Integrated Intelligent Research (IIR)

International Journal of Computing Algorithm
Volume: 03 Issue: 02 June 2014 Pages:110-113
ISSN: 2278-2397

On the Health Hazards of the Sugarcane Using IFRM Model

T.Pathinathan[1],S.Johnson Savarimuthu[2]
[1]Department of Mathematics, Loyola College, Chennai, India
[2]Department of Mathematics, St. Joseph's College, Cuddalore, India
Email: johnson22970@gmail.com

Abstract- In this paper, we use Induced Fuzzy Relational Mappings (IFRM) to analyze the problem of health hazards faced by the sugarcane cultivators due to chemical pollution. Based on our study, we made conclusions and suggest some remedial measures.

Keywords: Health Hazards, FRM,IFRM,Fixed Point, Limit Cycle, Hidden Pattern

I. INTRODUCTION

Fuzzy Models are mathematical tools. They have been introduced to study and analyze political decisions, neural networks, social problems etc., [1,2,6]. Among the various fuzzy models, some of the important models which have been used to study these problems are Fuzzy Associative Memories(FAM), Fuzzy Cognitive Maps(FCM), Fuzzy Relational Maps(FRM) and Bi-directional Associative Memories(BAM)[3,4]. The FRM model was introduced because this model is more applicable when the data in the first place is an unsupervised one. It is used to model several types of problems varying from gastric appetite behavior, popular political development etc. It is also used to model in robotics like plant control. This model works on the opinion of experts.These models have been used to study various social problems. In particular, the problem of health hazards caused by chemical industries, the causes for school dropouts which ultimately lead to child labour have been studied in the literature. In order to bring out much stronger relationship among the attributes, a new modes called Induced Fuzzy Relational Maps(IFRM)was proposed[5]

Many agriculture labourers are affected by health hazards due to chemical pollutions. As most of the chemicals applied for the eradication of pests and different diseases can cause serious health hazards, it will be wiser to plant variety of crops that can resist diseases and pests. Pesticides are particularly hazardous for farmers and farm workers. There are no comprehensive systems for tracking pesticide illnesses, and research shows that farmers and farm workers face risks of both short-term poisonings and long-term illness. Pesticides can be dangerous if they are working in fields that have been treated or sprayed with them or when handling and applying them. Pesticides can enter our body in many ways. Simple contact through skin and clothes is one of the main ways that chemicals enter our body. Another way is through breathing mist, dust, fumes or smoke containing pesticides and chemicals.In this paper, we use Induced Fuzzy Relational Mappings (IFRM) to analyze the problem of health hazards faced by the agricultural labourers especially the sugarcane cultivators due to chemical pollution. In order to make an analysis of these we have taken sample study from fifteen villages in cuddalore district. The data was gathered from these people by using a linguistic questionnaire and this linguistic questionnaire consisting of casual associations was transformed into a fuzzy data. Based on our study, we made conclusions and suggest some remedial measures.This paper has been organized as follows: After giving the introduction in section 1, we give the basic notions and definitions relevant to this paper in section 2. The description of the problem is given in Section 3 and in section 4 we analyze the problem using IFRM. In section 5 we draw the conclusions from our study and propose remedial measures.

II. FUZZY RELATIONAL MAPS (FRM)

Initially the casual associations are divided into two disjoint units. To define a Fuzzy Relational map these two disjoint units are taken as a domain space and a range space. Here the term disjoint we mean the sense of concepts which we have taken. Further it is assumed that no intermediate relations exist among the domain elements itself and within the elements of the range space. In general, the number of elements in the range space need not be equal to the number of elements in the domain space. In this discussion, the elements of the domain space are taken from the real vector space of dimension n and that of the range space are from the real vector space of dimension m. That is, $m \neq n$. These domain space and the range space is denoted by D and R respectively. Thus $D=\{D_1,D_2,\ldots,D_n\}$ is the domain space, where each $Di=[(x_1,x_2,\ldots,x_n)/x_i=0 \text{ or} 1]$, for $i=1,2,\ldots,n$. similarly $R=\{R_1,R_2,\ldots R_m\}$ is the range space, where $R_i=\{(x_1,x_2,\ldots,x_m)/x_j=0 \text{ or } 1\}$, for $i=1,2,\ldots,m$.

