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Analyzing the Expectations of the Old Aged People Using Fuzzy Model

Research Article

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Abstract: The advancement of technology and the necessities of the day to day life force the children to leave their parents to the old aged homes. Due to this process, the mushroom growths of old aged homes exist. And how far this home for aged satisfies the expectations of the parents and the responsibilities of the children are of major concern. The expectations of the elderly are very simple but not all children realize their importance or value their presence in their lives. The varying degree of acceptance of their ageing parents according to the human values is a valid criterion to study the expectations of the old aged people. The fuzzy logic serves as an appropriate tool to study the expectations as it is an unsupervised data. The problem of study is analyzed using the appropriate fuzzy model in this paper. The section one is of introductory nature. The second section gives the introduction to triangular fuzzy cognitive maps. The description of the problem is given in section three; and in the fourth section the model is adapted to the problem of study. The conclusion is derived in the final section.

Keywords: Triangular fuzzy number, linguistic variables, weightage and maximum weight.

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1. Introduction

Fuzzy set theory was introduced in 1965 by L.A.Zadeh to deal with vagueness and impreciseness. In 1976 Axelrod used cognitive maps to study decision making in social and political system. In 1986 The Fuzzy Cognitive Maps were introduced by Bart Kosko. Triangular Fuzzy Cognitive Map was introduced by M.Clement Joe Anand and A. Victor Devadoss in 2013 [6]. It is a simple yet powerful tool which is widely used in the socio economical, medical fields and more. Usually the number of nodes in the on position gives the conclusion but Triangular Fuzzy Cognitive Map gives ranking for each causes of the problem by using the weightage of attributes.

2. Triangular Fuzzy Cognitive Maps (TrFCM)

Definition 2.1 ([6]). *The Triangular fuzzy cognitive map is a fuzzy number represented with three points as follows $A = (a_1, a_2, a_3)$.*
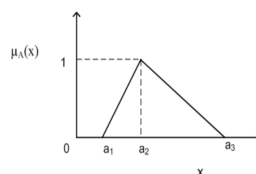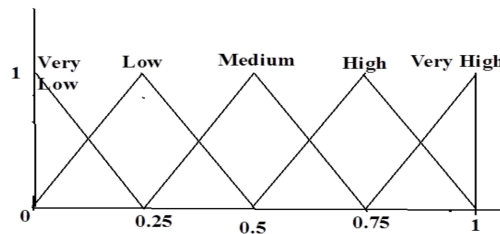
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Definition 2.2 ([6]). *The membership function is defined as follows,*

$$\mu_{\underset{\sim}{A}}(x) = \begin{cases} 0 & for\ x < a_1 \\ \frac{x-a_1}{a_2-a_1} & for\ a_1 \le x \le a_2 \\ \frac{a_3-x}{a_3-a_2} & for\ a_2 \le x \le a_3 \\ 0 & for\ x > a_3 \end{cases}$$

Definition 2.3. *The linguistic values of the triangular fuzzy numbers are chosen with five point scales*

Very Low	(0,0,0.25)
Low	(0,0.25,0.50)
Medium	(0.25,0.50,0.75)
High	(0.50,0.75,1)
Very High	(0.75,1,1)

Definition 2.4 ([6]). *Nodes of the TrFCM are called Fuzzy Triangular nodes.*

Definition 2.5 ([6]). *Simple TrFCM has its edges weight from the set $\{-1, 0, 1\}$.*

Definition 2.6 ([6]). *The TrFCM is a directed graph with concepts as nodes and causalities as edges. It gives causal relationship between concepts.*

Definition 2.7 ([6]). *Consider the nodes TrC_1, TrC_2, TrC_3,..., TrC_n of the TrFCM. The matrix M is called a connection matrix with $M = (e_{ij})$ where e_{ij} is the weight of the directed edge TrC_iTrC_j. TrFCM is a square matrix where always the diagonal entries are zero.*

