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A STUDY ON THE VALUES IN A FAMILY USING THE NEW TRIANGULAR FUZZY COGNITIVE RELATIONAL MAPS (TrFCRM)

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Abstract: The main objective of this paper is to introduce a new fuzzy bimodel called Triangular Fuzzy Cognitive Relational Maps (TrFCRM). This model gives both the causal relationship as well the ranking of the attributes in the system involved. Using this bimodel an analysis is made on the values in a family across three generations and whether the present generation parents have succeeded in implanting the basic values in the children or not. As the importance a person gives for the basic values in his day to day life is subjective from person to person, fuzzy logic can be applied to study this problem. Based on this study conclusions are derived. The first section is of introductory nature. The second section gives the description of the problem of study. The third section derives the definitions and method of determining the hidden pattern by the TrFCRM. The fourth section deals with the adaptation of the new model to the problem of study. And the conclusions are derived in the last section.

AMS Subject Classification: 03E72
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1. Introduction

In the year 1965, L.A.Zadeh introduced the mathematical tool called fuzzy models. In the computational intelligence fuzzy models based on neural net-

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works were highly established. Later in the year 1976 Robert Axelrod analyzed the decision making in a social and political system using the fuzzy models. Then Bart Kosko proposed several other models which provided a mathematical power of capturing the uncertainties associated with the human thinking and reasoning. The fuzzy models have a great advantage of analyzing and solving many real world problems not only in the fields of science and engineering but also in the fields of humanities and social sciences which also deals with the basic feelings and emotions of the human kind.

The fuzzy cognitive maps were introduced by Bart Kosko in the year 1986 to represent causal reasoning as fuzzy graph structures. The fuzzy relational maps were introduced by W.B.Vasantha Kandasamy and Yasmin Sultana to analyze the knowledge processing in the year 2000. The bimodel called Fuzzy Cognitive Relational Maps was introduced by Praveen Prakash in the year 2010 to study the psychological problems faced by the People with Disabilities (PWDs) mainly due to disability, discrimination, social stigma and poverty. In this paper the new fuzzy bimodel Triangular Fuzzy Cognitive Relational Maps (TrFCRM) is introduced. It not only gives the causal relationship between concepts but also to rank the attributes based on their respective weightage.

2. New Triangular Fuzzy Cognitive Relational Maps (TrFCRM)

Definition 2.1. A triangular fuzzy cognitive relational map (TrFCRM) is a directed special bigraph with concepts like policies, events, etc as nodes and the causalities as edges. It represents a causal relationship between the concepts. The associated nodes of a TrFCRM are called as the binodes. The binodes of the TrFCRM bimodel are denoted by $\left\{TrC_1{}^1 TrC_2{}^1 \cdots TrC_n{}^1\right\}$ of the FCM and $\{TrD_1 ... TrD_p\}$ and $\{TrR_1 ... TrR_m\}$ of the FRM.

Definition 2.2. The TrFCRM with edge biweight $1, 0, -1$ are called simple TrFCRM. Let $TrC_1 ... TrC_n(TrD_1, ... TrD_p), (TrR_1, ... TrR_m)$ be the binodes of the TrFCRM. $A = A_1 \cup A_2 = (a_1, ... a_n) \cup (b_1, ... b_p)(or(c_1, ... c_m))$ where $a_i, b_j, c_t \in 0, 1;\ 1 \leq i \leq n,\ 1 \leq j \leq p$ and $1 \leq t \leq m$. A is called instantaneous state bivector and it denotes the ON-OFF position of the node at an instant:

$a_j = 0$ if a_j is OFF and $a_j = 1$ if a_j is ON for $1 \leq j \leq n$,
$b_i = 0$ if b_i is OFF and $b_i = 1$ if b_i is ON for $1 \leq i \leq p$,
$c_t = 0$ if c_t is OFF and $c_t = 1$ if c_t is ON for $1 \leq t \leq m$.

