Analysis of Problems faced by IT Professionals using Fuzzy Linguistic Cognitive Maps

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Abstract

This Paper deals with the study of problems faced by IT Professionals using Fuzzy Linguistic Cognitive Maps. Here we analyze the problems as attributes and based on the algorithm we frame the Fuzzy Linguistic Graph along with the Fuzzy Linguistic Matrix. Finally we arrive at the Hidden Pattern as Fixed Point by using the Fuzzy Linguistic State Vector along with the help of Max-Min Composition Techniques; here we perform Max-Min operation.

Keywords: Fuzzy Linguistic State Vector, Hidden Pattern, Max-Min Composition.

1. Introduction

Nowadays IT industries play a major role as fast growing industries. In an increasingly digital world, people who produce and distribute computer software, assist with installation, and provide support services to software purchasers will be more in demand. For all these IT Professionals takes the major part of this rapid growth. Between monitoring networks, configuring applications, and managing technology projects, IT professionals spend massive amounts of time in front of the computer screen. We have collected data's and the information available is sometimes vague, sometimes inexact or sometimes insufficient. Out of several higher order fuzzy sets, intuitionistic fuzzy sets (IFS) [3,6] have been found to be highly useful to deal with vagueness. There are situations where due to insufficiency in the information available, the evaluation of membership values is not possible up to our satisfaction. Due to the some reason, evaluation of non-membership values is not also always possible and consequently there remains a part indeterministic on which hesitation survives. Certainly fuzzy sets theory is not appropriate to deal with such problem; rather IFS theory is more suitable. Out of several generalizations of fuzzy set theory for various objectives, the notion introduced by Atanassov [3] in defining intuitionistic fuzzy sets is interesting and useful.

In this paper we have discussed about the problems of IT Professionals and using that as attributes we frame the Fuzzy Linguistic Graph along with the the Fuzzy Linguistic Matrix. Then the algorithm for the method and we arrive at the hidden pattern or fixed point using Fuzzy Linguistic State Vector which is given by Kosko, B., [4] by introducing max-min operation from Max-Min Composition techniques[10] with the help of Intuitionistic fuzzy sets(IFS) by Atanassov [3]. Finally we give the conclusion based on our study.

Preliminaries

Here we discuss the Basic Definitions for our study:

Definition: 1

Let X = $\{x_1,\ldots..x_n\}$ and Y = $\{y_1,\ldots\ldots y_m\}$,($m \neq n$) be two distinct and disjoint fuzzy linguistic sets with 0.Here X is called the domain space of linguistic fuzzy terms and Y is called the range space of linguistic fuzzy terms.We denote by S a set of linguistic terms or linguistic values which are comparable and contains 0. For any $x_i \in X$, we find the relation of its effect on $y_k \in Y$. If there is no relation, we mark '0'.

Definition: 2

For the relations of every element in X on Y is described by a graph with vertices from X and Y and its edge values are form S. This graph is called Fuzzy Linguistic Graph.

Definition: 3

The Matrix $M = (m_{ij})$, $m_{ij} \in S$, $1 \leq i \leq n$ and $1 \leq j \leq m$ associated with Fuzzy Linguistic Graph is called Fuzzy Linguistic Matrix.

Definition: 4

If $T= \{(s_1,\ldots,s_n) / s_i \in S, 1 \leq i \leq n\}$ is called the fuzzy linguistic state vector associated with X. Similarly $V= \{(s_1,\ldots,s_m) / s_j \in S, 1 \leq j \leq m\}$ is called the fuzzy linguistic state vector associated with Y.

Definition: 5

Let a set E be fixed. An Intuitionistic fuzzy sets or IFS A in E is an object having the form $A=\{\langle x, \mu_A(x), \gamma_A(x)\rangle / x \in E\}$ where the function $\mu_A : E \rightarrow [0, 1]$ define the degree of membership and degree of non-membership respectively of the element $x \epsilon E$ to the set A, which is a subset of E, and for every $x \in E$, $0 \leq \mu_A(x) + \gamma_A(x) \leq 1$. The amount $\Pi_A(x) = 1-(\mu_A(x) + \gamma_A(x))$ is called the hesitation part, which may cater to either membership value or non-membership value or both.

