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Problems Faced by Experienced Women IT Professionals in Chennai using Fuzzy Relational Maps (FRMs)

M.GeethaLakshmi[1], A.Rajkumar[2]
[1] KCG college of Technology, Chennai.
[2] Hindustan University, Chennai
Email: geetharamon@gmail.com, raj30102003@gmail.com

Abstract - This paper deals with the relationship between health related problems and the problems in Workplace of Women IT Professionals in Chennai using Fuzzy Relational Maps. In an FRM, we have associated with it are the domain spaces and range space, the attributes contributing to the rows of the connection matrix form the concepts relating the domain of the FRM and the range attributes correspond to the columns of the connection matrix. Using this FRM we analyze the problem by giving definition for fuzzy relational maps followed by the description of the women's IT problem along with the adaptation of the fuzzy relational maps to the women's IT problem along with the conclusion.

Keywords: Fuzzy Relational Maps (FRM), Risk factors, Domain Space, Range Space, Health Problem, Workplace problem.

I. INTRODUCTION

Fuzzy Relational Maps are constructed analogous to Fuzzy Cognitive Maps, which promote the correlation between casual associations among concurrently active units. But in FRMs we divide the very casual associations into two disjoint units, i.e., the relation between a mother and a child or relation between a patient and doctor or a relation between team leader and co-worker and so on. An FRM is Directed Graph or Map from Domain Space to a Range Space. Here the rows correspond to the domain space and the columns corresponding to range space. Thus to define a FRM we need a domain space and a range space which are disjoint in concepts. So we have to assume that there is no intermediate relation exists within domain and range space attributes. In our day-to-day life we come across women in each and every field in Chennai. Not only in Chennai but also in all over the world .Here we analyze the problems of women in IT industry. They are facing so many problems in their workplace and they are facing health related problems as well. Here we discuss the relationship between health's related problems and the problems in workplace of women IT professionals in Chennai using Fuzzy Relational Maps by taking the health related problems as domain space and problems in workplace as range space.

II. FUZZY RELATIONAL MAPS (FRMS)

2.1 Preliminaries:

In our study, the elements of the domain space are taken from the real vector space of dimension n and that of the range space are real vectors from the vector space of dimension m (m in general need not be equal to n). We denote by R the set of nodes $R_1, \ldots, R_m$ of the range space, where $R_i = \{(x_1, x_2, \ldots, x_m) / x_j = 0 \text{ or } 1\}$ for i = 1,… ,m. If $x_i = 1$ denotes the node R_i is in the ON state and if $x_i = 0$ denotes the node R is in the OFF state. Similarly D denotes the nodes $D_1, D_2 \ldots, D_n$ of the domain space where $D_i = \{(x_1, x_2, \ldots, x_n) / x_j = 0 \text{ or } 1\}$ for i = 1, …, n. If $x_i = 1$, denotes the node D_i is in the ON state and if $x_i = 0$ denotes the node D_i is in the OFF state.

Definition: 2.1.1 A FRM is a directed graph or a map from Domain Space to Range Space with concepts like policies or events etc. as nodes and causalities as edges. It represents casual relations between spaces D and R.

Definition: 2.1.2 The directed edge from D to R denotes the casuality of D on R, called relations. Every edge in the FRM is weighted with a number in the set {0, 1}.

Definition: 2.1.3 Let D_i and R_j denote the two nodes of an FRM. Let e_{ij} be the weight of the edge $D_i R_j$, $e_{ij} \in \{0,1\}$. The weight of the edge D_iR_j is positive if increase in D_i implies increase in R_j or decrease in D_i implies decrease in R_j. i.e.casuality of D_i on R_j is 1. If $e_{ij} = 0$ then D_i does not have any effect on R_j. We do not discuss the cases when increase in D_i implies decrease in R_j or decrease in D_i implies increase in R_j. When the nodes of the FRM are fuzzy sets, then they are called fuzzy nodes, FRMs with edge weights {0, 1} are called simple FRMs. Let $D_1, \ldots, D_n$ be the nodes of the domain space D of an FRM and $R_1, \ldots, R_m$ be the nodes of the range space R of an FRM.

Definition: 2.1.4Let the matrix E be defined as $E = (e_{ij})$ where $e_{ij} \in \{0, 1\}$; is the weight of the directed edge D_iR_j(or R_jD_i) , E is called the relational matrix of the FRM. It is pertinent to mention here that unlike the FCMs, the FRMs can be a rectangular matrix; with rows corresponding to the domain space and columns corresponding to the range space. This is one of the marked differences between FRMs and FCMs.

Definition: 2.1.5Let $D_1, \ldots, D_n$ and $R_1,\ldots,R_m$ be the nodes of an FRM. Let D_iR_j (or R_jD_i) be the edges of an FRM, j = 1,2….m, i =1,2 …, n. The edges form a directed cycle if it possesses a directed cycle. An FRM is said to be a cycle if it does not possess any directed cycle.

