International Journal of Mathematical Archive-8(10), 2017, 184-189
Available online through www.ijma.info ISSN 2229 – 5046

ANALYSIS OF EFFECT OF SMART PHONE ON HUMAN BODY USING COMBINED DISJOINT BLOCK FUZZY COGNITIVE MAPS (CDBFCM)

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(Received On: 19-07-17; Revised & Accepted On: 10-10-17)

ABSTRACT

There is no doubt that our technology has evolved dramatically compared to how it was in the 19th century. Given all the advancements we have seen in recent history, we seem to be enjoying the luxury of having smart phones, the most. Smart phones have changed how we live. But, as our technology improves the way we live, our health may be deteriorating. Here are some disturbing facts about how your smart phone affects your brain and body health without your knowledge. In this paper the major effects of smart phone on human body is analyzed 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 large in number. In this paper we analyzed the problems and find out the major effects of smart phone on human body using neutroscophic tool. This paper has five sections. First section gives the information about the development of Fuzzy Cognitive Maps and about the effects of smart phone on human body. Second section gives the preliminaries of Fuzzy Cognitive Maps and Combined Disjoint Block Fuzzy Cognitive Maps. In section three we explain the 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.

Key words— *Combined disjoint Fuzzy Cognitive Maps, Smart phone, human body.*

1. INTRODUCTION

In 1965L.A.Zadeh has introduced a mathematical model called Fuzzy Cognitive Maps. After a decade in the year 1976, Political scientist R.Axelord[9] used this Fuzzy model to study decision making in social and political systems. Then B.Kosko [3], [4], [5] enhanced the power of cognitive maps considering fuzzy values for the concepts of the cognitive maps 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 behaviour of any system. It is a very convenient simple and powerful tool, which is used in numerous fields such as social, economical, Medical etc. We all love our mobile phones, and they have certainly made our lives easier in a number of ways. From online research to Google maps to social media, they help us with everything and an entire world seems to fit-in this 5-inch device. However, helpful as they may be, there is no doubt that slowly we are getting addicted to their usage, leading to numerous physical, social as well as psychological issues. In this article we have listed 16 ways in which excessive usage of phones can affect our life.

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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 casual relations between classes.

2.1 Definition: When the nodes of the FCM are fuzzy sets then they are called fuzzy nodes.

2.2 Definition: FCMs with edge weights or casualities 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 casualities as edges. It represents casual relationships between concepts.

2.4 Definition: Consider the nodes/concepts C_1, C_2,…, C_n of the FCM. Sup-pose 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 $C_1, C_2, \dots, C_n$ *be the* be the nodes of an FCM. A= $(a_1, a_2, \dots, a_n)$ 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 $C_1, C_2, \dots, C_n$ *be the* be the nodes of an FCM. Let $\overline{C_1C_2}$, $\overline{C_2C_3}$, $\overline{C_3C_4}$,…,$\overline{C_iC_j}$ be the edges of the FCM($i \neq j$). 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 possesses 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 casual relations flow through a cycle in a revolutionary way, the FCM is called a dynamical system.

2.9 Definition: Let $\overline{C_1C_2}$, $\overline{C_2C_3}$, $\overline{C_3C_4}$,…,$\overline{C_{n-1}C_n}$ be a cycle. When C_i is switched on and if the casuality 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.

2.10 Definition: If the equilibrium state of a dynamical system is a unique state vector, then it is called a fixed point. Consider an FCM with $\{C_1, C_2, \dots, C_n\}$ 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$(1,0,0, \dots 0)$*is* called fixed point.

2.11 Definition: If the FCM settles down with a state vector repeating in the form $A_1 \rightarrow A_2 \rightarrow \dots \rightarrow A_i \rightarrow A_1$ 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 $E_1, E_2, \dots, E_p$ be the adjacency matrices of the FCMs with nodes $C_1, C_2, \dots, C_n$ then the combined FCM is got by adding all the adjacency matrices $E_1, E_2, \dots, E_p$. We denote the combined FCM adjacency matrix by E =$E_1 + E_2 + \cdots + E_p$.

