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Analysis of the problems faced by CWPDs using Fuzzy Cognitive Relational Maps (FCRMs) bimodel

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Abstract

In this paper the study of the problems faced by children with physical disabilities (CWPDs) is carried out using the Fuzzy Cognitive Relational Maps (FCRMs) bimodel.

Key words: Fuzzy Cognitive Maps (FCMs) model, Fuzzy Relational Maps (FRMs), Hidden Pattern, Fixed point, Directed graph and connection matrix, Children with Physical Disabilities (CWPDs), Fuzzy Cognitive Relational Maps (FCRMs) bimodels.

1. Introduction

In this section each of the nodes related associated with CWPDs is explained in line or two. These nodes were given by most of the experts and the disabled children who could be interviewed. Further the justification for using these models is also given.

The nodes about the CWPDs and other related nodes described in a line or two are enlisted below:

C_1 – Disabled children looked depressed. Most of the disabled children looked depressed or were sad and not cheerful and happy.

C_2 – Caretakers/ parents did not tend them with love or affection but treated them as an extra burden.

C_3 – Poverty is one of the major causes for treating Children With Physical Disabilities (CWPDs) is a rude way.

C_4 – The parents said they too suffer the social stigma due to their CWPDs.

C_5 – These children after 8 or ten years became school dropouts as they were not in a position to bear the ill treatment or mocking of their school mates.

C_6 – Several CWPDs had never entered the school premises.

C_7 – CWPDs were dressed poorly, no specially made/stitched clothes depending on their disability was ever found on them.

C_8 – They were ill fed and ill treated.

C_9 – They had no proper shelter even in the place they lived. The shelter they enjoyed depended on their disability. To be more

precise if they were disabled with no mobility and looked very crippled in face then they were put at the backyard of their house with very poor shelter.

C_{10} – Most of the disabled children suffer health problems.

C_{11} – These CWPDs were never given any health care measures or regular exercise etc; similar to that given in case of rich CWPDs.

C_{12} – Their health problems were never attended to unless it was in the very critical stage. In some cases the neglected health problems which led to death.

C_{13} – As they were not maintained properly they had all associated health problems like scabies, urinary tract infection, cold, bronchitis, T.B., constant cough, fever and other unsaid problems depending on their disability.

C_{14} – No recreation. These CWPD are denied of all types of recreation. Several of them cannot sit to watch T.V. many a times for the reasons best known to the family members. They are not taken for any public functions. They are always put in the house doing the work of a watch dog.

C_{15} – The parents have no mind to train them for any sort of self employment.

C_{16} – Their future is very bleak.

C_{17} – Even on festive occasions the CWPDs are denied costly clothing or sometimes even new clothes.

C_{18} – They are given only stale old rice on many days (less Nutritious food).

C_{19} – They felt depressed for they always received a second hand treatment. Starved of love and affection from parents or caretakers or from other siblings in some cases leading to suicide. (Specially the symptom of suicide occurred mostly after 13 years).

C_{20} – Caretakers/parents of CWPDs were also depressed.

C_{21} – Social stigma–The entire family suffered a social stigma.

C_{22} – No means for CWPDs to move to public/ government to get some sort of help as most of the CWPDs were immobile or cannot move without a support.

These attributes were defined and described by most of the experts, NGOs, socio scientists, siblings of CWPDs, CWPDs themselves and some parents/ caretakers. However it is pertinent to keep on record that in this CWPDs - who were blind children, deaf/ dumb children and children who are self sufficient inspite of their disability are not taken into this study. Only those CWPDs who do not belong to the above category is taken for study. Since all the attributes are packed with feelings and emotions one is justified in using FCRMs model[1-5] to study the problem For more about FCRMs bimodel, refer[5].

This paper has three sections. Section one is introductory in nature and describes the nodes associated with the problems of CWPDs living in rural areas and justification for using the FCRMs bimodel. Section two gives the adaptation of FCRMs bimodel to study the problems of CWPDs living in rural areas. Section three provides the conclusions.

2. Adaptation of FCRMS model to study the problems of CWPDs living in rural areas :

In this section using the attributes

given by the experts given in section one of this paper; FCRMs bimodel is used to study. Already[5] has used the FCRMs model in the study of PWDs in rural areas of Tamil Nadu. Here specifically the FCRMs model is used to study the problems faced by the CWPDs living in rural areas of Tamil Nadu. Here only two experts opinion are given of which one of them have used the FCMs model and the other has used FRMs model. Using these a FCRMs bimodels is constructed. However several experts were used and their opinions are also recorded in the conclusions given in section three of this paper.