Definition 2.8 ([6]). *A is called the Instantaneous state vector where it denotes only ON-OFF position with $A = (a_1, a_2, a_3, \ldots, a_n)$. $a_i = 1$ $(i = 1, \ldots, n)$ represents ON otherwise it is OFF position.*

Definition 2.9 ([6]). *Let $\overline{TrC1TrC2}$, $\overline{TrC2TrC3}$,..., $\overline{TrCiTrCj}$ be the edges of the TrFCM. TrFCM is said to be cyclic if it possesses a directed cycle, otherwise it is called acyclic.*

Definition 2.10 ([6]). *Where there is a feedback in TrFCM i.e., when the causal relations flow through a cycle in a revolutionary way, the TrFCM is called a dynamical system.*

Definition 2.11 ([6]). *Let $\overline{TrC1TrC2}$, $\overline{TrC2TrC3}$,..., $\overline{TrCiTrCj}$ be a cycle. If the unique state vector exists in a dynamical system then it is called a fixed point.*

Definition 2.12 ([6]). *If the TrFCM settles down with a state vector repeating in the form $A1 \to A2 \to \ldots Ai \to A1$, then this equilibrium is called limit cycle.*

Algorithm 2.13 (TrFCM).

Step 1: *Let TrC_1, TrC_2, TrC_3,..., TrC_n be the nodes of the TrFCM. Let $Tr(M)$ be the adjacency matrix.*

Step 2: *The hidden pattern is found out when TrC_i is switched ON $(i = 1.....n)$. Let us take $A_1 = (1000...0)$ and multiply the data into triangular matrix M.*

Step 3: *We get a triangular weight of the attributes which called as $A_iTr(M)_{weight}$.*

Step 4: *Adding the corresponding experts opinion and finding the average we call it as $A_iTr(M)_{Average}$.*

Step 5: *Find $A_1Tr(M)_{Maxweight}$ by thresholding $(\hookrightarrow)$ that is replace maximum weight of the triangular node $(a_i = 1)$ as 1.*

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

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

Step 8: *The threshold operation is denoted by $(\hookrightarrow)$ ie., $A_2Tr(M)_{Maxweight}$. 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 9: *If the $A_1Tr(M)_{Maxweight} = A_2Tr(M)_{Maxweight}$ then the dynamical system ends.*

Step 10: *Continue the procedure till we get repeated limit cycle.*

3. Description of the Problem

The advancement of technology and the necessities of the day to day life force the children to leave their parents to the old aged homes. Due to this process, the massive growths of old aged homes exist. And how far this home for aged satisfies the expectations of the parents and the responsibilities of the children are of major concern. The lives of the people today have become very busy that they aren't able to spend quality time with their family members as well as their elderly parents who are staying with them. People have several commitments in which their parents are not a part of. Everyone has become so much obsessed with materialistic things and money that the human values and morality are gradually diminishing. Thus in several cases the old aged parents get pushed into old aged homes.

4. Adaptation of TrFCM to the Problem of Study

The attributes related to the expectations of the old aged people are:

TrC_1- Love

TrC_2- Respect

TrC_3- Protection

TrC_4- Care

TrC_5- Peace

TrC$_6$- Economical Security

$$Tr(M) = \begin{bmatrix} 0 & VH & VH & VH & H & M \\ M & 0 & M & H & L & H \\ H & H & 0 & VH & M & H \\ H & H & H & 0 & H & M \\ H & H & H & H & 0 & M \\ VH & VH & VH & H & H & 0 \end{bmatrix}$$