A. 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 casual relations between spaces D and R. let Di and R_j denote the two nodes of a FRM. The directed edge from D to R denotes the causality of D on R, called relation. Every edge in the FRM is weighted with the number from the set {0,1}. Let e_{ij} be the weight of the edge D_iR_j, $e_{ij} \in \{0,1\}$.

The weight of the edge D_iR_j =1 if increase in D_i implies increase in $R_j$or decrease in Di implies decrease in R_j and that of D_iR_j=0 if Di does not have any effect on R_j. The cases when increase in Di implies decrease in R_j or decrease in Di implies increase in R_j are not taken here for discussion.

B. Definition

If the nodes of the Fuzzy Relational Mappings are fuzzy sets, then they are called fuzzy nodes.

International Journal of Computing Algorithm
Volume: 03 Issue: 02 June 2014 Pages:110-113
ISSN: 2278-2397

C. Definition

If the edge weights of Fuzzy Relational Mappings are only {0,1}, then they are called simple Fuzzy Relational Mappings

D. Definition

Let $D_1,\ldots,D_n$ be nodes of the domain space D and let $R_1,\ldots,R_m$ be the nodes of the range space R for a Fuzzy Relational Mapping. The relational matrix M for this Fuzzy Relational Mapping model is defined as $M=(e_{ij})$ where e_{ij} is the weight of the directed edge $D_i R_j$(or $R_j D_i$). Let $A = (a_1,\ldots a_n),a_i \epsilon \{0,1\}$. A is called the instantaneous state vector of the domain space and it denotes the ON-OFF position of the nodes at any instant. Similarly let $B = (b_1,\ldots,b_m)$, $b_i \epsilon \{0,1\}$. B is called the instantaneous state vector of the range space and it denotes the ON-OFF position of the nodes at any instant. a_i =0 or 1 if ai is ON or OFF respectively, fori = 1,…..,n. similarly b_i=0 or 1 if bi is ON or OFF respectively, for I = 1,…..m.cycle of a FRM-Every Fuzzy Relational Mapping can be viewed as a directed bipartite graph. If this bipartite graph has a directed cycle, then we say that the corresponding Fuzzy Relational Mapping has directed cycle.

E. Definition

Feedback in FRM -A Fuzzy Relational Mapping with cycles is said to have a feedback.

F. Definition

Dynamical System-If there is a feedback in the Fuzzy Relational Mapping, that is, if there are casual relations flow through a cycle in a revolutionary manner, then we say Fuzzy Relational Mapping model is said to be dynamic.

G. Definition

Hidden Pattern-Let D_iR_j (or $R_j D_i$), 1<j<m, 1<i<n. when R_j (or D_i) is switched ON and if causality flows through edges of the cycle and if it again causes $R_i(D_j)$, then it is said that the dynamical system goes round and round. This is true for any node R_j(or D_j) for 1<i<m, (or 1<j<n). the equilibrium state of this dynamical system is called the hidden pattern.

H. Definition

Fixed point -If the equilibrium state of the dynamical system is a unique state vector, then it is called a fixed point. Consider a FRM with $R_1,\ldots,R_m$ and $D_1,\ldots D_n$ as nodes. For example, start the dynamical system by switching on R_1 or D_1. Also assume that the FRM settles down with R_1 and R_m(orD_1 and D_n) ON, that is, the state vector remains as (1,0,….,0,1) in R [or (1,0,…0,1)in D], this state vector is called the fixed point.

I. Definition

Limit cycle-If a Fuzzy Relational Mapping settles down with a state vector repeating in the form A_1 $A_2\ldots A_i$ (or B_1 $B_2\ldots B_i\ldots B_1$), then this equilibrium is called a limit cycle.

Determination of hidden pattern:Let R_1 …..,R_m and $D_1,\ldots,D_n$ be the nodes of a FRM with feedback. Let M be the relational matrix. Find a hidden pattern when D_1 is switched ON, that is, when an input is given as vector A_1 = (1000….0) in D the data should pass through the relational Matrix M. This is obtained by multiplying A_1 with the relational matrix M. Let A1M = $(r_1,\ldots,r_m)$.

After teresholding andupdating the resulting vector A_1M, we get a vector B. Now we pass on B into M^T to obtain BM^T. We update and threshold the vector BM^Tso that the thresholded BM^T is equal to D. This procedure is repeated till we get a limit cycle or a fixed point.