The first expert who is an NGO wishes to work with the FCMs model using the set of attributes taken from the set of attributes given in section one of this paper.

The nodes/attributes taken by him are $A = \{C_1, C_2, C_3, C_4, C_5, C_7, C_{10}$ and $C_{15}\} \subseteq \{C_1, C_2, C_3, C_4, \ldots, C_{22}\}$. The directed graph G_1 given by this NGO for the FCMs model is as follows:

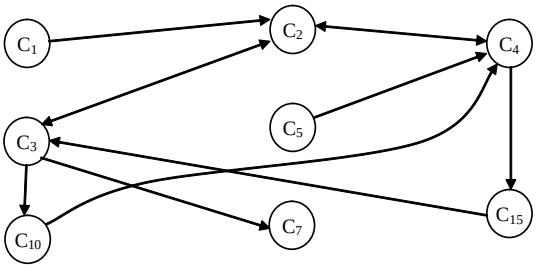


Figure 2.1: Graph G_1

The connection matrix M_1 associated with this graph G_1 is as follows:

$$M_1 = \begin{array}{c} \\ C_1 \\ C_2 \\ C_3 \\ C_4 \\ C_5 \\ C_7 \\ C_{10} \\ C_{15} \end{array} \begin{array}{c} \begin{array}{cccccccc} C_1 & C_2 & C_3 & C_4 & C_5 & C_7 & C_{10} & C_{15} \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \end{array}.$$

Let $X_1 = (1\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$ be the on state of the node C_1. The effect of X_1 on the dynamical system M_1 is as follows.

$X_1M_1 \rightarrow (1\ 1\ 0\ 0\ 0\ 0\ 0\ 0) = Y_1$
$Y_1M_1 \rightarrow (1\ 1\ 1\ 1\ 0\ 0\ 0\ 0) = Y_2$
$Y_2M_1 \rightarrow (1\ 1\ 1\ 1\ 0\ 1\ 1\ 1) = Y_3$
$Y_3M_1 \rightarrow (1\ 1\ 1\ 1\ 0\ 1\ 1\ 1) = Y_4 (= Y_3)$.

Only the node C_5 is in the off state which clearly shows that the students (CWPDs) should have become school dropouts on their own accord for the insults they would have received from classmates and school mates has no effect on their desperation.

Let $X_2 = (0\ 1\ 0\ 0\ 0\ 0\ 0\ 0)$ be the on state of the node C_2 alone and all other nodes are in the off state. The effect of X_2 on the dynamical system M_1 is as follows:

$X_2M_1 \rightarrow (0\ 1\ 1\ 1\ 0\ 0\ 0\ 0) = Z_1$ (say)
$Z_1M_1 \rightarrow (0\ 1\ 1\ 1\ 0\ 1\ 1\ 1) = Z_2$ (say)
$Z_2M_1 \rightarrow (0\ 1\ 1\ 1\ 0\ 1\ 1\ 1) = Z_3 (= Z_2$ say).

Thus the hidden pattern of the initial state vector X_2 is a fixed point given by the resultant vector $Z_3 = (0\ 1\ 1\ 1\ 0\ 1\ 1\ 1)$. This

somehow predicts CWPDs are sad not because of parents do not show affection to them. Hence their sadness can be poverty, no future or bleak future, torments given by class mates on disability and so on. The node C_5 remaining in the off state clearly shows that torments by classmates and becoming school dropouts has no bearing of the CWPDs. However all the other nodes are interrelated with the node C_2. Let $X_3 = (0\ 0\ 1\ 0\ 0\ 0\ 0\ 0)$ be the on state of the node C_2. To find the effect of X_3 on the dynamical system M_1.

$X_3M_1 \rightarrow (0\ 1\ 1\ 0\ 0\ 1\ 1\ 0) = P_1$ (say)
$P_1M_1 \rightarrow (0\ 1\ 1\ 1\ 0\ 1\ 1\ 0) = P_2$ (say)
$P_2M_1 \rightarrow (0\ 1\ 1\ 1\ 0\ 1\ 1\ 1) = P_3$ (say)
$P_3M_1 \rightarrow (0\ 1\ 1\ 1\ 0\ 1\ 1\ 1) = P_4$ (= P_3 say).