$$= \begin{bmatrix} (0,0,0) & (0.75,1,1) & (0.75,1,1) & (0.75,1,1) & (0.50,0.75,1) & (0.25,0.50,0.75) \\ (0.25,0.50,0.75) & (0,0,0) & (0.25,0.50,0.75) & (0.50,0.75,1) & (0,0.25,0.50) & (0.50,0.75,1) \\ (0.50,0.75,1) & (0.50,0.75,1) & (0,0,0) & (0.75,1,1) & (0.25,0.50,0.75) & (0.50,0.75,1) \\ (0.50,0.75,1) & (0.50,0.75,1) & (0.50,0.75,1) & (0,0,0) & (0.50,0.75,1) & (0.25,0.50,0.75) \\ (0.50,0.75,1) & (0.50,0.75,1) & (0.50,0.75,1) & (0.50,0.75,1) & (0,0,0) & (0.25,0.50,0.75) \\ (0.75,1,1) & (0.75,1,1) & (0.75,1,1) & (0.50,0.75,1) & (0.50,0.75,1) & (0,0,0) \end{bmatrix}$$

Let us consider the initial state vector A= (0, 1, 0, 0, 0, 0).

$$ATr(M)_{Weight} = ((0.25,0.50,0.75),(0,0,0),(0.25,0.50,0.75),(0.50,0.75,1),(0,0.25,0.50),(0.50,0.75,1))$$

$$ATr(M)_{Average} = (0.5,0,0.5,0.75,0.25,0.75)$$

$$ATr(M)_{Max\ Weight} \hookrightarrow (0,0,0,1,0,1) = A_1$$

$$A_1 Tr(M)_{Average\ 1} = (1.25,1.25,1.25,0.5625,1.125,0.375)$$

$$A_1 Tr(M)_{Max\ Weight} \hookrightarrow (1,1,1,0,0,0) = A_2$$

$$A_2 Tr(M)_{Average\ 2} = (1.5625,2.0834,1.7709,3.2292,1.875,2.5)$$

$$A_2 Tr(M)_{Max\ Weight} \hookrightarrow (0,0,0,1,0,0) = A_3$$

$$A_3 Tr(M)_{Average} = (2.4219,2.4219,2.4219,0,2.4219,1.6146)$$

$$A_3 Tr(M)_{Max\ Weight} \hookrightarrow (1,1,1,0,1,0) = A_4$$

$$A_4 Tr(M)_{Average\ 1} = (4.8438,5.8530,5.2475,8.0732,3.6329,6.0548)$$

$$A_4 Tr(M)_{Max\ Weight} \hookrightarrow (0,0,0,1,0,0) = A_5 = A_3$$

State Vector	TrC$_1$	TrC$_2$	TrC$_3$	TrC$_4$	TrC$_5$	TrC$_6$
(1, 0, 0, 0, 0, 0)	8.4034	10.1542	9.1038	14.0059	6.3026	10.5043
(0, 1, 0, 0, 0, 0)	4.8438	5.8530	5.2475	8.0732	3.6329	6.0548
(0, 0, 1, 0, 0, 0)	1.375	1.6615	1.4896	2.2917	1.0313	1.7188
(0, 0, 0, 1, 0, 0)	1.5	1.8125	1.6250	2.5	1.125	1.875
(0, 0, 0, 0, 1, 0)	2.9064	3.5119	3.1486	4.8441	2.1798	3.633
(0, 0, 0, 0, 0, 1)	3.5524	4.2925	3.8485	5.9208	3.6643	4.4405
Total Weight	22.581	27.2856	24.463	37.6357	17.9359	28.2264
Total Average	3.7635	4.5476	4.0772	6.2726	2.9893	4.7045
Rank	*5*	*3*	*4*	*1*	*6*	*2*

5. Conclusion

The expectations of the old aged people were taken into account in this paper and the triangular fuzzy cognitive maps were adapted to the problem considered. The expectations were ranked using the fuzzy model. The old aged people expect care

mostly from their children in their old age. Secondly they expect economic security to lead a peaceful and happy life. Every human being should realize it is their duty to take good care of the old people because none should forget that this phase of life should be faced by each one of them in the future.

Acknowledgement

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