A Systematic Study On Problemsof IT Professionalsin Chennai Using Induced Fuzzy Cognitive Maps (IFCMS)

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Abstract –This Paper deals with the systematic study on problems faced by IT Professionals in Chennai using Induced Fuzzy Cognitive Maps (IFCMS).The imperative reasons for the study is to derive an optimistic solution to theproblemwith an unsupervised data collected from a survey among IT Professionals. The problems of IT Professionals are analyzed by a tool called fuzzy theory in general and in particular by induced fuzzy cognitive maps with the help of directed graphs andconnection matrices.

Keywords –Directed Graph, Fixed Point, Connection Matrix, Unsupervised, Fuzzy Cognitive Maps.

1. Introduction

The cognitive map as a formal tool for decision-making was proposed byAxelrod [1] in the year 1976. He used the matrixrepresentation of the directed graph to represent andstudy the social scientific knowledge. Then in the year 1986 Kosko[2] introduced Fuzzy Cognitive Maps based on the cognitive map structure which play a major with the unsupervised data's. This method is most simple and effective and further using this,the data's can be analyzed by directed graphs andconnection matrices.

Nowadays there is a rapid growth in IT Industry and the day-to-day life problems among the IT Professionals in IT Companies are also growing very fast. Here their problems are discussed and analyzed. In this Paper, we discuss the basics of Fuzzy Cognitive Maps and Induced Fuzzy Cognitive Maps; then the adaptation of IFCM on the problems of IT Professionals; implementation of IFCM based on the expert's opinion with the help of directed graph along with the connection matrix and lastly the conclusion based on our study.

2. Preliminaries of FCMs and Induced FCMs

Basic notions of fuzzy cognitive maps.[2]- [4].

Fuzzy cognitive maps (FCMs) are techniques which analyze the cognitive process of Human behavior and thinking by creating models and those models are represented as directed graphs of concepts in which the data's are unsupervised one and by the various casual relationships that exists between the concepts. The FCMs work on the opinion of experts.

Definition 2.1: 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 2.2: When the nodes of the FCM are fuzzy sets then they are called as fuzzy nodes.

Definition 2.3: FCMs with edge weights or causalities from the set {-1, 0, 1} are simple.

Definition 2.4: The edges e_{ij} take values in the fuzzy causal interval [-1, 1]. $e_{ij} = 0$ 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… C_n of FCM. Suppose the directed graph is drawn using edge weight eij Є {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 2.5: Let C_1, C_2… C_n be the nodes of an FCM. Let A= (a_1, a_2… a_n), where a_iЄ {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=1
a_i =1 if a_i is on, where i = 1, 2, …, n.

Definition 2.6: Let C_1, C_2… $C_n$be the nodes of an FCM.Let C_1 C_2, C_2 C_3… 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 becyclic if it possesses a directed cycle. An FCM is said to be acyclic if it does not possess any directed cycle.

Definition 2.7: An FCM with cycles is said to have a feedback.

Definition 2.8: Where there is a feedback in an FCM, i.e., When the causal relations flow through a cycle in arevolutionary way, The FCM is called a dynamical system.

Definition 2.9: Let C_1C_2, C_2 C_3… C_i C_j, be a cycle when $C_i$is switched on and if the causality flows through the edges ofa cycle and if it again causes C_i, We say that the dynamicalsystem goes round and round. This is true for any node C_i, fori = 1, 2… n. The equilibrium state for this dynamical systemis called the hidden pattern.

Definition 2.10: If the equilibrium state of a dynamicalsystem 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 letus start the dynamical system by switching on C. Let usassume 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 2.11: If the FCMsettles down with a state vectorrepeating in the form
$A_1 \longrightarrow A_2 \longrightarrow$…….. $A_i \longrightarrow A_1$. Then thisequilibrium is called limit cycle.

Definition 2.12: Finite number of FCMs can be combinedtogether 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 addingall the adjacency matrices E_1… E_p. We denote the combinedFCM adjacency matrix by $E = E_1 + E_2 + \ldots + E_p$.