Thus the hidden pattern is a fixed point given by $P_4 = (0\ 1\ 1\ 1\ 0\ 1\ 1\ 1)$.

Finally let $X_8 = (0\ 0\ 0\ 0\ 0\ 0\ 0\ 1)$ be the on state of the node C_{15} alone and all other nodes are in the off state. To find the effect of X on the dynamical system M_1.

$X_8M_1 \rightarrow (0\ 0\ 1\ 0\ 0\ 0\ 0\ 1) = N_1$ (say)
$N_1M_1 \rightarrow (0\ 1\ 1\ 0\ 0\ 1\ 1\ 1) = N_2$ (say)
$N_2M_1 \rightarrow (0\ 1\ 1\ 1\ 0\ 1\ 1\ 1) = N_3$ (say)
$N_3M_1 \rightarrow (0\ 1\ 1\ 1\ 0\ 1\ 1\ 1) = N_4$ (= N_2).

Thus once again the hidden pattern is a fixed point given by the resultant vector N_4. The parents have no mind to train them has no impact on the CWPDs depression and it has no effect of being school dropouts. Thus the expert who was the NGO clearly said that these children suffered chronic depression which cannot be easily identified.

The hidden patterns are tabulated in the following Table 2.1.

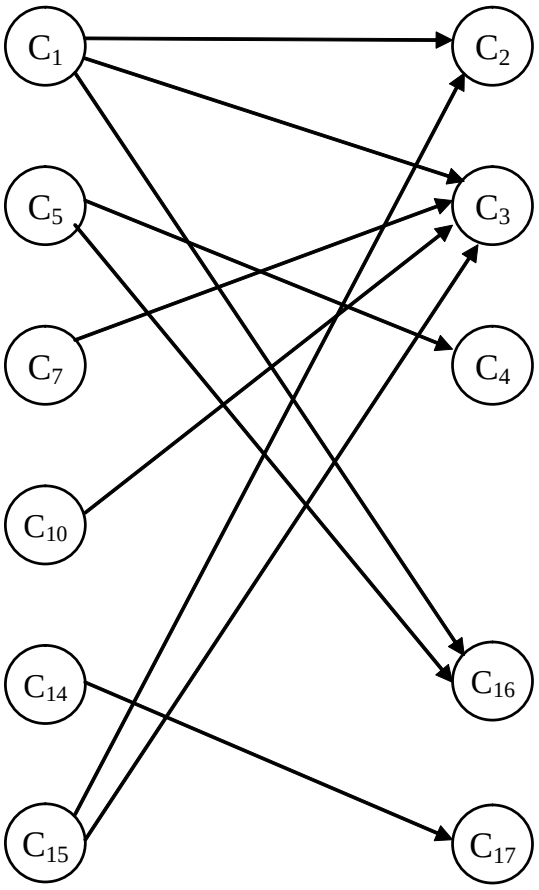
Table 2.1: Hidden patterns of the initial state vectors

S.No.	Initial State Vectors	Hidden Patterns	C_i's
1	$X_1 = (1\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$	$(1\ 1\ 1\ 1\ 0\ 1\ 1\ 1)$	C_1
2	$X_2 = (0\ 1\ 0\ 0\ 0\ 0\ 0\ 0)$	$(0\ 1\ 1\ 1\ 0\ 1\ 1\ 1)$	C_2
3	$X_3 = (0\ 0\ 1\ 0\ 0\ 0\ 0\ 0)$	$(0\ 1\ 1\ 1\ 0\ 1\ 1\ 1)$	C_3
4	$X_4 = (0\ 0\ 0\ 1\ 0\ 0\ 0\ 0)$	$(0\ 1\ 1\ 1\ 0\ 1\ 1\ 1)$	C_4
5	$X_5 = (0\ 0\ 0\ 0\ 1\ 0\ 0\ 0)$	$(0\ 1\ 1\ 1\ 1\ 1\ 1\ 1)$	C_5
6	$X_6 = (0\ 0\ 0\ 0\ 0\ 1\ 0\ 0)$	$(0\ 0\ 0\ 0\ 0\ 1\ 0\ 0)$	C_7
7	$X_7 = (0\ 0\ 0\ 0\ 0\ 0\ 1\ 0)$	$(0\ 1\ 1\ 1\ 0\ 1\ 1\ 1)$	C_{10}
8	$X_8 = (0\ 0\ 0\ 0\ 0\ 0\ 0\ 1)$	$(0\ 1\ 1\ 1\ 0\ 1\ 1\ 1)$	C_{15}

The second expert wishes to work with FRMs model using the following nodes for the domain and range spaces.