Definition 2.3. Let $TrC_iTrC_jTrD_sTrR_k$ be the biedges of the TrFCRM; $i \neq j, 1 \leq i, j \leq n, 1 \leq s \leq p, 1 \leq k \leq m$. Then the biedges form a directed bicycle. The TrFCRM is said to be bicyclic if it possesses a directed bicycle. The TrFCRM is said to be abicyclic if it does not possess any directed bicycle.

Definition 2.4. The TrFCRM with bicycles is said to have a feedback. When there is a feedback in the TrFCRM, i.e., when the causal relations flow through a cycle in a revolutionary manner, the TrFCRM is called a dynamical bisystem.

Definition 2.5. The equilibrium bistate for the dynamical bisystem is called the hidden bipattern. If the equilibrium bistate of the dynamical bisystem is a unique bistate bivector then it is called fixed bipoint.

Definition 2.6. If the TrFCRM settles down with a bistate bivector repeating in the form $A_1 \to A_2 \to ... \to A_1 \cup B_1 \to B_2 \to ... \to B_j \to B_1 (or D_1 \to D_2 \to ... \to D_k \to D_1)$ then this equilibrium is called a limit bicycle.

2.1. Method of Determining the Hidden Bipattern

Step 1. Let $TrC_1...TrC_n \cup (TrD_1, ...TrD_p), (TrR_1, ...TrR_m)$ be the binodes of the TrFCRM. Let $Tr(M) = Tr(M_1) \cup Tr(M_2)$ be the adjacency bimatrix.

Step 2. The hidden pattern is found out when TrC_i is switched ON (i=1 ... n). Let us take the initial state vector $A_1 = (1000000) \cup (1000000)$ and multiply the bivector into the triangular bimatrix M.

Step 3. The triangular weight of the attributes called $A_iTr(M)_{weight}$ is obtained.

Step 4. Then the average called $A_iTr(M)_{Average}$ is determined.

Step 5. Next $A_1Tr(M)_{Maxweight}$ is found by thresholding ($\hookrightarrow$).The threshold process is done by replacing a_i by 1 if a_i has the maximum weight of the triangular node($a_i = 1$), otherwise a_i will be 0.

Step 6. Suppose $A_1Tr(M) \hookrightarrow A_2$ then consider $A_2Tr(M)_{weight}$. (addition of weightage of the ON attribute in $A_1Tr(M)_{Maxweight}$).

Step 7. Find $A_2Tr(M)_{Average}i(i = 1 \cdots n)$. by multiplying with the highest value.

Step8. The $A_2Tr(M)_{Maxweight}$ bivector is obtained by the process of thresholding.

Step9. If the $A_1Tr(M)_{Maxweight} = A_2Tr(M)_{Maxweight}$ then the process ends.

Step10. Continue the procedure till limit bicycle is obtained.

3. Description of the Problem

A person's basic character formation starts from home.In the past years, that is in the generation of the forefathers, life was different. The families were mostly joint families where the grandparents, parents, uncles, aunts and cousins used to live under the same roof sharing their happiness and sorrows, living a very peaceful and prosperous meaningful life though not rich. In the present scenario life has become a race. Everybody is so much self obsessed, that people forget the true meaning of life. The importance of value is long forgotten in several people's life. The world today is doing excellently outstanding with all the developments in the science and technology. It is very much competitive too, where the competition is not healthy or sportive but egoistic. The parents of this generation want to provide their children with a very sophisticated life, which is with a big house, separate room, mobile phones, tabs, game station and so on. The children of this generation are very smart. The ones born after 1996 are termed as the *Centennials*. They question or reason out a lot and get convinced only when experimented, says a child psychiatrist. They posses a strong ability to decide. The main objective of this paper is to analyze whether the values have been inseminated in the children of today's generation by the parents. The fuzzy logic can be applied as a tool to study this problem as the importance a person gives for the basic values in his day to day life is subjective.

4. Adaptation of the Fuzzy Model to the Problem

The main attributes related with the family set up of the grandparents at their time are as follows:

TrC_1- Importance for education;
TrC_2- No corporal punishment;
TrC_3- Grown up in joint family;
TrC_4- Importance for values;
TrC_5- Fear of doing wrong;
TrC_6- Respect for elders;
TrC_7- Less importance for money.

