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A Study of Pervasive Computing Environments in Improving the Quality of Life Using Induced Linked Fuzzy Relational Maps (ILFRMs)

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Abstract - The values in the society can be acquired using education. Education can be used as a tool in shaping character, confidence and personality etc., In this paper we use pervasive computing environments, in improving a better and quality life. Using Induced Linked Fuzzy Relational Map (ILFRM) the impact of computer education among the students on job opportunity in improving the quality of life is analyzed. This paper has four sections. In section one wegive an introduction. In Section two we recall the definition of Induced Linked Fuzzy Relational Map. Section three is deals with the methods of finding the hidden pattern in ILFRM and analysis of Computer education using Induced Linked Fuzzy Relational Map. In the final section we give the conclusion based on our study.

Keywords - Computer Education, Quality life, Pervasive Computing, Fuzzy Relational Maps, Induced Linked Fuzzy Relational Maps.

I. INTRODUCTION

The computer technology has a deep impact on education. Computer education forms a part of the school and college curricula, as it is important for every individual today, to have the basic knowledge of computer. Computers have been a significant part of the student's education since the early 1980s. Although computer technology has become much more pervasive since then, people often wonder why we need to learn computer use in school. An analysis of computer technology in schools showed that those who learned with computers showed above-average results on standardized achievement. This education leads to Quality life. It is important to note that.i.e.,"New information and communications technologies can improve the quality of life for people with disabilities, but only if such technologies are designed from the beginning so that everyone can use them. Given the explosive growth in the use of the World Wide Web for publishing, electronic commerce, lifelong learning and the delivery of government services, it is vital that the Web be accessible to everyone.[19], In 1999 Andrea kavanaugh[1]came out with a study on "The impact of computer networking on community" in which he analyzed the relationship between computer networks, social network and civic engagement in geographic community. In 2000 Paul Taenzer[12]came out with a study on "Impact of computerized quality of life screening on physician behavior and patient satisfication in lung cancer out patients". In 2002, RonetteL.Kolotkin & Ross D. Crosby[14] came out with a study on "Psychometric evaluation of the impact of weight on quality of life", in which he analyzed life is a 31-item, self-report, obesity-specific measure of health related quality life that consist of a total score and score on each of five scales – physical function, self-esteem, sexual life, public distress, and work. Mercy N. Fodje[10]came out with a study on "Impact of technology to education in the developing country", in which he analyzed, difference between technological development and human development after reworked the indigenous cultures and promote human values.In 2007 Gough [4] came out with a study on "Wellbeing in development countries: from theory to research", in which he analyzed well-being as 'what people are nationally able to do and to be, and what they have actually been able to do and to be'. In 2008, Robert D. Atkinson & Daniel D. [13] came out with a study on "Digital quality life", in which he analyzed the understanding the personal & social benefits of the information technology. Konsbruck Robert Lee[9], "Impact of Information Technology on society in the new century", in which he analyzed information technology and electronic commerce on business model, commerce, market structure, workplace, labor market, education is promote a quality of life, In 2008 Angner[2] came out with a study on "The philosophical foundations of subjective measures of well-being", Schalock said that "Quality of life is a concept that reflects a person's desired conditions of living related to eight core dimensions of one's life: emotional well-being, interpersonal relationships, marital well-being, personal development, physical well-being, self-determination, social inclusion and rights. Therefore, education is a one tool to promote the quality life. We shall discuss the computer education that how its play a vital role for our quality life.

A. Basic Notation and Definitions

a) Fuzzy Relational Maps (FRMs)

The new notation called Fuzzy Relational Maps (FRMs) was introduced by Dr. W.B. Vasantha and Yasmin Sultana in the year 2000. In FRMs we divide the very casual associations into two disjoint units, like for example the relation between the teacher and a student or relation employee and employer or a relation between the parent and the child in the case of school dropouts and so on. Thus for us to define an FRM we need a domain space and a range space which are disjoint in the sense of concepts. We further assume no intermediate relations exist within the domain and the range space. The number of elements in the range space need not in general be equal to the number of elements in the domain space. In our discussion the

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

i. Definition

A FRM is a directed graph or a map from D to R with concepts like policies or events etc as nodes and causalities as edges. It represents causal relations between spaces D and R.

Let D_i and R_j denote that the two nodes of an FRM.