Let $D_1 = \{C_1, C_5, C_7, C_{10}, C_{15}, C_{14}\}$ and $R_1 = \{C_2, C_3, C_4, C_{16}, C_{17}\}$ are taken by the second expert who is a socio scientist. The directed graph H_1 given by him is as follows:

Figure 2.2: Graph H_1



The connection matrix B_1 associated with the graph H_1 is as follows:

$$B_1 = \begin{array}{c} \\ C_1 \\ C_5 \\ C_7 \\ C_{10} \\ C_{14} \\ C_{15} \end{array} \begin{array}{c} \begin{array}{ccccc} C_2 & C_3 & C_4 & C_{16} & C_{17} \end{array} \\ \begin{bmatrix} 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & 0 \end{bmatrix} \end{array}.$$

Now the effect of $a_1 = (1\ 0\ 0\ 0\ 0\ 0)$ where only the node C_1 is in the on state is analyzed using the matrix B_1.

$a_1B_1 \rightarrow (1\ 1\ 0\ 1\ 0) = t_1$ (say)

$t_1 B_1^t \rightarrow (1\ 1\ 1\ 1\ 0\ 1) = s_1$ (say)

$s_1B_1 \rightarrow (1\ 1\ 1\ 1\ 0) = t_2$ (say)

$t_2 B_1^t \rightarrow (1\ 1\ 1\ 1\ 0\ 1) = s_2$ (say)

$s_2B_1 \rightarrow (1\ 1\ 1\ 1\ 0) = t_3 (= t_1)$.

Thus the hidden pattern pair is a fixed pair given by $\{(1\ 1\ 1\ 1\ 0\ 1), (1\ 1\ 1\ 1\ 0)\}$.

Let $a_2 = (0\ 1\ 0\ 0\ 0\ 0)$ be the given initial state vector where only the node C_5 is in the on state.

$a_2B_1 \rightarrow (0\ 0\ 1\ 1\ 0) = l_1$ (say)

$l_1 B_1^t \rightarrow (1\ 1\ 0\ 0\ 0\ 0) = m_1$ (say)

$m_1B_1 \rightarrow (1\ 1\ 1\ 1\ 0) = l_2$ (say)

$l_2 B_1^t \rightarrow (1\ 1\ 1\ 1\ 0\ 1) = m_2$ (say)

$m_2B_1 \rightarrow (1\ 1\ 1\ 1\ 0) = l_3$ (say)

$l_3 B_1^t \rightarrow (1\ 1\ 1\ 1\ 0\ 1) = m_3 (= m_2)$.

Thus the hidden pattern pair is a fixed pair given by $\{(1\ 1\ 1\ 1\ 0\ 1), (1\ 1\ 1\ 1\ 0)\}$.

Let $b_4 = (0\ 0\ 0\ 1\ 0)$ that is only the node C_{16} is in the on state and all other nodes are in the off state. The effect of b_4 on the dynamical system B_1 is as follows:

$b_4\ B_1^t \rightarrow (1\ 1\ 0\ 0\ 0\ 0) = k_1$ (say)

$k_1B_1 \rightarrow (1\ 1\ 0\ 1\ 0) = o_1$ (say)

$o_1 B_1^t \rightarrow (1\ 1\ 1\ 1\ 0\ 1) = k_2$ (say)

$k_2B_1 \rightarrow (1\ 1\ 1\ 1\ 0) = o_2$ (say)

$o_2\ B_1^t \rightarrow (1\ 1\ 1\ 1\ 0\ 1) = k_3 (= k_2$ say).

Thus the hidden pattern pair is given by {(1 1 1 1 0), (1 1 1 1 0 1)}.

Let b_5 = (0 0 0 0 1) that is only the node C_{17} is in the on state and all other nodes are in the off state. The effect of b_5 on the dynamical system B_1 is as follows:

$b_5 B_1^t \rightarrow (0\ 0\ 0\ 0\ 1\ 0) = c_1$

$c_1 B_1 \rightarrow (0\ 0\ 0\ 0\ 1) = b_5.$

Thus the hidden pattern is a fixed point pair given by {(0 0 0 0 1), (0 0 0 0 1 0)}.