Definition 2.13: Let P be the problem under investigation. Let {C_1, C_2… C_n} be n concepts associated with p (n verylarge). Now divide the number of concepts {C_1, C_2… 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 witheach S. Using these matrices we obtain an n × n matrix. Thisn × n matrix is the matrix associated with the combinedoverlap block FCM (COBFCM) of blacks of same sizes.

Definition 2.14: Suppose A= ($a_1 \ldots a_n$) is a vector which ispassed 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$\rightarrow$means that the resultant vector has beenthresholded and updated. FCMs have several advantages aswell as some disadvantages. The main advantage of thismethod it is simple. It functions on experts opinions. Whenthe data happens to be an unsupervised one the FCM comeshandy. This is the only known fuzzy technique that gives thehidden pattern of the situation. As we have a very well knowntheory, which states that the strength of the data depends onthe number of expert's opinions we can use combined FCMswith several experts' opinions. At the same time thedisadvantage of the combined FCM is when the weightagesare 1 and -1 for the same C_i C_j. We have the sum adding tozero thus at all times the connection matrices $E_1 \ldots E_k$ maynot be comfortable for addition. This problem will be easilyovercome if the FCM entries are only 0 and 1.

Definition 2.15: Algorithmic approach in induced fuzzycognitive maps (IFCMs). [5] Even though IFCM is an advancement of FCM it follows thefoundation of FCM. To derive an optimistic solution to theproblem with an unsupervised data, the following steps to be followed as per the flowchart given below:

FLOW CHART

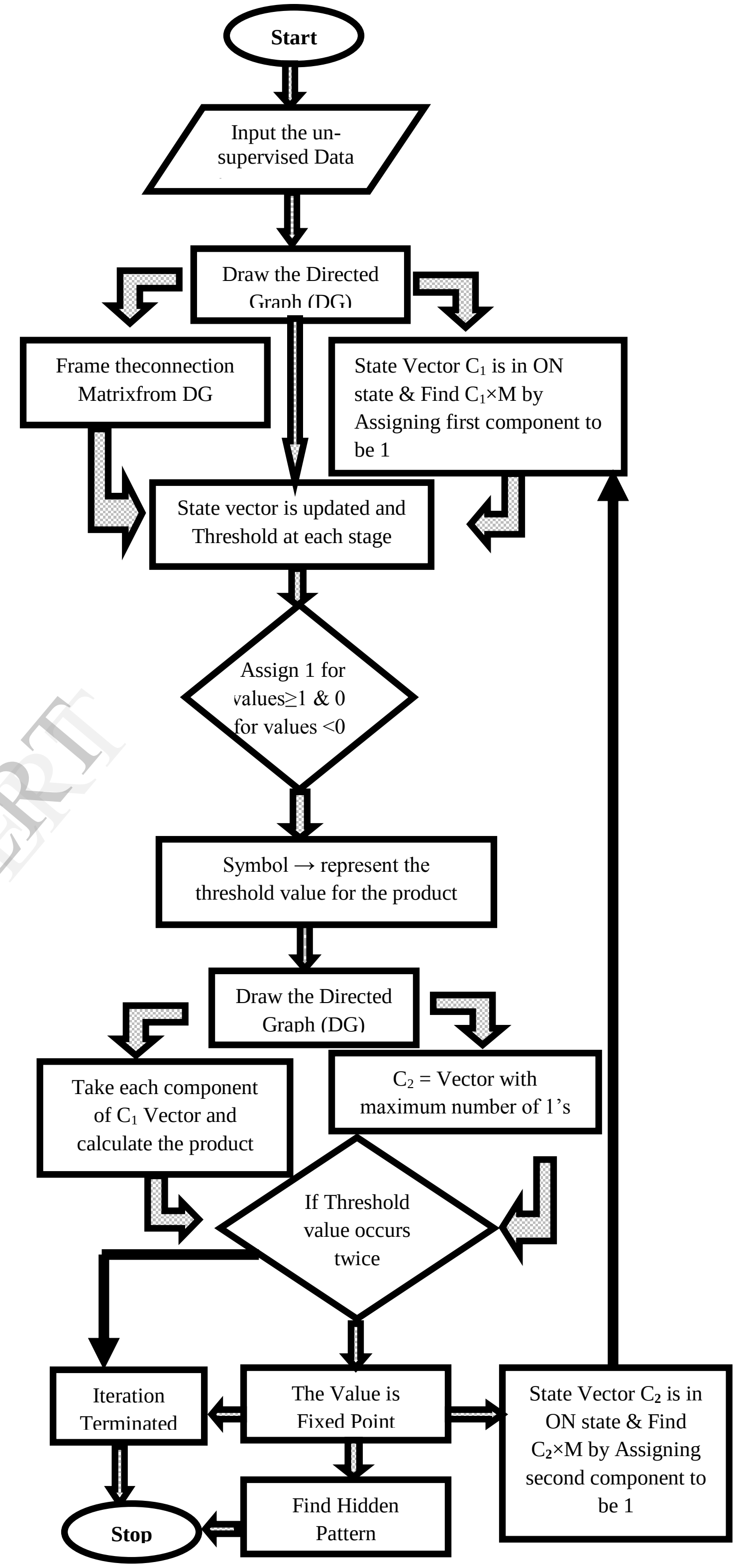

Figure: 1

3. Adaptation of Induced FCMS to the problems faced by the IT Professionals in Chennai.

Here the illustration of the dynamical system for the problems faced by the IT Professionals in Chennai by a very simple model.At the very first stage we have taken the following elevenarbitrary attributes (A_1, A_2, ..., A_{11}). It is not a hard and fast rule we need to consider only theseeleven attributes but onecan increase or decrease the number of attributesaccording to needs. The following attributes are taken asthe main nodes for study.

An expert system spells out the eleven major conceptsrelating to the problem of ITprofessionals as:

A_1 –Night Shift disrupts the natural sleep-wakefulness cycle

A_2–Eye Irritation due to focus and refocus on the image again & again

A_3 –Loss of identity

A_4–High work targets

A_5–Poor lighting

A_6–Documents and monitor screen is not at same angle & plane

A_7–Poor workplace setup

A_8–Repetitive Motions & Tasks

A_9–High Blood Pressure

A_{10} –Social Isolation

A_{11}–Lower Back/ Leg support is inadequate

3.1 The Directed Graph Related to the Problem of IT Professionals

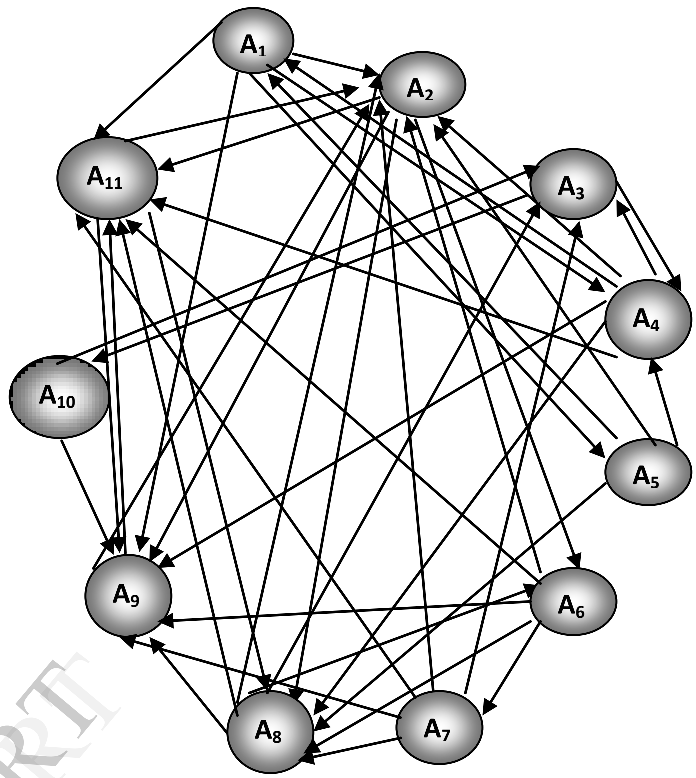

Figure: 2 Directed Graph

3.2 Implementation of IFCMs Model to the Study

The directed diagram and the corresponding connection matrix M is given based on the expert's opinion. The connection matrix M isthe relation between the eleven attributes as concepts, assigning values as 1, if there is any relation and 0, if there is no relation as follows:

$$
\begin{array}{c|ccccccccccc|}
 & A_1 & A_2 & A_3 & A_4 & A_5 & A_6 & A_7 & A_8 & A_9 & A_{10} & A_{11} \\
A_1 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
A_2 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\
A_3 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
A_4 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
A_5 & 1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
M = A_6 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
A_7 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
A_8 & 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
A_9 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
A_{10} & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
A_{11} & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0
\end{array}
$$