Definition: 6

If A and B are two IFS of the set E, then $A \subset B$ if and only if $\forall x \in E$,
$[\mu_A(x) \leq \mu_B(x)$ and $\gamma_A(x) \geq \gamma_B(x)]$ $A \supset B$ iff $B \subset A$, $A = B$ iff $\forall x \in E$, $[\mu_A(x) \leq \mu_B(x)$ and $\gamma_A(x) \geq \gamma_B(x)]$, $\overline{A} = \{\langle x, \gamma_A(x), \mu_A(x)\rangle / x \in E\}$,
$A \cap B = \{\langle x, \min(\mu_A(x), \mu_B(x)), \max(\gamma_A(x), \gamma_B(x))\rangle / x \in E\}$,
$A \cup B = \{\langle x, \max(\mu_A(x), \mu_B(x)), \min(\gamma_A(x), \gamma_B(x))\rangle / x \in E\}$.
Obviously every fuzzy set has the form $\{\langle x, \mu_A(x), \mu_{A^c}(x)\rangle / x \in E\}$.

Definition: 7

Let Q(X→Y) and R(Y→Z) be two Intuitionistic Fuzzy Relations. The max-min-max composition R o Q is the intuitionistic fuzzy relations from X to Z, defined by the membership function,

μ_{RoQ} (x,z) = $\vee(\mu_Q(x,y) \wedge \mu_R(y,z))$ and the non-membership function

γ_{RoQ} (x,z) = $\wedge(\gamma_Q(x,y) \vee \gamma_R(y,z))$ $\forall$ x $\in$ (x, z) $\in$ X × Z and $\forall$ y $\in$ Y.

In this study we are using the composition as T ○ M = Max {Min $\{s_i, m_{ij}\}$} V ○ M Max {Min $\{s_j, m_{ij}\}$}.

2. Algorithm

Step: 1 Drawing Fuzzy Linguistic Graph using the Attributes.
Step: 2 Framing Fuzzy Linguistic Matrix M.
Step: 3 Choosing State Vector.
Step: 4 Finding the effect of state vector on M using Max-Min Composition Technique.
Step: 5 Repeating the Composition Technique until we get the Fuzzy Linguistic Fixed Point or Hidden Pattern.

3. Case Study

The following are the attributes in our case study:

A_1- Benching

Benching is a common process that is employed mainly in MNCs. Companies are given MNC status after it satisfies a specific criteria. One of those criteria is the number of employees. In order to show that they have the required number of employees to get the MNC status, the companies hire more people. These extra employees that they recruit are not involved in any project and they are given salary. Once the company decides to cut down their employees, these people are the ones who are targeted.

A_2- Shortage of time

At present IT companies are trying to get rid of most of their employees in order to cut down their cost and increase their profit. For this reason they are imposing tuff projects to their employees and they give very less time to complete their project. Since their time is short, employees have to work day and night in order to complete the project within the specified time. They are constantly being pressurized by the higher authorities.

A_3- High Work Target

The IT Workers fix the target to complete their projects. Even they are forced to fix for high work target by giving internal pressures.

A_4- Obsession

Our mission is to share knowledge among young IT professionals and also aim to guide students with their live/dummy projects to help them gain a vision of the industry they are going to be a part of and engaging in training and guiding aspiring IT professionals, preparing them for the industry and giving more preferences to young IT professionals.

A_5- Reduction of Salary

In order to cut down their cost, IT companies are reducing the salary given to its employees. They try to drive their employees off by giving them very low salaries. People with experience tend to resign their jobs when they are given low salaries.

A_6- Anxiety/Stress

The signs of stress can vary significantly from person to person, cognitive impairment is common. Stressed people make more mistakes. This feeling is due to too much of work and not enough time and this leads to Anxiety.

A_7- Time Limit Projects

This refers to the time limit given for completing the project. The time deadline is too short for them to complete their projects. IT Workers are in urge to complete their projects in given time.

A_8- Lack of Concentration

Because of work pressure their concentration level will be decreased and this leads to many difficulties in their job and job dissatisfaction occurs.

A_9- Sleeplessness

Shift system workers face this problem, mentally they have to prepare well in advance. Working hours even extended till late night. Lack of sleep leads to health problems.

A_{10}- Recruiting Fresher's

Since freshers agree to work for very low salaries, companies tend to recruit more freshers over experienced candidates. This effectively decreases the company's expense but it degrades the company's performance.

A_{11}-Decreased Memory

As IT Professionals are overloaded with time limit projects, they lost their memory power in one stage and they totally get confused. Because of this decreased memory they are not able to concentrate on the projects.