III. DESCRIPTION OF THE PROBLEM

Sugarcane is the most cultivated crop in tamilnadu. Sugarcane is used as a main grocery in many types of food. The cultivation of sugarcane is done mainly by the farmer belonging to southern region. Unfortunately lot of risk factor is involved in the cultivation of sugarcane. During the process of cultivation, the farmers are affected by many health hazards and these diseases are taken as the attributes for the domain space of the IFRM model and the process of cultivation of sugarcane has different stages. The different types of works at different stages are taken as the attributes for the range space of a IFRM model.

Thus the attributes for the domain space D are:

D_1: Asthma
D_2: Dermatitis
D_3: Respiratory distress
D_4: Nasal discharges
D_5: Pneumonia
D_6: Insect bites
D_7: snake bites
D_8: Fever
D_9: Irritation in Eye
D_{10}: Dust allergy
D_{11}: Wound injuries
D_{12}: Inhalation of toxic pesticides

The attributes for the range space R are:

R_1: Pudding
R_2: Adding minerals before planting
R_3: Plantation of sugarcane transplants
R_4: Adding chemical fertilizer
R_5: Removal of weeds
R_6: Protecting the sugarcane plants from other animals
R_7: Controlling microbial diseases
R_8: Harvesting
R_9: Transportation to sugar mills
R_{10}: Burning of weeds

Expert opinion is obtained through some relationship between the set of diseases and the different types of works at different stages. the concepts in the domain space are taken as $D_1,\ldots,D_{12}$ and the attributes in the range space are taken as $R_1,\ldots,R_{10}$ and thus the connection matrix is given as follows:

M =

	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}
D_1	1	1	0	0	1	1	1	1	0	0
D_2	0	0	0	1	1	1	0	0	1	0
D_3	1	1	0	0	1	1	0	1	0	0
D_4	1	1	0	0	1	1	0	1	0	0
D_5	1	1	0	0	1	1	0	1	0	0
D_6	0	1	0	1	0	1	0	0	0	0
D_7	0	0	1	0	0	0	1	1	1	0
D_8	1	1	1	1	1	0	0	1	0	1
D_9	1	1	1	1	1	1	1	0	1	1
D_{10}	0	0	0	1	1	0	1	0	1	1
D_{11}	1	0	1	1	1	0	1	0	1	0
D_{12}	0	1	0	1	0	1	0	0	0	0

Figure:1

International Journal of Computing Algorithm
Volume: 03 Issue: 02 June 2014 Pages:110-113
ISSN: 2278-2397

IV. ANALYSIS USING INDUCED FRM

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 relational matrix.The hidden pattern of an IFRM when D1 is switched on is obtained asfollows. Initially, pass the state vector C1 through the Connection matrix M. A particular attribute, say, D1 is kept on ON state and all other components are kept on OFF state. Let C1M yield C'_1. to convert this into a signal function, choose the first two highest values to ON state and other values to OFF state with 1 and 0 respectively. Now allow each component of the vector C'_1 through M repeatedly for each positive entry 1 and the symbol → is used to convert into signal function. Then choose a vector which contains the maximum number of 1´s. that is, a vector which causes the maximum number of attributes to ON state, then choose the first vector as C_2. if two or more vectors with maximum number of 1's are on ON state, then choose the first vector as C_2. Repeat the same procedure for C_2 till a fixed point or a limit cycle is obtained.

Tis process is done to give due importance to each vector separately as one vector induces another or many vectors into ON state. Thus the hidden pattern either from the limit cycle or from the fixed point is obtained. One can observe a pattern which leads one cause to another and it ends up, may be in one vector or a cycle. Next choose the vector by keeping the second component on ONstate and repeat the same procedure to get another cycle and it is repeated for all the vectors separately. The hidden pattern of some On The Health Hazards of The Sugarcane Cultivators Using IFRM Model 7 vectors found in all or in many cases is observed. Inference from this hidden pattern summarizes or highlights the causes.