The directed edge from D_i to R_j denote the causality of D_i on R_j called relations. Every edge in the FRM is weighted with a number in the set$\{0,\pm1\}$. Let e_{ij} be the weight of the edge D_iR_j, $e_{ij}\in\{0,\pm1\}$. The weight of the edge D_iR_j is positive if increase in D_i implies increase in 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.

ii. Definition

When the nodes of the FRM are fuzzy sets then they are called fuzzy nodes. FRMs with edge weights $\{0,\pm1\}$ are called simple FRMs.

iii. Definition

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. Let the matrix E be defined as $E=(e_{ij})$ where e_{ij} is the weight of the directed edge D_iR_j (or R_jD_i), E is called the rational 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 range space. This is one of the marked differences between FRMs and FCMs.

iv. Definition

Let $D_1,\ldots,D_n$ and $R_1,\ldots,R_m$ denote the nodes of the FRM. Let $A=(a_1,\ldots,a_n)$ $a_i\in\{0\pm1\}$. A is called the instantaneous stage vector of the domain space and it denotes the ON-OFF off position of the nodes at any instant. Similarly let B = $(b_1,\ldots,b_m)$ $b_i\in\{0,\pm1\}$. B is called instantaneous stage vector of the range space and it denotes the ON-OFF position of the nodes at any instant $a_i = 0$ if a_i is OFF and $a_i = 1$ if a_i is ON for i = 1,2,…,n Similarly, $b_i =0$ if b_i is OFF and $b_i = 1$ if b_i is ON, for i = 1,2,…,m.

v. Definition

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

vi. Definition

An FRM with cycles is said to be an FRM with feedback.

vii. Definition

When there is a feedback in the FRM, i.e., when the causal relation flow through a cycle in a revolutionary mannar, the FRM is called a dynamical system.

viii. Definition

Let D_iR_j (R_jD_i), $1 \le j \le m$, $1 \le i \le n$. When R_i (or D_j) is switched on and if causality flows through edges of the cycle and if it again causes R_i (or D_j), we say that the dynamical system goes round and round. This is true for any node R_j (or D_i) for $1 \le j \le m$ (or $1 \le i \le n$). The equilibrium stage of this dynamical system is called the hidden pattern.

ix. Definition

If the equilibrium state of a dynamical system is a unique stage vector, then it is called a fixed point. Consider an FRM with $R_1,R_2,\ldots,$ R_m and $D_1,D_2,\ldots D_n$ 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) i.e. the stage vector remains as (1, 0,…,0,1) in R (or 1,0,0,…,0,1) in D). This state vector is called the fixed point.

x. Definition

If the FRM settles down with a state vector repeating is in the form $A_1\to A_2\to A_3\to\ldots\to A_i\to A_1$ (or $B_1\to B_2\to\ldots\to B_i\to B_1$) then this equilibrium is called a limit cycle. Now we give the methods of determining the hidden pattern.Let R_1, R2,…,R_m and $D_1,D_2,\ldots,D_n$ be the nodes of a FRM with feedback. Let E be the relational matrix. Let us find a hidden pattern when D_i is switched on i.e. when an input is given as vector A_1 = (1,0,…,0) in D_1, the data should pass through the relational matrix E. This is done by multiplying A_1 with the relational matrix E. Let $A_1E = (r_1,r_2,\ldots,r_m)$. After thresholding and updating the resultant vector we get $A_1E\in R$. Now let $B=A_1E$, we pass on B into E^T and obtain BE^T. We update and threshold the vector BE^T so that $BE^T\in D$. This procedure is repeated till we get a limit cycle or a fixed point.

b) Linked Fuzzy Relational Maps (LFRMs)

Two FRMs represented by a relational matrix, say E_1 of order *m* x *n* and E_2 of order *n* x *t* can be linked to form a new relational matrix E of order *m* x *t*. There may not be direct relationship between the domain space of relational matrix E_1 and the range space of E_2 but certainly we could find out the hidden pattern in the Linked FRMs

II. METHOD OF FINDING THE HIDDEN PATTERN OF INDUCED LINKED FUZZY RELATIONAL MAPS (ILFRMS)

Let $R_1,\ldots,R_m$ and $D_1,\ldots,D_n$ be the nodes of a FRM with feed back. Let M be the ralational matrix. Let us find a hidden pattern when D_1 is switched on. We pass the stage vector C_1 through the connection matrix M. A particular attribute, say, D_1 is kept in ON state and all other components are kept in OFF stage. Let $C_1\circ M$ yields, C_1. To convert to signal function, choose the first two highest values to ON state and other values to OFF state with 1 and 0 respectively. We make each component of C_1 vector pass through M repeatedly for each positive entry 1 and we use the symbol(≈). Then choose that vector which contains the maximum number of 1's,that

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which causes maximum attributes to ON state and call it, say, C_2. Suppose that there are two vectors with maximum number of 1's in ON state, we choose the first vector. Repeat the same procedure for C_2 until we get a fixed point or a limit cycle. We do this process to give due importance to each vector separately as one vector induces another or many more vectors into ON state. We get the hidden pattern. We observe a pattern that leads one cause to another and may end up one vector or a cycle.Next we choose the vector by keeping the second component in ON state and repeat the same to get another cycle and it is done for all the vectors separately. We observe the hidden pattern of some vectors found in all or in many cases. Inference from this hidden pattern summarizes or highlights the causes.