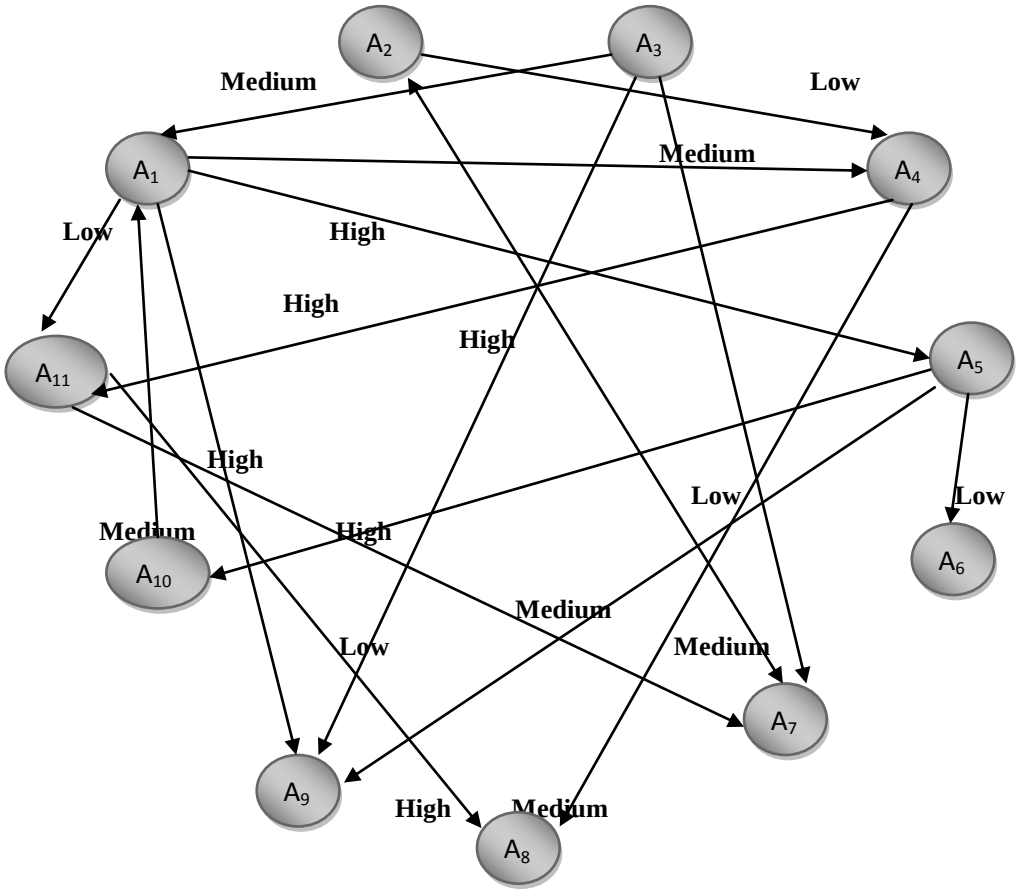

Figure:1

$$M = \begin{array}{c} \begin{matrix} \mathbf{A_1} & \mathbf{A_2} & \mathbf{A_3} & \mathbf{A_4} & \mathbf{A_5} & \mathbf{A_6} & \mathbf{A_7} & \mathbf{A_8} & \mathbf{A_9} & \mathbf{A_{10}} & \mathbf{A_{11}} \end{matrix} \\ \begin{bmatrix} 0 & 0 & 0 & Medium & High & 0 & 0 & 0 & High & 0 & 0 \\ 0 & 0 & 0 & Low & 0 & 0 & Medium & 0 & 0 & 0 & 0 \\ Medium & 0 & 0 & 0 & 0 & 0 & Low & 0 & High & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & Medium & 0 & 0 & High \\ 0 & 0 & 0 & 0 & 0 & Low & 0 & 0 & Medium & High & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & Medium & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ Medium & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & High & 0 & 0 & 0 \end{bmatrix} \end{array}$$

Fuzzy Linguistic Matrix

Suppose X = (High 0 0 0 0 0 0 0 0 0 0) be the Fuzzy Linguistic State Vector.

Only the attribute A_1 Benching is in ON State and all the other attributes are in OFF State.

$X \circ M = Max \{Min \{(X, M)\}\}$

$\longrightarrow$ (0 0 0 Medium High 0 0 0 High 0 Low) $= X_1$

$X_1 \circ M = Max \{Min \{(X_1, M)\}\}$

$\longrightarrow$ (0 0 0 0 0 Low 0 Medium Medium High Medium) $= X_2$

$X_2 \circ M = Max \{Min \{(X_2, M)\}\}$

$\longrightarrow$ (Medium 0 0 0 0 0 0 Medium 0 0 0) $= X_3$

$X_3 \circ M = Max \{Min \{(X_3, M)\}\}$

$\longrightarrow$ (0 0 0 Medium Medium 0 0 0 Medium 0 Low) $= X_4$

$X_4 \circ M = Max \{Min \{(X_4, M)\}\}$

$\longrightarrow$ (0 0 0 0 0 Low 0 Medium Medium Medium Medium) $= X_5$

$X_5 \circ M = Max \{Min \{(X_5, M)\}\}$

$\longrightarrow$ (Medium 0 0 0 0 0 0 Medium 0 0 0) $= X_6$

Therefore $X_3 = X_6$ which is a fuzzy Linguistic fixed point.