Let the input be

C_1 = (1 0 0 0 0 0 0 0 0 0 0 0)
Now (1 0 0 0 0 0 0 0 0 0 0 0)
M = (1 1 0 0 1 1 1 1 0 0 0)
→ (1 1 0 0 1 1 1 1 0 0)
(1 1 0 0 1 1 1 1 0 0)

M^T = (6 2 5 5 5 2 2 4 5 2 3 2)
→ (1 0 1 1 1 0 0 0 1 0 0 0) = C'_1

The new vectors areC_1^1 = (1 0 0 0 0 0 0 0 0 0 0 0)
C_1^2 = (0 0 1 0 0 0 0 0 0 0 0 0)
C_1^3= (0 0 0 1 0 0 0 0 0 0 0 0)
C_1^4= (0 0 0 0 1 0 0 0 0 0 0 0)
C_1^5= (0 0 0 0 0 0 0 0 1 0 0 0)

Case: 1
$C_1^{(1)}$M= (1 0 0 0 0 0 0 0 0 0 0)
M= (1 1 0 0 1 1 1 1 0 0)
→(1 1 0 0 1 1 1 1 0 0)
(1 1 0 0 1 1 1 1 0 0)
M^T= (6 2 5 5 5 2 2 4 5 2 3 2)
→ (1 0 1 1 1 0 0 0 1 0 0 0)
SUM is 5

Case: 2
$C_1^{(2)}$M = (0 0 1 0 0 0 0 0 0 0 0 0)
M = (1 1 0 0 1 1 0 1 0 0)
→ (1 1 0 0 1 1 0 1 0 0)
(1 1 0 0 1 1 0 1 0 0)
M^T = (5 2 5 5 5 2 1 4 4 1 2 2)
→ (1 0 1 1 1 0 0 1 1 0 0 0)
SUM is 6

Case: 3
$C_1^{(3)}$M = (0 0 0 1 0 0 0 0 0 0 0 0 0)
M = (1 1 0 0 1 1 0 1 0 0)
→ (1 1 0 0 1 1 0 1 0 0)
(1 1 0 0 1 1 0 1 0 0)
M^T = (5 2 5 5 5 2 1 4 4 1 2 2)
→ (1 0 1 1 1 0 0 1 1 0 0 0)
SUM is 6

Case : 4
$C_1^{(4)}$M = (0 0 0 0 1 0 0 0 0 0 0 0)
M = (1 1 0 0 1 1 0 1 0 0)
→ (1 1 0 0 1 1 0 1 0 0)
(1 1 0 0 1 1 0 1 0 0)
M^T = (5 2 5 5 5 2 1 4 4 1 2 2)
→ (1 0 1 1 1 0 0 1 1 0 0 0)
SUM is 6

Case: 5
$C_1^{(5)}$M= (0 0 0 0 0 0 0 0 1 0 0 0)
M= (1 1 1 1 1 1 1 0 1 1)
→ (1 1 1 1 1 1 1 0 1 1)
(1 1 1 1 1 1 1 0 1 1)
M^T= (5 4 4 4 4 3 3 6 9 5 6 3)
→ (0 0 0 0 0 0 0 1 1 0 1 0)
SUM is 3

Therefore the new input vector C_2 to be multiplied with M is:
(1 0 1 1 1 0 0 1 1 0 0 0)
Now C_2M = (1 0 1 1 1 0 0 1 1 0 0 0)
M = (6 6 2 2 6 5 2 5 1 2)
→ (1 1 0 0 1 1 0 1 0 0)
(1 1 0 0 1 1 0 1 0 0)
M^T = (5 2 5 5 5 2 1 4 4 1 2 2)

→ (1 0 1 1 1 0 0 1 1 0 0 0) = C'_2The new vectors are
$C_2^{(1)}$ = (1 0 0 0 0 0 0 0 0 0 0 0)
$C_2^{(2)}$ = (0 0 1 0 0 0 0 0 0 0 0 0)
$C_2^{(3)}$= (0 0 0 1 0 0 0 0 0 0 0 0)
$C_2^{(4)}$= (0 0 0 0 1 0 0 0 0 0 0 0)
$C_2^{(5)}$= (0 0 0 0 0 0 0 1 0 0 0 0)
$C_2^{(6)}$= (0 0 0 0 0 0 0 0 1 0 0 0)

Repeating the above process, we get the new input vector C_3 to be multiplied with M as:

(1 0 1 1 1 0 0 1 1 0 0 0)
Now C_3M = (1 0 1 1 1 0 0 1 1 0 0 0)
M = (6 6 2 2 6 5 2 5 1 2)
→ (1 1 0 0 1 1 0 1 0 0)
(1 1 0 0 1 1 0 1 0 0)