Now the problems are determined by using the matrix M.

Here the Threshold value is calculated by assigning 1 for thevalues >1 and 0 for the values <0. The symbol '↪' represents the threshold value for the product of the result. Now as per Induced Fuzzy Cognitive Mapmethodology, each component in C_1' vector is taken separately and product of the given matrix is calculated.The vector which has the maximum number of one's which occurs first is considered as C_2. The symbol **'~'** denotes the calculation performed with the respective vector, here C_1'.

When the same threshold value occurs twice, thevalue is considered as the fixed point. The iteration gets terminated and the calculation gets terminated.

Process: 1

Let us take Night Shift disrupts the natural sleep- wakefulness cycle as ON state and others in OFF state.

Let $C_1 = (1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$

Now Product of C_1 *and M is calculated.*

$C_1 \times M = (0\ 1\ 0\ 1\ 1\ 0\ 0\ 0\ 1\ 0\ 1)$

$\hookrightarrow (1\ 1\ 0\ 1\ 1\ 0\ 0\ 0\ 1\ 0\ 1) = C_1'$

$C_1' \times M = (1\ 1\ 0\ 1\ 1\ 0\ 0\ 0\ 1\ 0\ 1) \times M$

$C_1' \times M \sim (1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$

$\hookrightarrow (0\ 1\ 0\ 1\ 1\ 0\ 0\ 0\ 1\ 0\ 1)$

$= (0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$

$\hookrightarrow (0\ 0\ 0\ 0\ 0\ 1\ 0\ 1\ 1\ 0\ 1)$

$= (0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$

$\hookrightarrow \boldsymbol{(1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)}$

$= (0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0) \times M$

$\hookrightarrow (1\ 1\ 0\ 1\ 0\ 0\ 0\ 1\ 0\ 0\ 0)$

$= (0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0) \times M$

$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1)$

$= (0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1) \times M$

$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 0)$

Maximum Number of 1's is C_2

$\therefore C_2 = (1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)$

Now Product of C_2 *and M is calculated.*

$C_2 \times M = (0\ \ 4\ \ 1\ \ 2\ \ 1\ \ 2\ \ 0\ \ 2\ \ 4\ \ 1\ \ 4)$

$\hookrightarrow (1\ \ 1\ \ 1\ \ 1\ \ 1\ \ 1\ \ 0\ \ 1\ \ 1\ \ 1\ \ 1) = C_2'$

$C_2' \times M = (1\ \ 1\ \ 1\ \ 1\ \ 1\ \ 1\ \ 0\ \ 1\ \ 1\ \ 1\ \ 1) \times M$

$C_2' \times M \sim (1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$

$\hookrightarrow (0\ 1\ 0\ 1\ 1\ 0\ 0\ 0\ 1\ 0\ 1)$

$= (0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$

$\hookrightarrow (0\ 0\ 0\ 0\ 0\ 1\ 0\ 1\ 1\ 0\ 1)$

$= (0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$

$\hookrightarrow (0\ \ 0\ \ 0\ \ 1\ \ 0\ \ 0\ \ 0\ \ 0\ \ 0\ \ 1\ \ 0)$

$= (0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$

$\hookrightarrow \boldsymbol{(1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)}$