Thus X ○ M gives a Hidden Pattern which is a Fixed Point.

Suppose S = (0 Medium 0 0 0 0 0 0 0 0 0) be the Fuzzy Linguistic State Vector.

Only the attribute A_2 is in ON State and all the other attributes are in OFF State.

$S \circ M = Max \{Min \{(S, M)\}\}$

$\longrightarrow$ (0 0 0 Low 0 0 Medium 0 0 0 0) $= S_1$

$S_1 \circ M = Max \{Min \{(S_1, M)\}\}$

$\longrightarrow$ (0 Medium 0 0 0 0 0 Low 0 0 Low) $= S_2$

$S_2 \circ M = Max \{Min \{(S_2, M)\}\}$

$\longrightarrow$ (0 0 0 Low 0 0 Medium Low 0 0 0) $= S_3$

$S_3 \circ M = Max \{Min \{(S_3, M)\}\}$

$\longrightarrow$ (0 Medium 0 0 0 0 0 Low 0 0 Low) $= S_4$

Therefore $S_4 = S_2$ which is a fuzzy Linguistic fixed point

Thus S ○ M gives a Hidden Pattern which is a Fixed Point.

Suppose Y = (0 0 0 0 0 0 0 0 0 High 0) be the Fuzzy Linguistic State Vector.

Only the attribute A_{10} is in ON State and all the other attributes are in OFF State.

$Y \circ M = Max \{Min \{(Y, M)\}\}$

$\longrightarrow$ (Medium 0 0 0 0 0 0 0 0 0 0) $= Y_1$

$Y_1 \circ M = Max \{Min \{(Y_1, M)\}\}$

$\longrightarrow$ (0 0 0 Medium Medium 0 0 0 Medium 0 Low) $= Y_2$

$Y_2 \circ M = Max \{Min \{(Y_2, M)\}\}$

$\longrightarrow$ (0 0 0 0 0 Low 0 Medium Medium Medium Medium) $= Y_3$

$Y_3 \circ M = \text{Max}\{\text{Min}\{(Y_3, M)\}\}$

$\longrightarrow$ (Medium 0 0 0 0 0 0 Medium 0 0 0) $= Y_4$

$Y_4 \circ M = \text{Max}\{\text{Min}\{(Y_4, M)\}\}$

$\longrightarrow$ (0 0 0 Medium Medium 0 0 0 Medium 0 Low) $= Y_5$

Therefore $Y_5 = Y_2$ which is a fuzzy Linguistic fixed point

Thus $Y \circ M$ gives a Hidden Pattern which is a Fixed Point.

Conclusion

In this paper we have discussed three cases, in the first case we have taken the attribute benching alone in ON state. Then the fuzzy linguistic fixed point is given by benching is medium and lack of concentration is medium and all other attributes are in OFF state. In second case , we have taken Shortage of time alone in ON state, then the the fuzzy linguistic fixed point is given by Shortage of time is medium, lack of concentration is low, Decreased Memory is Low as the hidden pattern and all other attributes are in OFF state. In the last case, we have taken Recruiting Fresher's alone in ON state, then Obsession is Medium, Reduction of Salary is Medium, Sleeplessness is medium and Decreased Memory is Low as the hidden patterns. Similarly we can extend and take the remaining attributes in ON state and observe the corresponding hidden patterns.

This may vary if we choose ON state as High, Medium and Low. In the first case if benching is in ON condition, this will leads to lack of concentration. And in the second, Shortage of time in ON condition leads to lack of concentration and Decreased Memory and in the last case Recruiting Fresher's gives way to Obsession, Sleeplessness and Decreased Memory. The remedies for these pressures in IT field as follows:

- Taking enough sleep and rest to maintain your energy levels.
- Giving rest by taking regular short walks outside in-between the break timings.
- By taking healthy, balanced diet
- By taking Breathing methods, meditation, and relaxation techniques can be especially helpful for stress reduction.
- By Completing the time limited Projects well in advance and makes it ready.

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