M^T = (5 2 5 5 5 2 1 4 4 1 2 2)
→ (1 0 1 1 1 0 0 1 1 0 0 0) = C'_3=C'_2

Therefore the pair of limit point is:
(1 0 1 1 1 0 0 1 1 0 0 0) (1 1 0 0 1 1 0 1 0 0) →

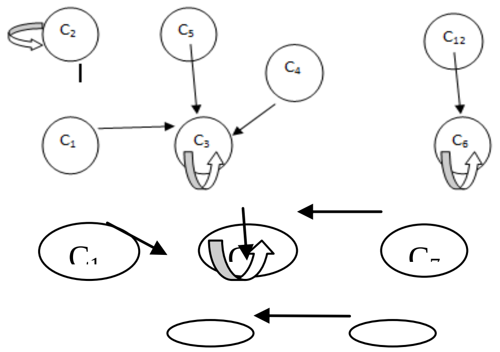

Figure 1. The Graph for the Triggering Patterns

For various input vectors, we get different triggering patterns and all these triggering patterns are given in the table. The triggering patterns for these limit points are shown in figure 1

Table:1.

S.no	Input Vector	Limit Point	Triggering Pattern
1	(100000000000)	(1100110100)(101110011000)	$C_1 \to C_3 \to C_3$
2	(010000000000)	(0001101010)(010000001110)	$C_2 \to C_2 \to C_2$
3	(001000000000)	(1100110100)(101110011000)	$C_3 \to C_3 \to C_3$
4	(000100000000)	(1100110100)(101110011000)	$C_4 \to C_3 \to C_3$
5	(000010000000)	(1100110100)(101110011000)	$C_5 \to C_3 \to C_3$
6	(000001000000)	(0100110000)(111111011001)	$C_6 \to C_6 \to C_6$
7	(000000100000)	(1011101010)(000000001010)	$C_7 \to C_{11} \to C_{11}$
8	(000000010000)	(1011101010)(000000001010)	$C_8 \to C_9 \to C_{11} \to C_{11}$
9	(000000001000)	(1011101010)(000000001010)	$C_9 \to C_{11} \to C_{11}$
10	(000000000100)	(1011101010)(000000001010)	$C_{10} \to C_{11} \to C_{11}$
11	(000000000010)	(1011101010)(000000001010)	$C_{11} \to C_{11} \to C_{11}$
12	(000000000001)	(0100110000)(111111011001)	$C_{12} \to C_6 \to C_6$

V. CONCLUSION

Through the analysis using IFRM Model we observed that the main diseases which affect the sugarcane cultivators are respiratory distress (D_3)and wound injuries (D_{11})while they are doing cultivation like Pudding (R_1), Adding minerals before planting (R_2), Removing the weeds (R_5) and protecting the sugarcane plants from other animals (R_6). Based on the above conclusion we suggest the following: Working conditions should be improved and the health hazard reduced through increased mechanization where possible. Ergonornicinterventions to organize the work and working equipment and systematic training of the body and its movements to ensure good working methods are essential.Necessary medical preventive methods should be strictly applied including the introduction of first aid instruction, the provision of treatment facilities and medical surveillance of workers.Improvement of housing, sanitary standards, accessible potable water, nutritional environment hygiene and economic stability are essential for the quality of sugarcane field workers.Uses of protective equipment as long rubber boots, mask, gloves, and glasses have big values in protecting against different parasites and chemical agents.

REFERENCES

[1] Balasangu.K.,Thirusangu.K. and Rajkumar Dare.V, (2007), "A Fuzzy Approach on The Analysis of Health Hazards Faced by the Agriculture Labourers Due to Chemical Pollutions", Proceedings of the Indian Conference on Intelligent Systems, (Allied Publishers), pp.123 – 128,.
[2] Klir.G.J and Folger.T.A., (1998), Fuzzy sets, "Uncertainty and Information", Prentice Hall, New Jersey.
[3] Kosko.,B.,(1988), "Bidirectional Associative Memories",IEEE Transactions on Systems, Man and Cybernetics, SMC., pp. 1849-60.
[4] Kosko.B. 2001, "Neural Networks and Fuzzy Systems", Prentice Hall of India.
[5] Pathinathan.T.,Thirusangu.K and Mary John, (2005), "On Causes for School Dropouts-A Fuzzy Approach, ActaCiencia Indica",31 m,(4), 1279-1299.
[6] Zadeh.L.A, (1965), Fuzzy Sets, Information Control, (8), pp. 338-353.