2.13 Definition: Let $C_1, C_2, \dots, C_n$ be n distinct attributes of a problem n very large and a non prime. If we divide n in to k equal classes i.e., k/n = t which are disjoint and if we find the directed graph of each of these 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×n matrix. This n×n connection matrix forms the combined disjoint block FCM of unequal classes/size.

2.14 Definition: Suppose A = $(a_1, a_2, \dots, a_n)$ is a vector which is passed in to a dynamical system E. Then AE = $(a_1', a_2', \dots, a_n')$ after thresholding and updating the vector suppose we get $(b_1, b_2, \dots, b_n)$, we denote that by $(a_1', a_2', \dots, a_n')$ ↰ $(b_1, b_2, \dots, b_n)$.Thus the symbol ↰ means the resultant vector has been thresholded and updated. FCMs have several advantages as well as some disadvantages. The main advantage of this method is simple. It functions on expert's opinion. When the data happens to be an unsupervised one the FCM becomes 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 opinions. At the same time the disadvantages of

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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 $E_1, E_2, \dots, E_k$ 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 $C_1, C_2, \dots, C_n$ 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_1 by the matrix E. Let A_1E = $(a_1, a_2, \dots., a_n)$ 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 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_1E ┐ 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

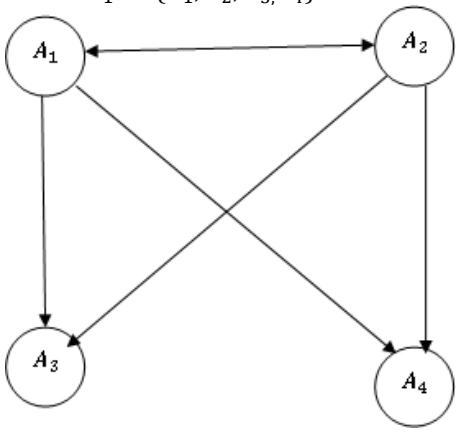
Using the linguistic questionnaire and the expert's opinion we have taken the following sixteen attributes $\{A_1, A_2, \dots, A_{15}, A_{16}\}$.

A_1 - A serious addiction
A_2 - Withdrawal is painful
A_3 - Back problems
A_4 - Radiation
A_5 - Anxiety and depression
A_6 - Stress
A_7 - Weight management
A_8 - Disrupted sleep
A_9 - Germs and infections
A_{10} - Attention span
A_{11} - Effect on relationships
A_{12} - Indirect injuries
A_{13} - Text claw
A_{14} - Nerve damage
A_{15} - Hearing
A_{16} - Eye sight

These 16 attributes are divided into 4 classes C_1, C_2, C_3, c_4 with 4 in each class.

Let $C_1 = \{A_1, A_2, A_3, A_4\}$
$C_2 = \{A_5, A_6, A_7, A_8\}$
$C_3 = \{A_9, A_{10}, A_{11}, A_{12}\}$
$C_4 = \{A_{13}, A_{14}, A_{15}, A_{16}\}$

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 $C_1 = \{A_1, A_2, A_3, A_4\}$ is in the form of the directed graph.

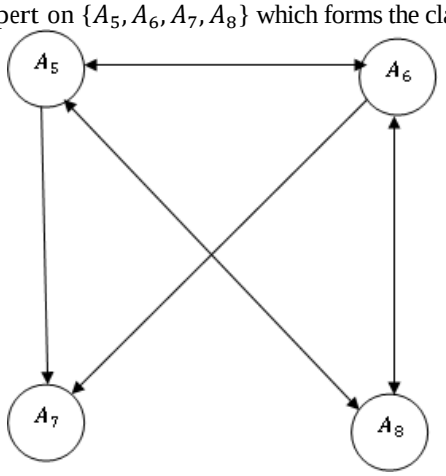


According to this expert the attribute a serious addiction is interrelated with withdrawal is painful. The attribute a serious addiction is the reason for back problems and radiation. The attribute withdrawal is painful is the reason for back problems and radiation.

The related connection matrix M_1 is given below.

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

The directed graph is given by the expert on $\{A_5, A_6, A_7, A_8\}$ which forms the class C_2 . .

