A STUDY ON PROBLEMS FACED BY IT PROFESSIONALS THAT AFFECTS THEIR HEALTH USING COMBINED OVERLAP BLOCK FUZZY COGNITIVE MAPS (COBFCMs)

M.GEETHALAKSHMI, A.PRAVEEN PRAKASH

Abstract: In this Paper the Imperative reasons for the Problems faced by the IT Professionals using combined overlap block fuzzy cognitive maps (COBFCMS) defined by W.B Vasantha kandasamy is analyzed. Here we are defining the combined overlap block FCM's and it is effective only when the number of concepts can be grouped and are large in numbers. In this paper we analyzed the problems of IT Professionals are large in number. In this the problems of IT Professionals that affect their health are observed and we are finding the reasons for the occurrences of problems. This paper consist of six sections, first section gives the information about development of fuzzy cognitive maps, second section gives preliminaries of fuzzy cognitive maps, and combined overlap block fuzzy cognitive maps, in the third section, we explain about the problems of IT Professionals, in section four we explain the method of determining their hidden pattern, in section five, we give the concept of the problem, final section gives the conclusion based on our studies.

Keywords: COBFCMS, FCMS, Problems, State Vector.

Introduction: Political scientist R.Axelrod [1] introduced cognitive maps for representing social scientific knowledge and describing the methods that are used for decision making in social and political systems. Then B. Kosko [2, 3, and 4] enhanced the power of cognitive maps considering fuzzy values for the concepts of the cognitive map and fuzzy degrees of interrelationships between concepts. Uncertain casual knowledge is stored in fuzzy cognitive maps (FCMs). FCMs can successfully represent knowledge and human experience, introduce concept to represent the essential elements and cause the 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 economic and medical etc. Fuzzy Cognitive Maps (FCMs) are an efficient modeling method providing flexibility on the simulated system's design. They consist of nodes-concepts and weighted edges that connect the nodes and represent the cause and effect relationships among them. The purpose of study is to identify risk groups, problem is an event that apparently contradicts known scientific laws and is hence thought to be due to natural causes. Here we analyze the problems of IT Professionals that affects their health in their work place by identifying the hidden pattern and giving the final conclusion. Moreover the data is an unsupervised one and also there is uncertainty in the concepts. These concepts are chosen since fuzzy tools alone have the capacity to analyze these concepts.

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 worlds as a collection of classes and causal relation between classes.

Definition 1: An FCM is a directed graph with concepts like policies, events etc., as nodes and causalities as edges. It represents causal relationship between concepts.

Definition 2: When the nodes of the FCM are fuzzy sets then they are called as fuzzy nodes.

Definition 3: FCMs with edge weights or causalities from the set {-1, 0, 1} are simple.

Definition 4: The edges e_{ij} take values in the fuzzy causal interval [-1, 1].Here $e_{ij} = 0$ indicates no causality $e_{ij} > 0$ indicates causal increase C_j increases as C_i increases (Or C_j Decreases as C_i Decreases). $E < 0$ indicates causal decrease or negative causality. C Decreases as C increases (And or Cj increases as Ci Decreases). Simple FCMs have edge values in {-1, 0, 1}. Then if causality occurs, it occurs to a maximal positive or negative degree. Simple FCMs provide a quick first approximation to an expert stand or printed causal knowledge. If increase (Or decrease) in one concept leads to increase (or decrease) in another, then we give the value 1.If there exists to relation between the two concepts, the value 0 is given. If increase (or decrease) in one concept decreases (or increases) another, then we gives the value -1.Thus FCMs are described in this way. Consider the concepts $C_1 \ldots C_n$ of FCM.Suppose the directed graph is drawn using edge weight eij $\in$ {0, 1,-1}.The matrix E be defined by

$E = (e_{ij})$, Where the e_{ij} is the weight of the directed edge C_i, C_j. E is called the adjacency matrix of the 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.