Now the hidden pattern pairs are given following Table 2.2:

Table 2.2: Hidden patters pairs

S.No.	Initial State Vectors	C_i	Hidden Patterns
1	(1 0 0 0 0 0) = a_1	C_1	{(1 1 1 1 0 1), (1 1 1 1 0)}
2	(0 1 0 0 0 0) = a_2	C_5	{(1 1 1 1 0 1), (1 1 1 1 0)}
3	(0 0 0 1 0 0 0) = a_3	C_7	{(1 1 1 1 0 1), (1 1 1 1 0)}
4	(0 0 0 1 0 0) = a_4	C_{10}	{(1 1 1 1 0 1), (1 1 1 1 0)}
5	(0 0 0 0 1 0) = a_5	C_{14}	{(0 0 0 0 1 0), (0 0 0 0 1)}
6	(0 0 0 0 0 1) = a_6	C_{15}	{(1 1 1 1 0 1), (1 1 1 1 0)}
7	b_1 = (1 0 0 0 0)	C_2	{(1 1 1 1 0), (1 1 1 1 0 1)}
8	b_2 = (0 1 0 0 0)	C_3	{(1 1 1 0), (1 1 1 1 0 1)}
9	b_3 = (0 0 1 0 0)	C_4	{(1 1 1 1 0), (1 1 1 1 0 1)}
10	b_4 = (0 0 0 1 0)	C_{16}	{(1 1 1 1 0), (1 1 1 1 0 1)}
11	b_5 = (0 0 0 0 1)	C_{17}	{(0 0 0 0 1), (0 0 0 0 1 0)}

Now using these two fuzzy model the FCRMs model is constructed.

Thus the bimatrix $S = M_1 \cup B_1$ serves as the connection matrix of this FCRMs model. If x = (1 0 0 0 0 0 0 0) $\cup$ (1 0 0 0 0 0) is the initial birow vector in which the node C_1 alone is the on state. The effect of x on the bimatrix $S = M_1 \cup B_1$ is given by the hidden pattern of the birow vector which is a fixed point pair {(1 1 1 1 0 1 1 1) $\cup$ (1 1 1 1 0 1), (1 1 1 1 0 1 1 1) $\cup$ (1 1 1 1 0)}. However the working is shown explicitly for one or two on state bivectors in the following:

Let y= (0 0 0 1 0 0 0 0) $\cup$ (0 0 1 0 0 0) be the given on state initial state bivector with which the expert wishes to work.

The effect of y on the dynamical system $S = M_1 \cup B_1$ is given by

$yS = (0\ 0\ 0\ 1\ 0\ 0\ 0\ 0)\, M_1 \cup (0\ 0\ 1\ 0\ 0\ 0)\, B_1$

$\rightarrow (0\ 1\ 0\ 1\ 0\ 0\ 0\ 1) \cup (0\ 1\ 0\ 0\ 0)$

$= y_1$ (say)

$y_1 S_S^{t_2}$ = (0 1 0 1 0 0 0 1) $M_1 \cup$ (0 1 0 0 0) B_1^t
$\rightarrow$ (0 1 1 1 0 0 0 1) $\cup$ (1 0 1 1 0 1)
= y_2

$y_2 S$ = (0 1 1 1 0 0 0 1) $M_1 \cup$ (1 0 1 1 0 1) B_1
$\rightarrow$ (0 1 1 1 0 1 1 1) $\cup$ (1 1 0 1 0)
= y_3 (say)

$y_3 S_S^{t_2}$ = (0 1 1 1 0 1 1 1) $M_1 \cup$ (1 1 0 1 0) B_1^t
$\rightarrow$ (0 1 1 1 0 1 1 1) $\cup$ (1 1 1 1 0 1)
= y_4

$y_4 S$ = (0 1 1 1 0 1 1 1)M_1 (1 1 1 1 0 1) B_1
$\rightarrow$ (0 1 1 1 0 1 1 1) $\cup$ (1 1 1 1 0)
= y_5 (say)

$y_5 S_S^{t_2}$ = (0 1 1 1 0 1 1 1)M_1 (1 1 1 1 0) B_1^t
$\rightarrow$ (0 1 1 1 0 1 1 1) $\cup$ (1 1 1 1 0 1)
= y_6 (= y_4).

Thus the hidden pattern bipair is a fixed bivector pair given by {(0 1 1 1 0 1 1 1) $\cup$ (1 1 1 1 0 1), (0 1 1 1 0 1 1 1) $\cup$ (1 1 1 1 0)}.

