0	I	I
M_4	1	0	0	0	0	0	1	1
M_5	I	0	1	I	0	1	I	I
M_6	1	0	0	I	I	0	1	1
M_7	0	0	0	0	0	0	0	1
M_8	0	0	0	0	0	0	I	0

Here we preferred to study the effect of the problem "Changes in family environment" on the other factors. For this purpose, we study the effect of the state vector X= (0 1 0 0 0 0 0 0) on the dynamical system N.

$XN = (1\ 0\ 1\ I\ I\ I\ I\ I)$

after updating and thresholding we get,

$XN = (1\ 1\ 1\ I\ I\ I\ I\ I) = X_1$ (say)

$X_1N = (1\ 0\ 1\ 1\ I\ I\ 2I\ 1)$

after updating and thresholding we get,

$X_1N = (1\ 1\ 1\ 1\ I\ I\ I\ 1) = X_2$ (say)

$X_2N = (1\ 0\ 1\ 1\ I\ I\ 1\ 1)$

after updating and thresholding we get,

$X_2N = (1\ 1\ 1\ 1\ I\ I\ 1\ 1) = X_3$ (say)

$X_3N = (1\ 0\ 1\ 1\ I\ I\ 1\ 1)$

after updating and thresholding we get,

$X_3N = (1\ 1\ 1\ 1\ I\ I\ 1\ 1) = X_4$ (say)

which is a fixed point.

From the above it is inferred that the factor ""Changes in family environment" has a direct effect on other factors "Changes on routine study hours" , "Changes in conveyance and travel time" , "Changes in health condition", "Lack of concentration in studies" and "Changes in academic performance" while "Changes in economic condition" and " Burdened with family responsibility" are an indeterminate concept to it. Likewise it is possible to assess the effect of each factor on the other factors.

Conclusion:

The concept of Neutrosophic Cognitive Map can be used to find concrete solutions to various issues. As it gives a better insight into the mindset of the target group, the policy makers are well equipped to frame and modify policies that facilitate desired outcomes. Applications of Neutrosophic Cognitive Maps gained momentum, in the recent past, in the fields of sociology, psychology, consumer behavior, marketing, banking, insurance and so on.

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