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A Study on the Impact of Violent Video-Games playing among Children in Chennai using Neutrosophic Cognitive Maps (NCMs)

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Abstract— In this paper we analyzed, the impact of violent video-games playing among children in Chennai and find out its solution using Neutrosophic Cognitive Maps(NCMs), which is the generalization of Fuzzy Cognitive Maps(FCMs) defined by W.B. Vasantha Kandasamy and Florentine Smarandache. This paper has a five section. First section gives the information about development of Fuzzy Cognitive Maps and Neutrosophic Cognitive Map. Second section gives the preliminaries of FCMs and NCMs. In section three, we give the description of the problem. Final section gives the conclusion based on our study.

Index Terms— Children, Fuzzy Cognitive Maps (FCMs), Neutrosophic Cognitive Maps (NCMs), Violent Video-Games.

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 [7] 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. In this paper we use the Neutrosophic Cognitive Maps (NCMs) created by Florentine Smarandache [8], [9] which is an extension/combination of the Fuzzy Cognitive Maps (FCMs) in which inderminacy is included. It has also become very essential that the notation of Neutrosophic logic plays a vital role in several of the real world problems like law, medicine, industry, finance, IT, stocks and share etc. playing violent-video game, is a social problem. Youth spend and average of greater than 7 hours/day using media and majority of them have access to a video-game console. Playing violent video-games increases aggressive behaviors, cognition, emotions, physiological arousal and decrease the pro-social behaviors, researchers say. Children are more likely to initiate the actions of a character with whom they identify. With this background information a study was conducted to assess the effect of playing violent video games children in Chennai. Moreover the data is an unsupervised one and also there is uncertainty in the concepts. Hence Fuzzy tool alone has the capacity to analyze these concepts. Hence it is chosen here.

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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

A NCMs is a directed graph with concepts like policies, events etc, as nodes and causalities as edges. It represents causal relationship between concepts.

2.2 Definition

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

2.3 Definition

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

2.4 Definition

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, $e_{ij} \in$ {-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 decreases) 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.

2.5 Definition

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 $e_{ij} \in$ {-1, 0, 1, *I*}. N(E) is called the neutrosophic adjacency matrix of the NCM.

2.6 Definition

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

2.7 Definition

Let $C_1, C_2,\ldots, C_n$ be the nodes of and FCM. Let $\overrightarrow{C_1C_2}, \overrightarrow{C_2C_3}, \overrightarrow{C_3C_4}, \ldots, \overrightarrow{C_iC_j}$ 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.

2.8 Definition

An NCM with cycles is said to have a feedback.

2.9 Definition

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

2.10 Definition

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

2.11 Definition

If the equilibrium state of a dynamical system is a unique state vector, then it is called a fixed point. Consider a 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, 0,…, 1) this neutrosophic stage vector (1, 0, …, 0, 1) is called fixed point.

2.12 Definition

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

2.13 Definition

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

3 Method 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 $A_1 = (1, 0,\ldots, 0)$, 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 $a_i > k$ and a_i by 0 if $a_i < k$ (k-a is a suitable positive integer) and a_i by I if a_i is not 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 $A_1N(E) \to A_2$ then consider $A_2N(E)$ and repeat the same procedure. This procedure is repeated till we get a limit cycle or a fixed point.

4 Concepts of the Problem

A study to assess the impact of violent video-games playing among children in the age group of 13-18 years in Chennai. For that, using linguistic questionnaire and the expert's opinion we have taken the following nine concepts $\{C_1, C_2,\ldots, C_9\}$.

The following concepts are taken as the main nodes of our problem.

C_1 – Aggressive behavior
C_2 – Adamant character
C_3 – Lack of performance in the academics
C_4 – Loss of time/energy/wastage of money
C_5 – Stealing the money
C_6 – Lowered immunity feeling sick always
C_7 - Frustration
C_8 – Developing self-confidence
C_9 – Insomnia (inability to sleep)

Now we give the directed graph as well as the neutrosophic graph of two graphs of two experts in the following Fig. 1 and Fig.2

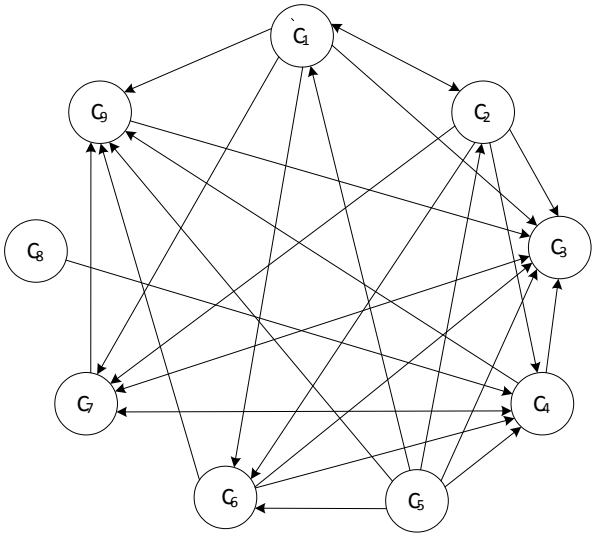

Fig. 1

Fig.1 gives the directed graph with $C_1, C_2, \ldots, C_9$ as nodes and Fig.2 gives the neutrosophic directed graph with the same nodes.