$= (0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0) \times M$

$\hookrightarrow (1\ 1\ 0\ 1\ 0\ 0\ 0\ 1\ 0\ 0\ 0)$

$= (0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0) \times M$

$\hookrightarrow (0\ \ 1\ \ 0\ \ 0\ \ 0\ \ 0\ \ 1\ \ 1\ \ 1\ \ 0\ \ 1)$

$= (0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0) \times M$

$\hookrightarrow (0\ \ 1\ \ 1\ \ 0\ \ 0\ \ 1\ \ 0\ \ 0\ \ 1\ \ 0\ \ 1)$

$= (0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0) \times M$

$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1)$

$= (0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0) \times M$

$\hookrightarrow (0\ \ 0\ \ 1\ \ 0\ \ 0\ \ 0\ \ 0\ \ 0\ \ 1\ \ 0\ \ 0)$

$= (0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1) \times M$

$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 0)$

Maximum Number of 1's is C_3

$\therefore C_3 = (1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)$

Thus $C_2 = C_3$.

$\therefore$ The Fixed Point is $(1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)$.

Process: 2

Let us take Eye Irritation due to focus and refocus on the image again & againas ON state and others in OFF state.

Let $C_1 = (0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$
Now Product of C_1 *and M is calculated.*
$C_1 \times M = (0\ 0\ 0\ 0\ 0\ 1\ 0\ 1\ 1\ 0\ 1)$
$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 1\ 0\ 1\ 1\ 0\ 1) = C_1'$
$C_1' \times M = (0\ 1\ 0\ 0\ 0\ 1\ 0\ 1\ 1\ 0\ 1) \times M$
$C_1' \times M \sim (0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$
$\hookrightarrow (0\ 0\ 0\ 0\ 0\ 1\ 0\ 1\ 1\ 0\ 1)$
$= (0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0) \times M$
$\hookrightarrow \boldsymbol{(0\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 1\ 0\ 1)}$
$= (0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0) \times M$
$\hookrightarrow \boldsymbol{(0\ 1\ 1\ 0\ 0\ 1\ 0\ 0\ 1\ 0\ 1)}$
$= (0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0) \times M$
$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1)$
$= (0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 0) \times M$
$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1)$
$= (0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1) \times M$
$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 0)$
Maximum Number of 1's is C_2
$\therefore C_2$ is either $(0\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 1\ 0\ 1)$ *or* $(0\ 1\ 1\ 0\ 0\ 1\ 0\ 0\ 1\ 0\ 1)$
Consider $C_2 = (0\ 1\ 1\ 0\ 0\ 1\ 0\ 0\ 1\ 0\ 1)$
Now Product of C_2 *and M is calculated.*
$C_2 \times M = (0\ 3\ 0\ 1\ 0\ 1\ 1\ 3\ 3\ 1\ 3)$
$\hookrightarrow (0\ 1\ 0\ 1\ 0\ 1\ 1\ 1\ 1\ 1\ 1) = C_2'$
$C_2' \times M = (1\ 1\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 1) \times M$
$C_2' \times M \sim (0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$
$\hookrightarrow (0\ 0\ 0\ 0\ 0\ 1\ 0\ 1\ 1\ 0\ 1)$
$= (0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$
$\hookrightarrow \boldsymbol{(1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)}$
$= (0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0) \times M$
$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 1\ 0\ 1)$
$= (0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0) \times M$
$\hookrightarrow (0\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)$
$= (0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0) \times M$
$\hookrightarrow (0\ 1\ 1\ 0\ 0\ 1\ 0\ 0\ 1\ 0\ 1)$
$= (0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0) \times M$
$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1)$
$= (0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0) \times M$
$\hookrightarrow (0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0)$
$= (0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1) \times M$
$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 0)$
Maximum Number of 1's is C_3
$\therefore C_3 = (1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)$
Now Product of C_3 *and M is calculated.*
$C_3 \times M = (0\ 4\ 1\ 2\ 1\ 2\ 0\ 2\ 4\ 1\ 4)$
$\hookrightarrow (0\ 1\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 1) = C_3'$
Similarly we are calculating
$C_3' \times M \sim (0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$
$\hookrightarrow (0\ 0\ 0\ 0\ 0\ 1\ 0\ 1\ 1\ 0\ 1)$
$= (0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$
$\hookrightarrow (0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0)$
$= (0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$
$\hookrightarrow \boldsymbol{(1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)}$
$= (0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0) \times M$
$\hookrightarrow (1\ 1\ 0\ 1\ 0\ 0\ 0\ 1\ 0\ 0\ 0)$
Similarly we are keeping 6^{th} 8^{th}, 9^{th}, 10^{th}& 11^{th} place as 1 and multiplying by M, we get the threshold vectors as
$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 1\ 0\ 1)$
$\hookrightarrow (0\ 1\ 1\ 0\ 0\ 1\ 0\ 0\ 1\ 0\ 1)$
$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1)$
$\hookrightarrow (0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0)$
$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 0)$
Maximum Number of 1's is C_4
$\therefore C_4 = (1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)$
Thus $C_3 = C_4$.
$\therefore$ The Fixed Point is $(1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)$
Similar result will be obtained when we choose $C_2 = (0\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 1\ 0\ 1)$, we get the same fixed point.