Definition: 2.1.6 An FRM with cycles is said to have a feed back when there is a feed back in the FRM, i.e. when the

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casual relations flow through a cycle in a revolutionary manner the FRM is called a dynamical system.

Definition: 2.1.7Let D_iR_j (or R_jD_i), $1 \le j \le m$, $1 \le i \le n$. When R_j (or D_i) is switched on and if casuality flows through edges of the cycle and if it again causes $R_i(D_j)$, we say that the dynamical system goes round and round. This is true for any node Rj (or D_j) for $1 \le i \le m$, (or $1 \le j \le n$). The equilibrium state of this dynamical system is called the hidden pattern. If the equilibrium state of the dynamical system is a unique state vector, then it is called a fixed point. Consider an FRM with $R_1 \ldots R_m$ and $D_1 \ldots D_n$ as nodes. For example let us start the dynamical system by switching on R_1 or D_1. Let us assume that the FRM settles down with R_1 and R_m (or D_1 and D_n) on i.e. the state vector remains as (10…01) in R [or (10…01) in D], this state vector is called the fixed point. If the FRM settles down with a state vector repeating in the form $A_1 \rightarrow A_2 \rightarrow \ldots \rightarrow A_i \rightarrow A_1$ or ($B_1 \rightarrow B_2 \ldots B_i \rightarrow B_1$) then this equilibrium is called a limit cycle.

III. METHOD OF DETERMINATION OF HIDDEN PATTERN

Let $R_1, \ldots R_m$ and $D_1, \ldots D_n$ be the nodes of a FRM with feedback. Let E be the $n \times m$ relational matrix. Let us find a hidden pattern when D_1 is switched on i.e. when an input is given as vector A_1= (1000...0) in D the data should pass through the relational matrix M. This is done by multiplying A_1 with the relational matrix M. Let $A_1M = (k_1, \ldots, k_m)$ after thresholding and updating the resultant vector (say B)belongs to R. Now we pass on B into M^T and obtain BM^T. After thresholding and updating BM^T we see the resultant vector say A_2 belongs to D. This procedure is repeated till we get a limit cycle or a fixed point.

IV. DESCRIPTION AND ADOPTION OF FRM MODEL TO STUDY ABOUT PROBLEMS OF WOMEN IT PROFESSIONALS

We have taken a survey of around 100 women IT Professionals living in Chennai (Sutherland Global Services, TCS, and SoftMartix Solutions) using questionnaire. Many women IT Professionals are facing problems in different situations. The situation may vary from person to person depending upon the situations. Very few problems that are discussed and that is common to many women IT Professionals in their daily life. Here we analyze those problems using fuzzy relational maps.The fuzzy concepts are given in the form of attributes and then framing the relational matrix and solving the problem. Here we consider the attributes related to health Problems and the attributes related to work place in our study.

4.1 Attributes Related to Problems in Workplace

The Range space W connected with the problems in workplaces are given by
$W = \{W_1, W_2, W_3 \ldots W_{10}\}$
W_1: Late Working Hours
W_2: Team Management Skills are not handed over to women in some IT Companies
W_3: Sexual Harassment
W_4: No Safe Transportation
W_5: Low Salaries with zero job security
W_6: Marriage is difficult for a women working in shifts
W_7: Competency Pressure
W_8: Time Limit Projects
W_9: Discrimination based on Sex
W_{10}: Sitting in same posture for continuous long hours

4.2 Attributes Related to Health Related Problems

The domain space H connected with the health problems are given by $H = \{H_1, H_2, H_3 \ldots H_8\}$
H_1: High Blood Pressure accompanied by Sleep Disorder
H_2: Problems in Regular Menstrual Cycle
H_3: Respiratory Illness and digestive problems
H_4: Numbness, tingling or burning sensation in hands or fingers
H_5: Blurred or Double Vision
H_6: Reduced grip strength in hand
H_7: Dry, Itchy, red or sore eyes \ Eye Strain
H_8: Dryness & Pain due to lighting situations and un-interrupted use of computers for long time.

Now using the expert's opinion. We have the following relation matrix by taking Health Problems $H_1, H_2, H_3 \ldots H_8$ as the rows and Workplace Problems $W_1, W_2, W_3 \ldots W_{10}$ as the columns.