A. Analysis using Induced ILFRM

We take the following attributes related to the Impact of Computer Education among the Students:
E_1-Increasing creative/tolerance power
E_2 - Developing the knowledge
E_3 - More values in the society
E_4 - Increasing efficiency
E_5 - Giving more job opportunity
E_6 - Entering into research area
E_7 - Learn how to enjoy in the real world
E_8 - Create a new technology

We take the following attributes related to job opportunity of computer technology:

C_1 -Space/Scientific research area
C_2 - Telecommunication/mobile networks
C_3 - Education
C_4 - Traffic/air trafficControlling
C_5 - Media/animation
C_6 - Business
C_7 - Product of Material/companies
C_8 - Software creation
C_9 - Submarines/defense
C_{10}- Robotics

We take the following attributes related to dimensions of quality life.
L_1-Physical well-being
L_2-Material well-being
L_3-Social well-being
L_4-Emotional well-being
L_5-Personal development
L_6-Self-determination
L_7-Activity
L_8-Inter-personal relationship

According to the expert opinion we present the following relation between the domain (impact of computer education) and range (available job opportunities of computer) attributes and its relational matrix

$$\begin{array}{c} \\ ET = \end{array} \begin{array}{c} T_1\ T_2 T_3\ T_4\ T_5\ T_6\ T_7\ T_8\ T_9\ T_{10} \\ \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

According to another expert opinion we present the following relation between the domain (available job opportunities of computer) and range (domains of quality life) attributes and its relational matrix

$$\begin{array}{c} \\ TC = \end{array} \begin{array}{c} C_1\ C_2\ C_3\ C_4\ C_5\ C_6\ C_7\ C_8 \\ \begin{bmatrix} 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

In Linked FRM, the relation between the impact of computer education and quality life attributes are combined and the resultant connection matrix is given below. We name it as M.

$$\begin{array}{c} \\ M = \end{array} \begin{array}{c} C_1\ C_2\ C_3\ C_4\ C_5\ C_6\ C_7\ C_8 \\ \begin{bmatrix} 1 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

Suppose we have the state vector X=(10000000) i.e., the attribute E_1 alone is in the ON state and all other nodes are in the OFF state. The effect of X on the dynamical system M is given by

Let X= (10000000)
XM=(10100010);
$(10100010)M^T$=(32322222)
↳ (11111111)=X_1
$X_1M \approx$ (10000000) M= (10100010);
$(10100010)M^T$ = (32322222)
↳(11111111) =X_2
(01000000)M= (01111111);
$(01111111)M^{T=}$ (27522432)
↳(11111111)
(00100000)M= (11101110);
(11101110) M^T = (35422533)
↳(11111111)
(00010000)M = (00100010);
(00100010) M^T= (22222121)
↳(11111111)
(00001000) M= (00100010);
(00100010) M^T= (22222121)
↳(11111111)

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(00000100) M= (11101100);
(11101100) M^T= (24511523)
↳(11111111)
(00000010) M= (01100010);
(01100010)M^T= (23322231)
↳(11111111)
(00000001) M= (10101000);
(10101000)M^T= (22311313)
↳(11111111)
X_2M= (44814361)
↳(11111111)

We repeat this process until we get all the attributes of dimensions of quality of life is ON state.Using the row representation on M namely D_1,D_2, we get the triggering pattern as $P_1 \Longrightarrow P_2$ when the first attribute is kept in ON state and all attributes resulting in ON state at the end.

III. CONCLUSION

A broad area of our study, impact education is related to the many more job opportunities in the world, it leads to the dimension of quality of life. But in there are certain problems and defect occurring in the computer education. Therefore we improvethe education using some technical, technological and modify the educational curriculum for better quality of life.To find the peak age group of computer user in the pervasive computing environments and what are the problems faced by system users.We will analyze what are the reasons will de promote to the School/College students when study of computer education.A study of computer education is connected with the emotions in the pervasive computing environments.

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