Definition 5: Let $C_1, C_2 \ldots C_n$ be the nodes of an FCM. Let $A = (a_1, a_2 \ldots a_n)$, where $a_i \in \{0, 1\}$. A is called the instantaneous state vector and it denoted 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, where i = 1, 2… n.

Definition 6: Let $C_1, C_2 \ldots C_n$ be the nodes of an FCM. Let $C_1 C_2, C_2 C_3 \ldots C_i C_j$, 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 a cyclic if it does not possess any directed cycle.

Definition 7: An FCM with cycles is said to have a feedback.

Definition 8: Where there is a feedback in an FCM, i.e., When the causal relations flow through a cycle in a revolutionary way, The FCM is called a dynamical system.

Definition 9: Let C_1C_2, C_2C_3… C_iC_j, 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.

Definition 10: If the equilibrium state of a dynamical system is a unique state vector, then it is called a fixed point. Consider a FCM with C_1, C_2…C_n as nodes. For example let us start the dynamical system by switching on C. Let us assume that the FCM settles down with C_1 and C_n on, i.e. the state vector remains as (1, 0, 0… 0, 1). This state vector (1, 0, 0… 0, 1) is called the fixed point.

Definition 11: If the FCM settles down with a state vector repeating in the form

$A_1 \rightarrow A_2 \rightarrow$…….. $A_i \rightarrow A_1$.Then this equilibrium is called limit cycle.

Definition 12: Finite number of FCMs can be combined together to produce the joint effect of all the FCMs. Let E_1, E_2… E_p is adjacency matrices of the FCMs with nodes C_1, C_2…C_n. Then the combined FCM [5, 6, and 7] is got by adding all the adjacency matrices E_1…E_p. We denote the combined FCM adjacency matrix by $E = E_1 + E_2 + \ldots + E_p$.

Definition 13: Let P be the problem under investigation. Let $\{C_1, C_2 \ldots C_n\}$ be n concepts associated with p (n very large). Now divide the number of concepts $\{C_1, C_2 \ldots C_n\}$ into classes $S_{1 \ldots} S_t$ Where classes are such that

(1) $S_i \cap S_{i+1} \neq \Phi$ where (i = 1, 2… t-1)

(2) $\cup S_i = (c_1 \ldots c_n)$

(3) $(S_i) \neq S_j$ if $i \neq j$ in general.

Now we obtain the FCM associated with each of the classesS_1… S_t. We determines the relational matrix associated with each S. Using these matrices we obtain an n × n matrix. This n × n matrix is the matrix associated with the combined overlap block FCM (COBFCM) of blacks of same sizes.

Definition 14: Suppose A= $(a_{1 \ldots} a_n)$ is a vector which is passed into a dynamical system E. Then AE = $(a_1', a_2' \ldots, a_n')$. After thresholding and updating the vectors suppose we get $(b_1 \ldots b_n)$. We denote that by $(a_1', a_2' \ldots, a_n') \rightarrow (b_1, b_2 \ldots b_n)$. Thus the symbol → means that the resultant vector has been thresholded and updated. FCMs have several advantages as well as some disadvantages. The main advantage of this method it is simple. It functions on experts opinions. When the data happens to be an unsupervised one the

FCM comes 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 expert's opinions we can use combined FCMs with several experts' opinions. At the same time the disadvantage of the combined FCM is when the weightages are 1 and -1 for the same C_i C_j. We have the sum adding to zero thus at all times the connection matrices $E_1 \ldots E_k$ may not be comfortable for addition. This problem will be easily overcome if the FCM entries are only 0 and 1.