The attributes related with the parents of the present generation are as follows:

TrD_1- Lack of quality time;
TrD_2- Importance for money;
TrD_3- Importance for job;
TrD_4- Lack of recognition;
TrD_5- Insensitiveness;
TrD_6- Substituted with technology;
TrD_7- Corporal Punishments.

The attributes associated with the children of the present generation are as follows:

TrR_1- Solid reasoning;
TrR_2- Intolerance;
TrR_3- Gaming;
TrR_4- Less personal interaction;
TrR_5- Depression;
TrR_6- Back answering;
TrR_7- No respect for elders.

The synaptic connection bimatrix is given as

$$\mathrm{M} = \begin{array}{c} \\ TrC_1 \\ TrC_2 \\ TrC_3 \\ TrC_4 \\ TrC_5 \\ TrC_6 \\ TrC_7 \end{array} \begin{array}{c} \begin{array}{ccccccc} TrC_1 & TrC_2 & TrC_3 & TrC_4 & TrC_5 & TrC_6 & TrC_7 \end{array} \\ \left[\begin{array}{ccccccc} 0 & L & M & H & H & H & H \\ L & 0 & H & H & H & H & M \\ M & H & 0 & H & H & H & M \\ M & H & H & 0 & H & H & M \\ H & L & H & H & 0 & H & M \\ H & M & H & H & H & 0 & M \\ H & M & M & H & H & H & 0 \end{array}\right] \end{array} \cup$$

$$\begin{array}{c} \\ TrD_1 \\ TrD_2 \\ TrD_3 \\ TrD_4 \\ TrD_5 \\ TrD_6 \\ TrD_7 \end{array} \begin{array}{c} \begin{array}{ccccccc} TrR_1 & TrR_2 & TrR_3 & TrR_4 & TrR_5 & TrR_6 & TrR_7 \end{array} \\ \left[\begin{array}{ccccccc} M & H & H & M & M & M & H \\ H & H & H & H & M & H & H \\ H & H & H & M & M & H & H \\ L & H & M & M & L & M & M \\ M & H & H & H & H & H & H \\ H & H & H & H & L & M & M \\ L & H & M & H & H & L & M \end{array}\right] \end{array},$$

$$Tr(M) = Tr(M_1) \cup Tr(M_2).$$

Let us consider the initial state vector $A = (1\ 0\ 0\ 0\ 0\ 0\ 0) \cup (1\ 0\ 0\ 0\ 0\ 0\ 0)$.

Now:

$$\begin{aligned}
ATr(M)_{weight} =&(0\ (0,0.25,0.50)\ (0.25,0.50,0.75)\ (0.50,0.75,1)\\
&(0.50,0.75,1)\ (0.50,0.75,1)\ (0.50,0.75,1))\\
&\cup((0.25,0.50,0.75)\ (0.50,0.75,1)\ (0.50,0.75,1)\\
&(0.25,0.50,0.75)\ (0.25,0.50,0.75)\ (0.25,0.50,0.75)\\
&(0.50,0.75,1)),\\
ATr(M)_{average} =&(0\ 0.25\ 0.50\ 0.75\ 0.75\ 0.75\ 0.75)\\
&\cup(0.50\ 0.75\ 0.75\ 0.50\ 0.50\ 0.50\ 0.75),\\
ATr(M)_{maxweight} \hookrightarrow&(0\ 0\ 0\ 1\ 1\ 1\ 1)\\
&\cup(0\ 1\ 1\ 0\ 0\ 0\ 1) = B,\\
BTr(M^T)_{average} =&(0\ 0\ 0\ 1\ 1\ 1\ 1)\cup(1.69\ 1.69\ 1.69\ 1.31\ 1.69\ 1.5\ 1.31),\\
BTr(M^T)_{maxweight} \hookrightarrow&(0\ 0\ 0\ 1\ 1\ 1\ 1)\cup(1\ 1\ 1\ 0\ 1\ 0\ 0) = A^{(1)}.
\end{aligned}$$