Suppose z = (0 0 0 0 0 0 1 0) $\cup$ (0 0 0 1 0) be the initial bistate vector the expert wishes to work with. Effect of z on is given by

z $S_S^{t_2}$ = (0 0 0 0 0 0 1 0) $M_1 \cup$ (0 0 0 1 0) B_1^t
$\rightarrow$ (0 0 0 1 0 0 1 0) $\cup$ (1 1 0 0 0 0)
= z_1 say

$z_1 S$ = (0 0 0 1 0 0 1 0) $M_1 \cup$ (1 1 0 0 0 0) B_1
$\rightarrow$ (0 1 1 1 0 1 1 1) $\cup$ (1 1 0 1 0)
= z_2

$z_2 S_S^{t_2}$ = (0 1 1 1 0 1 1 1) $M_1 \cup$ (1 1 0 1 0)
$\rightarrow$ (0 1 1 1 0 1 1 1) $\cup$ (1 1 1 1 0 1)
= z_3

$z_3 S$ = (0 1 1 1 0 1 1 1)$M_1 \cup$ (1 1 1 1 0 1)B_1
$\rightarrow$ (0 1 1 1 0 1 1 1) $\cup$ (1 1 1 1 0)
= z_4

$z_4 S_S^{t_2}$ = (0 1 1 1 0 1 1 1)$M_1 \cup$ (1 1 1 1 0)
$\rightarrow$ (0 1 1 1 0 1 1 1) $\cup$ (1 1 1 1 0 1)
= z_5 (= z_4).

Thus the bihidden pattern is a fixed bipair given by {(0 1 1 1 0 1 1 1) $\cup$ (1 1 1 1 0), (0 1 1 1 0 1 1 1) $\cup$ (1 1 1 1 0 1)}.

However the working has been carried out for all bivectors using the bimatrix S and is included in the conclusion.

3. Conclusions

From this study the following facts are derived. If the node C_1 is on that is the CWPDs are depressed/sad is in the on state from the domain space then all the nodes come to on state except the nodes C_{14} and C_{17} that is the CWPDs have no recreation and even on festive occasions they do not get good/new clothing.

Similarly on state of the node C_5 from the domain space that is these CWPDs are school dropouts only the nodes C_{14} and C_{17} remain off and all nodes come to on state. So in a way it is clear that the children (CWPDs) are not affected by denial of recreation or good cloths according to the socio scientist they are troubled beyond these. Thus the on state of node C_7, these CWPDs are dressed poorly also makes only the nodes C_{14} and C_{17} in the off state all the rest of the nodes both from the domain and range space come to on state.

The on state of the node C_{10} in the domain space that is most CWPDs suffer health problems makes on all the nodes to the on state except C_{14} and C_{17}.

However on state of C_{14} makes no node in the domain space on only makes on the node C_{17} to on state from the range space. That is no recreation given to the CWPDs causes only the node even on festive occasions they are not dressed properly comes to on state.

Likewise the on state of C_{17} in the range space makes only on the node C_{14} in the domain space to be on. All other nodes are highly integrated on each other and depend on each other seen from the hidden pattern pairs given by the system B_1. Clearly the nodes choosen by this expert are very equally weighted seen from the hidden pattern. Finally the study strongly recommends the government to make special arrangements to give special counseling to these CWPDs; for most of them were depressed.

References

1. Kosko, B., Fuzzy Cognitive Maps, *Int. J. of Man-Machine Studies, 24,* 65-75 (1986).
2. Vasantha Kandasamy, W.B., and Smarandache, F., *Fuzzy Cognitive Maps and Neutrosophic Cognitive Maps*, Xiquan, Phoenix (2005).
3. Vasantha Kandasamy, W.B., Smarandache, F., and Ilanthenral.K., *New Techniques to analyse the prediction of fuzzy models and Neutrosophic models,* Educational Publisher Inc, Ohio (2014).
4. Vasantha Kandasamy, W.B., Smarandache, F., and Ilanthenral.K., *Pseudo Lattice Graphs and their Applications to fuzzy neutrosophic models,* EuropaNova, Ohio, (2014).
5. Vasantha Kandasamy, W.B., Smarandache, F., and Praveen Prakash, A., *Mathematical Analysis of the problems faced by the People with Disabilities (PWDs) with specific Reference to Tamil Nadu*, Zip Publishing, Ohio (2012).