A Study on Health Problems of IT Professionals using COMFCMS: 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 for our problem.

c_1 – Stress

c_2 – Vision Problem

c_3 –Depression

c_4 – High Frustration

c_5 – Back Pain

c_6 – Ulcer/Acidity

c_7 –Join Pain and Neck Pain

c_8 –Insomnia (Inability to Sleep)

c_9 – No proper Food by Staying away from Native

c_1 – Stress: Anything that poses a challenge or a threat to our well-being is a stress and it is the body's reaction to any stimuli that disturb its equilibrium. Indeed, stress symptoms can affect your body, your thoughts and feelings, and your behavior. Stress that's left unchecked can contribute to health problems such as high blood pressure, heart disease, obesity and diabetes.

c_2 – Vision Problem: There are different types of eye problems and vision disturbances, such as Halos, Blurred vision (the loss of sharpness of vision and the inability to see fine details).Vision loss and blindness are the most severe vision problems. These problems lead to severe headache. This is because of watching the monitor continuously.

c_3 –Depression: A person may report feeling "sad" or "empty" or may cry frequently and may show markedly diminished interest or pleasure in all, or almost all, daily activities. Insomnia or sleeping too much may be a symptom of depression. The person may be observed to be either agitated or restless or physically slowed down in their movements. Deep fatigue or a loss of energy is a symptom of depression.

c_4 – High Frustration: A feeling of dissatisfaction, often accompanied by anxiety or depression, resulting from unfulfilled needs or unresolved problems and it is a deep chronic sense or state of insecurity and dissatisfaction arising from unresolved problems or unfulfilled needs

c_5 – Back Pain: Back pain is pain felt in the back that usually originates from the muscles, bones, nerves, joints or other structures in the spine. Back pain may have a sudden onset or can be a chronic pain; it can be constant or intermittent, stay in one place or radiate to other areas. It may be a dull ache, or a sharp or piercing or burning sensation. Back pain is one of humanity's most frequent complaints.

c_6 – Ulcer/Acidity: The first symptoms of ulceration in the stomach include dizziness, nausea, eructation and loss of appetite. Acidity goes on increasing leading to a burning sensation or even pain in the stomach, which is relieved after ingestion of food and also habits of thought

also play a vital role in cases of ulcers. Those given to excessive worry, anger, tension, jealousy and hurrying are more prone to suffer from ulcers.

c_7 –Join Pain and Neck Pain: Causes of neck pain include abnormalities in the bone or joints, Poor posture, Degenerative diseases, Muscle strain etc. Neck pain may arise due to muscular tightness in both the neck and upper back, and pinching of the nerves emanating from the cervical vertebrae. Joint disruption in the neck creates pain, as joint disruption in the upper back. The head is supported by the lower neck and upper back, and it is these areas that commonly cause neck pain. The top three joints in the neck allow for most movement of your neck and head.

c_8 –Insomnia (Inability to Sleep): By definition, insomnia is "difficulty initiating or maintaining sleep, or both" or the perception of poor quality sleep. Insomnia may therefore be due to inadequate quality or quantity of sleep. Insomnia is not defined by a specific number of hours of sleep that one gets, since individuals vary widely in their sleep needs and practices.

c_9 – No proper Food by Staying away from Native: Staying far away from native they won't get proper food, they won't take it in proper time that leads to some problems.

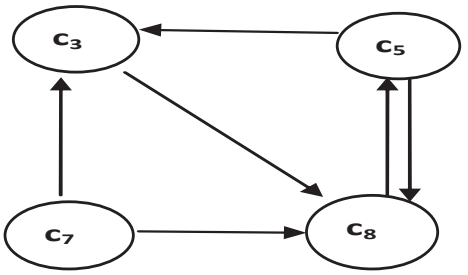
Method of Determining the Hidden Pattern: Let C_1, C_2… C_n be the nodes of an FCM, with feedback. Let E be the associated adjacency matrix. Let us find the hidden pattern when C_1 is switched on. When an input is given as the vector A_1= (1, 0, 0… 0), the data should pass through the relation matrix E. this is done by multiplying A_1 by the matrix E. Let A_1 E= (a_1… 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 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_1 E→ A_2 then consider A_2 E and repeat the same procedure. This procedure is repeated till we get a limit cycle or a fixed point.

Concept of the Problem: Using the linguistic questionnaire and the expert's opinion we have taken the above nine concepts {C_1, C_2... C_9}.