First Expert's Opinion

M_1

	M_1	M_2	M_3	M_4	M_5	M_6	M_7	M_8
W_1	1	0	0	1	1	1	1	1
W_2	0	0	0	0	0	0	0	0
W_3	1	1	0	0	0	0	0	0
W_4	1	0	0	0	0	0	0	0
W_5	1	0	0	0	0	0	0	0
W_6	0	1	1	1	1	1	1	1
W_7	1	0	0	1	1	1	1	1
W_8	1	0	0	1	1	1	1	1
W_9	1	0	0	0	0	0	0	0
W_{10}	1	1	1	1	1	1	1	1

The Hidden Pattern of the state vector
X = (0 0 1 0 0 0 0 0 0 0)
$X M_1$ = (1 1 0 0 0 0 0 0) = Y
$Y M_1^T$ = (1 0 2 1 1 1 1 1 1 2)
(1 01 1 1 1 1 1 1 1) = X_1
$X_1 M_1$ = (8 3 2 5 5 5 5 5)
(1 1 1 1 1 1 1 1) = Y_1
$Y_1 M_1^T$ = (6 0 2 1 1 7 6 6 1 8)
(1 01 1 1 1 1 1 1 1) = X_2
$X_2 M_1$ = (8 3 2 5 5 5 5 5)
(1 1 1 1 1 1 1 1) = Y_2

(Where ↰ denotes the resultant vector after thresholding and updating) If we take the attribute W_3 (i.e sexual harassment) in

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ON State and all the other attributes to be in OFF State. We notice the effect of X on the dynamical system M_1 is a fixed point given by the Binary Pair
{ (1 01 1 1 1 1 1 1 1) , (1 1 1 1 1 1 1 1)}.

Second Expert's Opinion

M_2 =

	H_1	H_2	H_3	H_4	H_5	H_6	H_7	H_8
W_1	0	0	0	0	1	0	1	1
W_2	1	0	0	0	0	0	0	0
W_3	0	1	1	0	0	0	0	0
W_4	1	1	1	0	0	0	0	0
W_5	1	0	0	1	1	1	1	1
W_6	1	1	1	1	1	1	1	1
W_7	1	0	0	1	1	1	1	1
W_8	1	0	0	1	1	1	1	1
W_9	0	0	0	0	0	0	0	0
W_{10}	1	1	1	1	1	1	1	1

The Hidden Pattern of the state vector
X = (0 0 1 0 0 0 0 0 0 0)

X M_2 = (0 1 1 0 0 0 0 0) = Y

Y M_2^T = (0 0 1 2 0 2 0 0 0 2)

(0 0 1 1 0 1 0 0 0 1) = X_1

X_1 M_2 = (3 4 4 2 2 2 2 2)
(1 1 1 1 1 1 1 1) = Y_1
Y_1 M_2^T = (3 1 1 3 6 8 6 6 0 8)
(1 1 1 1 1 1 1 1 0 1) = X_2
X_2 M_2 = (2 1 1 3 5 7 5 5 0 7)
(1 1 1 1 1 1 1 0 1) = Y_2
Y_2 M_2^T = (5 0 2 1 1 6 5 5 1 7)
(1 0 1 1 1 1 1 1 1 1) = X_3
X_3 M_2 = (6 4 4 5 6 5 6 6)
(1 1 1 1 1 1 1 1) = Y_3
Y_3 M_2^T = (6 0 2 1 1 7 6 6 1 8)
(1 0 1 1 1 1 1 1 1 1) = X_4
X_4 M_2 = (7 4 4 5 6 5 6 6)
(1 1 1 1 1 1 1 1) = Y_4
Y_4 M_2^T = (6 0 2 1 1 7 6 6 1 8)
(1 0 1 1 1 1 1 1 1 1) = X_5
X_5 M_2 = (7 4 4 5 6 5 6 6)
(1 1 1 1 1 1 1 1) = Y_5

If we take the attribute W_3 (i.e sexual harassment) in ON State and all the other attributes to be in OFF State. We notice the effect of X on the dynamical system M2 is a fixed point given by the same Binary Pair
{(1 01 1 1 1 1 1 1 1) , (1 11 1 1 1 1 1 1)}.

V. CONCLUSION

When the node W_3 (i.e sexual harassment) in ON State, we get the hidden pattern which makes all the nodes except the problem that the team management skills are not handed over to women which is not common to all women IT professionals and the rest of the nodes to be in ON State in the domain space and also makes all the nodes in the range space to be in ON State. Both in the first and second experts opinion, we find the same hidden pattern as the binary pairs. Except few IT companies, many companies are offering chances to women IT professionals as Team Lead; the only thing is they have to utilize that golden opportunity. Finally we conclude that, The following are the steps which are suggested based on our study to prevent the problems faced by women IT Professionals: Giving some rest for their eyes by taking a break in-between their work. Giving Movements for hands / legs by taking a small walk. Completing the projects in the correct deadline. Taking Balanced diet. Actively participating as Team Lead. By doing yoga, meditation etc., Regular Exercise retains energy for completing projects in time. Working actively as teams. Motivating team members for finishing the projects.

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