Process: 3

Let us take Loss of identityas ON state and others in OFF state.

Let $C_1 = (0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$
Now Product of C_1 *and M is calculated.*
$C_1 \times M = (0\ 0\ 0\ 1\ 0\ 1\ 0\ 1\ 1\ 0\ 1)$
$\hookrightarrow (0\ 0\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0) = C_1'$
$C_1' \times M = (0\ 0\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0) \times M$
$C_1' \times M \sim (0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$
$\hookrightarrow (0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0)$
$= (0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$
$\hookrightarrow \boldsymbol{(1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)}$
$= (0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0) \times M$
$\hookrightarrow (0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0)$
Maximum Number of 1's is C_2
$\therefore C_2 = (1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)$
Now Product of C_2 *and M is calculated.*
$C_2 \times M = (0\ 4\ 1\ 2\ 1\ 2\ 0\ 2\ 4\ 1\ 4)$
$\hookrightarrow (0\ 1\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 1) = C_2'$
$C_2' \times M = (0\ 1\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 1) \times M$
$C_2' \times M \sim (0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$
$\hookrightarrow (0\ 0\ 0\ 0\ 0\ 1\ 0\ 1\ 1\ 0\ 1)$
$= (0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$
$\hookrightarrow (0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0)$

$=(0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0) \times M$
$\hookrightarrow \boldsymbol{(1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)}$
$=(0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0) \times M$
$\hookrightarrow (1\ 1\ 0\ 1\ 0\ 0\ 0\ 1\ 0\ 0\ 0)$

Similarly we are keeping $6^{th} 8^{th}, 9^{th}\ 10^{th} \& \ 11^{th}$ place as 1 and multiplying by M,we get the threshold vectors as

$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 1\ 0\ 1)$
$\hookrightarrow (0\ 1\ 1\ 0\ 0\ 1\ 0\ 0\ 1\ 0\ 1)$
$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1)$
$\hookrightarrow (0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0)$
$\hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 0)$

Maximum Number of 1's is C_3
$\therefore C_3=(1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)$
Thus $C_2=C_3$.
$\therefore$ The Fixed Point is $(1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)$.

4. Conclusion

There are advantages and disadvantages in FCMs. The advantage is the method is very simple by taking the expert's opinion and data's which an unsupervised one that gives the hidden pattern. The limitation for this model is the procedure for calculations with matrices are lengthy and the manual calculation is fully based on the expert's opinion which leads to personal bias. But comparatively IFCM gives the accurate result than FCM model since using so many concepts results in the best vector, the threshold resultant vector as the fixed point and this is not possible in FCM model.

Thus according to the above IFCM summary and data's, we conclude that: while analyzing the IFCMs , if we take Night Shift disrupts the natural sleep- wakefulness cycle,Eye Irritation due to focus and refocus on the image again & again,Loss of identity as ON state ,

The resultant vector is $(1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1)$. Similarly we can take any state vector as ON State and the effect can be analyzed. We get the same fixed point.

While analyzing with IFCMs we observe that Night Shift disrupts the natural sleep- wakefulness cycle,Eye Irritation due to focus and refocus on the image again & again,Loss of identity,Repetitive Motions & Tasks, High Blood Pressure,Lower Back/ Leg support is inadequate are the major problems to the IT Professionals.

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