Now we proceed on to apply the effect of combined overlap block FCM of equal length. Let us consider the nine concepts. We divide these concepts into cyclic way of classes, each having just four concepts in the following way:

(a) The *directed graph and the relation matrix* for the class c = {c_3, c_5, c_7, c_8}. The expert opinion of an expert (software engineer) is given as follows:

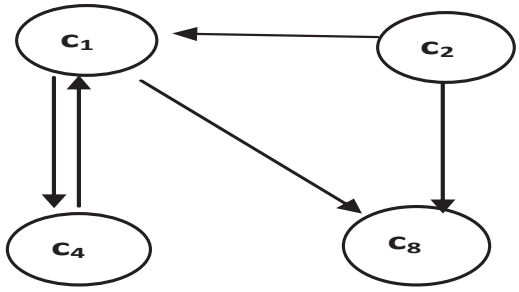
Figure 1



$$\begin{array}{c} c \\ c_3 \\ c_5 \\ c_7 \\ c_8 \end{array} \begin{pmatrix} c_3 & c_5 & c_7 & c_8 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{pmatrix}$$

(b) The directed graph and the relational matrix for the class c = {c1, c2, c4, c8} Given by the expert (system analyst) is as follows:

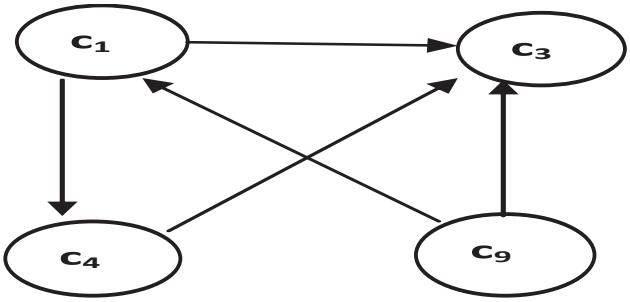
Figure 2



$$\begin{array}{c} \\ C_1 \\ C_2 \\ C_4 \\ C_8 \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & C_4 & C_8 \end{array} \\ \begin{pmatrix} 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} \end{array}$$

The *directed graph and the relational matrix* for the class c = {c_1, c_3, c_4, c_9} . Given by the expert (Team Leader) is as follows,

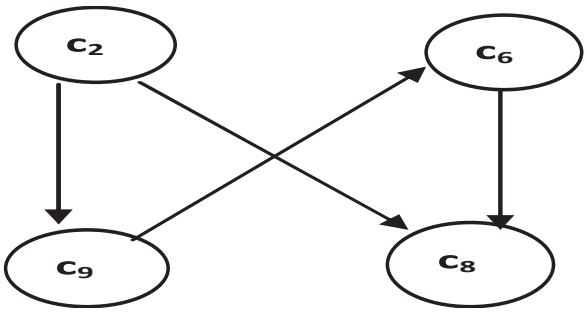
Figure 3



	C_1	C_3	C_4	C_9
C_1	0	1	1	0
C_3	0	0	0	0
C_4	0	1	0	0
C_9	1	1	0	0

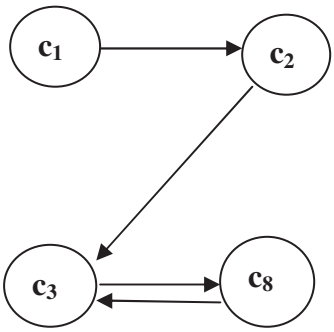
(d) The *directed graph and the relation matrix* for the class c = {c_2, c_6, c_8, c_9}
Given by the expert (Project Leader) is as follows:

Figure 4



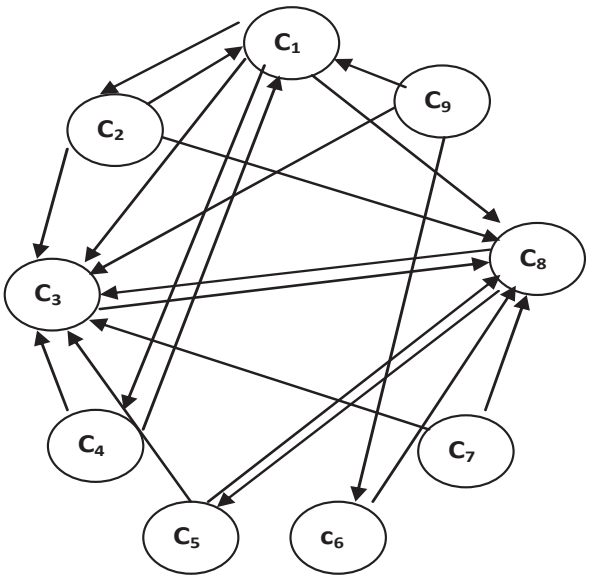
	C_1	C_3	C_4	C_9
C_1	0	1	0	0
C_3	0	0	1	1
C_4	0	0	0	1
C_9	0	0	1	0

(e) The *directed graph and the relational matrix* for the c = {c_1, c_2, c_3, c_8}. Given by the expert (Client) is as follows:



	C_1	C_3	C_4	C_9
C_1	0	1	0	0
C_3	0	0	1	1
C_4	0	0	0	1
C_9	0	0	1	0

The *combined direct graph and combined overlap block FCM* of equal sizes as follows:



	C (m)	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9
C_1	0	1	1	2	0	0	0	1	0	
C_2	1	0	1	0	0	0	0	3	1	
C_3	0	0	0	0	0	0	0	2	0	
C_4	1	0	1	0	0	0	0	0	0	
C_5	0	0	1	0	0	0	0	1	0	
C_6	0	0	0	0	0	0	0	1	0	
C_7	0	0	1	0	0	0	0	1	0	
C_8	0	0	0	0	1	0	0	0	0	
C_9	1	0	1	0	0	1	0	0	0	

Now using the matrix of the combined overlap block FCM, we determine the hidden pattern. Suppose the concepts C_1 is in the ON state the initial input vector be

X= (1 0 0 0 0 0 0 0 0)

X C (m) = (0 1 1 2 0 0 0 1 0) = X_1

X_1 C (m) = (3 0 3 0 1 0 0 5 1)

$\rightarrow$(1 0 1 0 1 0 0 1 1) = X_2

X_2 C (m) = (1 1 3 2 1 1 0 4 0)

$\rightarrow$(1 1 1 1 1 1 0 1 0) = X_3

X_3 C (m) = (2 1 4 2 1 0 0 8 1)

$\rightarrow$ (1 1 1 1 1 0 0 1 1) = X_4

X_4 C (m) = (3 1 5 2 1 1 0 7 1)

$\rightarrow$ (1 1 1 1 1 1 0 1 1) = X_5

X_5 C (m) = (3 1 5 2 1 1 0 8 1)

$\rightarrow$ (1 1 1 1 1 1 0 1 1) = X_6

X_6 C (m) = (3 1 5 2 1 1 0 8 1)

$\rightarrow$ (1 1 1 1 1 0 1 1 1) = X_7

Where $\rightarrow$ denotes the resultant vector after thresholding and updating.

X_7 is the hidden pattern which is the fixed point.

Conclusion: While analyzing FCM, When the concept C_1 "Stress is in the ON state, the other conceptsC_2, C_3, C_4, C5, C_6, C_8, C_9 are in ON state, but C_7 are in the off state. Each and every person in IT field is affected by Mental Stress which is the major problem in which the IT Professionals are facing. This Mental Stress can be cultivated through the following reasons:

1. Avoid seeing monitor continuously and giving rest for eyes.
2. Having a little walk during break hours.
3. Try to take regular food habit.
4. Having Balanced diet and Nutritious food.
5. Completing the allotted projects in time so that we can avoid pressures from it.
6. Doing yoga's and exercises.

So that we can avoid Mental Stress.

Future Work: Insomnia will be measured by using fuzzy model.

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M. GeethaLakshmi. KCG College of Technology/Assistant Professor/Anna University/geetharamon@gmail.com
A. Praveen Prakash. Hindustan University/ Head of the Department /Hindustan University/apraveenprakash@gmail.com