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A study on symptoms of stress on college students using combined disjoint block fuzzy cognitive maps (CDBFCM)

Research Article

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Abstract: Going through college is stressful for everybody. Caused by many reasons, the stress is present whether one is in their first year of college or their last. However, most seniors have an easier time dealing with stress because they have experience handling it. Most of the reasons for so much stress fall into one of three categories: academic stress, that is, anything to do with studying for classes, financial stress, which has to do with paying for school, and personal stress, which is stress associated with personal problems in college. College students experience many effects of stress and depression. They are Physical symptoms, Emotional symptoms, Cognitive symptoms. In this paper the main symptoms of stress on college students 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 main symptoms of stress using neutrosophic tool. This paper has five sections. First section gives the information about the development of Fuzzy Cognitive Maps and about the symptoms of stress on college students. 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.

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Keywords: Combined disjoint • Fuzzy cognitive maps • Stress • Symptoms.

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 [4] used this Fuzzy model to study decision making in social and political systems. Then Kosko [1], Kosko [2] Kosko [3] 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 behavior of any system. It is a very convenient simple and powerful tool, which is used in numerous fields such as social, economical, Medical etc. Stress, a common problem is one of the leading causes to effect college students. Going through college is stressful for everybody. Caused by many reasons, the stress is present whether one is in their first year of college or their last. However, most seniors have an easier time dealing with stress because they have experience handling it. Most of the reasons for so much stress fall into one of three categories: academic stress, that is, anything todo with studying for classes, financial stress, which has to do with paying for College, and personal stress, which is stress associated with personal problems in college. When most students stress over college it is usually because of something to do with academics. The purpose of study is to identify the risk groups. In this paper, various symptoms of stress are discussed and finally the major symptoms are identified.

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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_i,C_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 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,Ě, n.

2.6. Definition

Let $C_1,C_2,.....C_n$ 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≠ 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,Ě,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 $C_1,C_2,.....C_n$ 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 i.e., in the state vector remains as (1,0,0,....0) 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 in to k equal classes i.e., $\frac{k}{n}$=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 x n matrix. This n x n connection matrix forms the combined disjoint the large and a non prime. If we divide n into k equal classes i.e., $\frac{k}{n}$=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 unequal classes/size.

2.14. Definition

Suppose $A = (a_1, a_2, a_3, ...a_n)$ is a vector which is passed in to a dynamical system E. Then $AE = (a'_1, a'_2, a'_3, ...a'_n)$ after thresholding and updating the vector suppose we get $(b_1, b_2, ...b_n)$, we denote that by $(a_1, a_2, ...a_n)$↰$(b_1, b_2, ...b_n)$.
Thus the symbol ↰ means the resultant vector has been thresholded and updated.

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 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,Ě.,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,.....a_n) with the threshold operation that is by replacing by a_i 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_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.

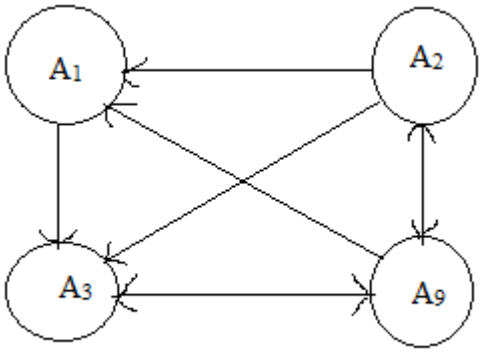
4. Concepts of the problem

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

A_1 - Increases heart rate
A_2 - Blood pressure
A_3 - Headache
A_4 - Indigestion
A_5 - Lack of concentration
A_6 - Reduced performance
A_7 - Body dimorphic disorder
A_8 - Depression
A_9 - Anger
A_{10} - Fear and anxiety
A_{11} - Eating disorder
A_{12} - Substance abuse A_{13} - Difficulty sleeping
A_{14} - Fatigue
A_{15} - Mood swings
A_{16} - Forgetfulness

These 16 attributes are divided into 4 classes C_1,C_2,C_3, C_4, with 4 in each class.
Let $C_1 = [A_1, A_2, A_3, A_9]$
$C_2 = [A_4, A_7, A_{11}, A_{14}]$
$C_3 = [A_5, A_6, A_8, A_{16}]$
$C_4 = [A_{10}, A_{12}, A_{13}, A_{15}]$
Now we take the expert opinion for each of these classes and take the matrix associated with the combined disjoint

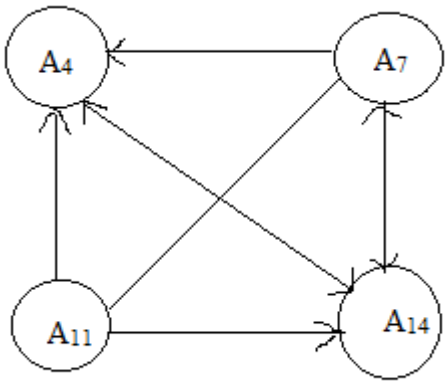
block FCMs. The experts opinion for the class $C_1 = [A_1, A_2, A_3, A_9]$ is in the form of the directed graph.