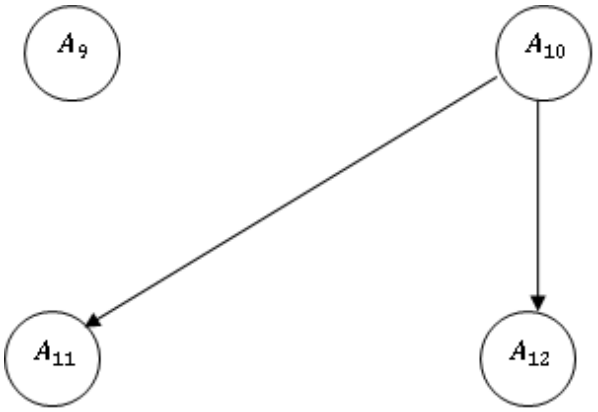


According to this expert the attribute anxiety and depression, stress are interrelated. The attribute anxiety and depression is the reason for weight management. The attributes anxiety and depression, disrupted sleepare interrelated. The attributes stress and disrupted sleep are interrelated. The attribute stress is the reason for weight management.

The related connection matrix M_2 is given below.

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

The directed graph is given by the expert on $\{A_9, A_{10}, A_{11}, A_{12}\}$ which forms the class C_3

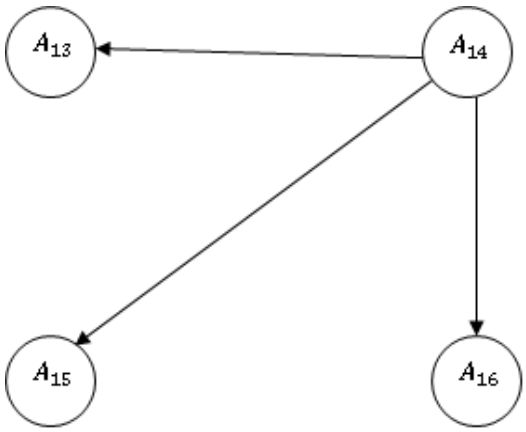


According to this expert the attribute attention span is the reason for effect on relationships and indirect injuries.

The related connection matrix M_3 is given below.

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

The directed graph is given by the expert on $\{A_{13}, A_{14}, A_{15}, A_{16}\}$ which forms the class C_4.



According to this expert the attribute nerve damage is the reason for text claw, hearing and eye sight.

The related connection matrix M_4 is given below.

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

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

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

Suppose we consider the on state of the attribute a serious addiction and all other states are off the effect of Y = (1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0) on the CDBFCM is given by

$YM \urcorner (0\ 1\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) = Y_1$ (say)

$Y_1 M \urcorner (1\ 0\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) = Y_2$ (say)

$Y_2 M \urcorner (0\ 1\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) = Y_3 = Y_1$

Y_1 is a fixed point of the dynamical system. When the state A_1 is on withdrawal is painful, back problems and radiation effects human body.

Suppose we consider the on state of the attributes a serious addiction, back problems, radiation, attention span, text claw and all other nodes are in off state. Now we study the effect of the dynamical system M.

Let S = (1 0 1 1 0 0 0 0 0 1 0 0 1 0 0 0) be the state vector depicting the on state vector S in to the dynamical system M. .

$SM \urcorner (0\ 1\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 0\ 0\ 0) = S_1$ (say)

$S_1 M \urcorner (1\ 0\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) = S_2$ (say)

$S_2 M \urcorner (0\ 1\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) = S_3$ (say)

$S_3 M \urcorner (1\ 0\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) = S_4 = S_2$

Then S_2 is a fixed point of the dynamical system. Thus the attributes $A_1, A_3, A_4, A_{10}, A_{13}$ are in the on states and the attributes withdrawal is painful, anxiety and depression ,stress, weight management, disrupted sleep, germs and infections, effect on relationships, indirect injuries, nerve damage, hearing, eye sight are in the off state all other states become on.

5. CONCLUSION

We investigated the effects of smart phone on human body using CDBFCM model. The limit point of the dynamical system reveals that the attributes A_1, A_3, A_4 are the main effects of smart phone on human body. This means a serious addiction, back problems, radiation are the main effects of smart phone on human body and because of these their health is getting effected.

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Source of support: Nil, Conflict of interest: None Declared.