The connection matrix E related to the graph in Fig.1 is given below:

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

According to this expert no connection however exists between Loss of time and energy/wastage of money and Developing self-confidence.

Now we reformulate a different format of the questionnaire where we permit the expert to give answers like the relation between certain nodes is indeterminable or not known. Now based on the expert's opinion also about the notion of indeterminacy we obtain the following neutrosophic directed graph:

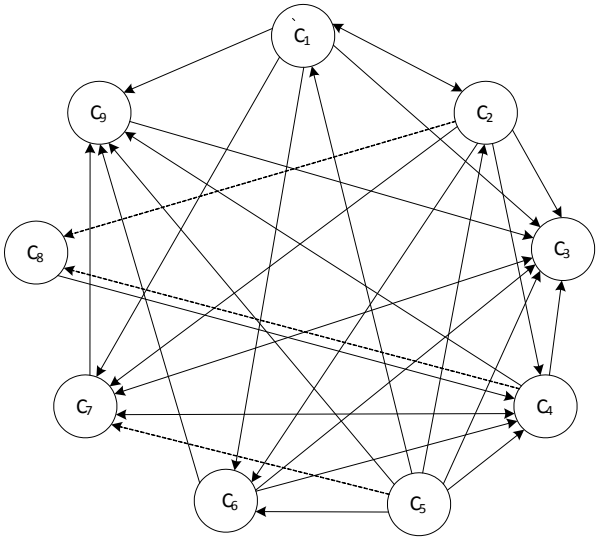

Fig. 2

The corresponding neutrosophic adjacency matrix N(E) related to the neutrosophic directed graph is given below:

$$N(E) = \begin{bmatrix} 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 & 1 & 1 & I & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & I & 1 \\ 1 & 1 & 1 & 1 & 0 & 1 & 0 & I & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Suppose we take the state vector $A_1 = (1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$. We will we the effect on E and N(E).

$A_1E = (0\ 1\ 1\ 0\ 0\ 1\ 1\ 0\ 1) \hookrightarrow A_2$

$A_2E = (1\ 0\ 4\ 4\ 0\ 1\ 2\ 0\ 2)$

$\hookrightarrow (1\ 0\ 1\ 1\ 0\ 1\ 1\ 0\ 1) = A_3$

$A_3E = (0\ 1\ 5\ 3\ 0\ 1\ 3\ 0\ 4)$

$\hookrightarrow (0\ 1\ 1\ 1\ 0\ 1\ 1\ 0\ 1) = A_4$

$A_4E = (1\ 0\ 5\ 5\ 0\ 1\ 3\ 0\ 3)$

$\hookrightarrow (1\ 0\ 1\ 1\ 0\ 1\ 1\ 0\ 1) = A_5 = A_3$

Thus the playing violent video games among children increases aggressive behavior, lack of performance in the academics, loss of time/ energy/wastage of money, lowered immunity feeling sick always, frustration and insomnia (inability to sleep) but developing self-confidence is absent in such a scenario. The state vector gives the point.

Now we find the effect of $A_1 = (1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$ on N(E).

$A_1N(E) = (0\ 1\ 1\ 0\ 0\ 1\ 1\ 0\ 1) \hookrightarrow A_2$

$A_2N(E) = (1\ 0\ 4\ 4\ 0\ 1\ 2\ I\ 2)$

$\hookrightarrow (1\ 0\ 1\ 1\ 0\ 1\ 1\ I\ 1) = A_3$

$A_3N(E) = (0\ 1\ 5\ 3+I\ 0\ 1\ 3\ I\ 4)$

$\hookrightarrow (0\ 1\ 1\ 1\ 0\ 1\ 1\ I\ 1) = A_4$

$A_4N(E) = (1\ 0\ 5\ 5\ 0\ 1\ 3\ I\ 3)$

$\hookrightarrow (1\ 0\ 1\ 1\ 0\ 1\ 1\ I\ 1) = A_5 = A_3$

Thus $A_5 = (1\ 0\ 1\ 1\ 0\ 1\ 1\ I\ 1)$, according to this expert playing violent video games among children certainly increases aggressive behavior, lack of performance in the academics and other factors are indeterminate to him. This mainly gives the indeterminate relating to loss of time and energy/wastage of money and developing self-confidence. Aggressive behavior, lack of performance in the academics, loss of time/energy/wastage of money, lowered immunity feeling sick always, frustration and insomnia (inability to sleep) become ON state.

5 CONCLUSION

While analyzing FCM and NCM, in FCM the concepts C_2, C_5 and C_8 is in the OFF state, the other concepts, C_1, C_3, C_4, C_7 and C_9 are ON State. Where as in NCM the concept C_2, C_5 are OFF

states. The other concepts C_1, C_3, C_4, C_7 and C_9 are ON state but C_8 is in the indeterminate position. However the results by FCM gives as if there is no effect by Loss of time and energy/wastage of money and developing self-confidence but by the results of NCM gives the effect between them.

1. Children spend a great deal of time playing violent video-games. It is important to note that boys, who consume more media, including video games, than girls, are part of increasing trend of low academic performance.
2. The time at such a tender age should not be wasted by simply playing violent video games and it should be used effectively for constructive learning so as to develop into healthy citizens.
3. An awareness programme should be conducted to inform the parents, children and teachers about the effects of playing violent video games.
4. An appropriate regulatory mechanism should be created to control the sale and playing of violent video games by the children.

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