According to this expert the attribute blood pressure is interrelated with anger. The attribute headache is interrelated with anger. The attribute blood pressure is related to increased heart rate and headache. The attribute increased heart rate is related to headache. The attribute anger is the reason to increased heart rate. The related connection matrix M_1 is given below.

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

The directed graph is given by the expert on $[A_4, A_7, A_{11}, A_{14}]$ which forms the class C_2.

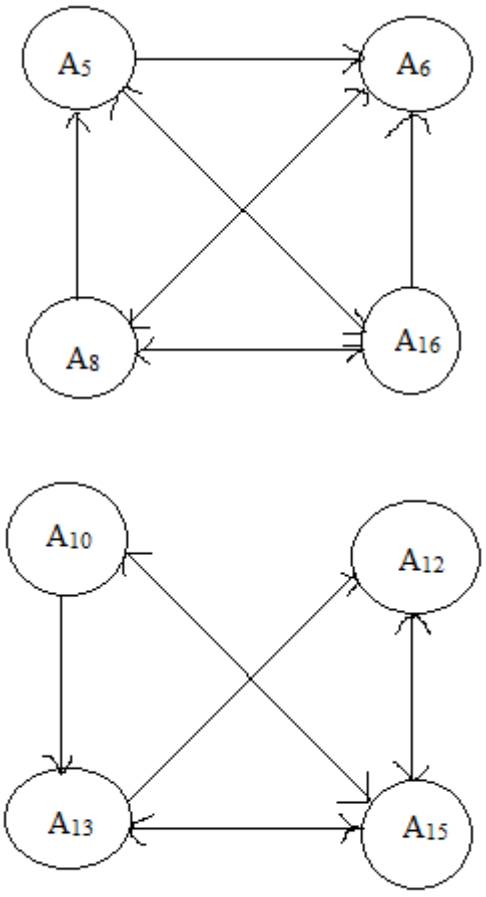


According to this expert the attribute indigestion is interrelated with fatigue. Also the attribute body dimorphic disorder is interrelated with fatigue. The attribute body dimorphic disorder is the reason for indigestion. The attribute eating disorder is the reason for body dimorphic disorder, indigestion and fatigue.

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

The directed graph is given by the expert on $[A_5, A_6, A_8, A_{16}]$ which forms the class C_3.
According to this expert the attribute lack of concentration is interrelated with forgetfulness. The attribute depression is interrelated with forgetfulness. The attribute reduced performance is interrelated with depression. Also the attributes lack of concentration and forgetfulness are the reasons for reduced performance. The attribute depression is the reason for lack of concentration. The related connection matrix is given below

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



The directed graph is given by the expert on $[A_{10}, A_{12}, A_{13}, A_{15}]$ which forms the class C_4.
According to this expert the attributes fear and anxiety, substance abuse and difficulty sleeping are interrelated with mood swings. The attribute fear and anxiety is the reason for difficulty sleeping. Also the attribute difficulty sleeping is the reason for substance abtuse. The related connection matrix is given below.

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

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

$$L = \begin{pmatrix}
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

Suppose we consider the on state of the attribute increased heart rate and all other states are off the effect of X = (1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0) on the CDBFCM is given by

XL $\urcorner$ (1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0) = X_1 (say)

X_1L $\urcorner$ (1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0) = X_2 (say)

X_2L $\urcorner$ (1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0) = X_3 (say)

X_3L $\urcorner$ (1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0) = X_4=X_2 (say)

X_2 is a fixed point of the dynamical system. When the state A_1 is on they felt anger which leads to stress. Suppose we consider the on state of the attributes increased heart rate, blood pressure and anger and all other nodes are in off state. Now we study the effect of the dynamical system L. Let T = (1 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0) be the state vector depicting the on state vector T in to the dynamical system L.

T L $\urcorner$ (1 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0) = T_1 = T

Then T is a fixed point of the dynamical system. Thus the attributes A_1, A_2, A_9 are in the on states and the attributes, then the attributes headache, indigestion, lack of concentration, reduced performance, body dimorphic disorder, depression, fear and anxiety, eating disorder, substance abtuse, difficulty sleeping, fatigue, mood swings and forgetfulness are in the off state and all other attributes become on.

5. Conclusion

We analyzed the symptoms of stress on college students using CDBFCM model. The limit point of the dynamical system reveals that the attributes A_1, A_2, A_9 are the main symptoms of stress on college students. This means Increased heart rate, Blood pressure and Anger are the main symptoms of stress on college students and because of these symptoms their health and studies are getting effected.

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