Continuing the proceedure until at the limit point we obtain

$$\begin{aligned}
A^{(5)}Tr(M)_{average} =&(11.72\ 7.82\ 15.63\ 11.73\ 11.73\ 11.73\ 10.42)\\
&\cup(8773.15\ 10527.78\ 10527.78\\
&8773.15\ 7895.84\ 9650.47\ 10527.78),\\
A^{(5)}Tr(M)_{maxweight} \hookrightarrow&(0\ 0\ 1\ 0\ 0\ 0\ 0)\cup(0\ 1\ 1\ 0\ 0\ 0\ 1) = B^{(5)},\\
B^{(5)}Tr(M^T)_{average} =&(0\ 0\ 1\ 0\ 0\ 0\ 0)\cup(23687.51\ 23687.51\\
&23687.51\ 18423.62\ 23687.51\ 21055.56\\
&18423.62),\\
B^{(3)}Tr(M^T)_{maxweight} \hookrightarrow&(0\ 0\ 1\ 0\ 0\ 0\ 0)\cup(1\ 1\ 1\ 0\ 1\ 0\ 0) = A^{(6)} = A^{(4)}.
\end{aligned}$$

The weightage and the ranking is mentioned in Table 1.

Input vector	(1000000)∪(1000000)	(0100000)∪(0100000)	(0010000)∪(0010000)	(0001000)∪(0001000)	(0000100)∪(0000100)	(0000010)∪(0000010)	(000001)∪(0000001)	Total Weight
TrC1	11.72	22.12	1.13	0.56	1.31	1.68	3.49	42.02
TrC2	7.82	14.75	1.69	1.69	1.69	1.13	2.33	31.1
TrC3	15.63	29.49	0	1.69	1.5	1.69	4.65	54.65
TrC4	11.73	22.12	1.69	0	1.69	1.69	3.49	42.41
TrC5	11.73	22.12	1.69	1.69	2.25	1.69	3.49	44.66
TrC6	11.73	22.12	1.69	1.69	1.69	0	3.49	42.41
TrC7	10.42	19.66	1.13	0.56	1.69	1.13	3.1	37.69
				∪				
	TrD1	TrD2	TrD3	TrD4	TrD5	TrD6	TrD7	Total Weight
TrR1	23687.51	17697.64	77.19	7.46	9.53	38.03	50.70	41568.06
TrR2	23687.51	21237.17	89.06	7.46	10.8	45.63	57.94	45135.57
TrR3	23687.51	20057.32	89.06	7.46	10.16	41.83	50.70	43944.04
TrR4	18423.62	14158.11	59.38	7.46	7.62	30.42	43.46	32730.07
TrR5	23687.51	20057.32	83.13	7.46	11.43	41.83	65.18	43953.86
TrR6	21055.56	18877.48	77.19	7.46	8.89	45.63	50.70	19088.91
TrR7	18423.62	14158.11	53.44	7.46	8.89	34.22	65.18	32750.87
Total Weight	128989.02	126243.15	528.45	52.22	67.32	277.59	383.86	
Average	18427.003	18034.736	75.493	7.46	9.617	39.656	54.837	
Rank	1	2	3	7	6	5	4	

Table 1: Table of Weightage

5. Conclusion

According to the proposed model TrFCRM, the attribute intolerance (TrR_2) ranks 1 with the weightage of 45135.57. The attribute lack of quality time (TrD_1) ranks 1 with the weightage of 128989.02 and the attribute grown up in joint family (TrC_3) ranks 1 with the weightage of 54.65. Thus it could be concluded from this study that mostly the children of the present generation are very much intolerant and lack patience. And the parents who are supposed to be implanting the basic values in these children give priority to several other materialistic things, in which they forget to spend quality time with the children as well as their family. Whereas it could also be noticed that this could be overcome if the families are joint families, in which the children could be molded better by the actions of the people around them rather than the present scenario of gadgets around them.

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