Integrated Intelligent Research (IIR)
International Journal of Computing Algorithm
Volume: 03 Issue: 03 December 2014 Pages: 312-315
ISSN: 2278-2397

Outcome Based Analysis of An Impact of Parental Conflicts on Development of Children Using Fuzzy Cognitive Maps (FCMs)

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Abstract - The healthy family relationship immensely affects emotional, social, behavioral, cognitive and physical development of children. Since 1930, it has been ascertained that a discord between parents has adverse effect on children's psychological development of all ages. Even an unborn child has a negative impact due to maternal stress resulting from conflicts. Babies less than one year may exhibit elevated heart rate in response to an overt. Children upto age of 5 years show signs of distress. Children between ages of 6 and 17 years show potentially intense effect when exposed to ongoing resentful, sarcastic exchanges between parents. Fuzzy Cognitive Maps (FCMs) are a flexible modeling technique with a goal of modeling causal relationships. This paper analyses the impact on children of age group 6 to 17 years due to lack of agreement between parents resulting in chronic conflicts using Fuzzy Cognitive Maps.

Keywords- Fuzzy Cognitive Maps, chronic conflicts, children's psychological development, stress

I. INTRODUCTION

The healthy family relationships play a critical role in children's better development while being their learning models. A family consisting of parents living together happily is the traditional pattern for best development of children. Basically all children wish that their parents do not argue or lead to any conflict with each other. But in actual case, nature of family varies in wide manner due to mismatch in thinking or nature that may result in conflicts. The interpersonal relation of parents either cares for child or their behavior scares the child imposing different impact on their mental health.

A discord between parents results in toxic effect on psychological development of children of all ages. However, an exposure to parental dispute is not necessarily harmful for children because it helps them to develop conflict-resolution skills when they observe their parents resolve disagreements mutually in caring and effective way. But if it becomes daily practice and it remains unresolved then it is called a chronic conflict. Chronic parental conflicts take place mostly in intact families. The toxic conflict can result into yelling, sarcasm, blaming, criticizing, insulting, ignoring, throwing or destroying things, hurting each other, shoving, slapping, hitting, kicking or any form of physical violence. Children feel insecure, frightened, helpless and sometimes looses sleep and do not find a stable family environment. Children get stressed worrying about taking sides and develops fear that one parent will leave the family to avoid frequent conflicts. When a child observes his friends of same age getting enough care and affection from their parents then he feels isolated. Advances in neuropsychology have shown that when a person is exposed to conflicts, his brain releases stress hormones that after some time can actually change brain functioning leading to trouble thinking that reduces cognitive abilities. As per one of the articles on Children's health by Hayley Dixon who is a journalist of The Telegraph in United Kingdom reported that when the babies are asleep, hearing arguments between parents is associated with functioning of brain. Using magnetic resonance, they measured brain activity which detects associated changes in blood flow when the babies were presented with rubbish or harsh sentences spoken in different tones. The results surprised that even during sleep, the infants from high-conflict homes showed much reactivity to very angry tones of voice in brain areas related to stress and emotion regulation. Parental discord even affects an unborn child in many ways such as inherited traits, physical damage to foetus or effects due to maternal stress. Babies less than one year may exhibit elevated heart rate in response to an overt. Children upto age of 5 years may respond by crying, acting out, freezing or involving themselves in conflict. This paper analyses the children of age group 6 to 17 years which shows signs of emotional and behavioral distress being exposed to sarcastic exchanges between parents. The lack of agreement between parents may result in depression, stress, anxiety, aggression, hostility, anti-social behavior and poor academic performance [2, 3].

II.FUZZY COGNITIVE MAP

This section is subdivided into three subsections. The first subsection highlights historical overview of Fuzzy Cognitive Maps (FCMs). The second subsection explains the basic definitions and concept of FCM as a learning background. The third subsection describes a procedure of finding the hidden pattern.

Historical Overview of FCM

Fuzzy logic was first introduced by Lotfi A. Zadeh in 1965 [11], which involved significant account of vagueness. Fuzzy logic is a superset of Boolean logic which is used to handle the randomness in concepts that are partial true between values 0 and 1. FCM is a very simple and convenient soft computing methodology to represent knowledge about the system graphically. Political scientist, Robert Axelrod, introduced Cognitive Map in 1976 to represent social scientific knowledge

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ISSN: 2278-2397

[4]. Later in year 1986, Prof. Bart Kosko, introduced fuzzy extension of cognitive maps considering fuzzy values for concepts and causal relationship between them [5, 7]. FCMs are fuzzy-graphs structures applicable for prediction, planning and decision making in various areas such as engineering, medical, robotics, physical science, political science, military science, international relations, socio-economic problems, agriculture, etc. [4-8].

Basic definitions and Concepts of FCM

Fuzzy Cognitive Map (FCM) is a tool used to study real-world situations. FCMs are more applicable when data in first place is an unsupervised one. It works on opinion of experts. Basic definitions to support learning model of FCM are described below [8].

Definition (i): An FCM is a directed graph with concepts like policies, events etc. as nodes and causalities as edges. It represents causal relationship between concepts.

Definition (ii): When the nodes of FCM are fuzzy sets then they are called as fuzzy nodes.

Definition (iii): FCMs with edge weights or causalities from the set {-1, 0, 1} are called simple FCMs.

Definition (iv): Consider the nodes / concepts C_1 , …, C_n of the FCM. Suppose the directed graph is drawn using edge weight $e_{ij} \in \{0, 1, -1\}$. The matrix E be defined by $E = (e_{ij})$, where e_{ij} is the weight of the directed edge $C_i C_j$. E is called the adjacency matrix of the FCM, also known as the connection matrix of the FCM. It is important to note that all matrices associated with an FCM are always square matrices with diagonal entries as zero.

Definition (v): Let $C_1, C_2, \dots , C_n$ be the nodes of an FCM. $A = (a_1, a_2, \dots , a_n)$, where $a_i \in \{0, 1\}$. A is called the instantaneous state vector and it denotes the on-off position of the node at an instant.

$a_i = 0$; if a_i is off and
$a_i = 1$; if a_i is on
for $i = 1, 2, \dots , n$.

Definition (vi): Let $C_1, C_2, \dots , C_n$ be the nodes of an FCM. Let $\overrightarrow{C_1 C_2}$, $\overrightarrow{C_2 C_3}$, $\overrightarrow{C_3 C_4}$, … , $\overrightarrow{C_i C_j}$ be the edges of FCM ($i \neq j$). Then the edges form a directed cycle. An FCM is said to be cyclic if it possesses a directed cycle. An FCM is said to be acyclic if it does not possess any directed cycle.

Definition (vii): An FCM with cycles is said to have a feedback.

Definition (viii): When there is a feedback in an FCM, i.e., when the causal relations flow through a cycle in a revolutionary way, the FCM is called a dynamical system.

Definition (ix): Let $\overrightarrow{C_1 C_2}$, $\overrightarrow{C_2 C_3}$, … , $\overrightarrow{C_{n-1} C_n}$ be a cycle. When C_i is switched on and if the causality flows through the edges of a cycle and if it again causes C_i, we say that the dynamical system goes round and round. This is true for any node C_i, for i = 1, 2, … , n. The equilibrium state for this dynamical system is called the hidden pattern.

Definition (x): If the equilibrium state of a dynamical system is a unique state vector, then it is called a fixed point.

Definition (xi): If the FCM settles down with a state vector repeating in the form $A_1 \rightarrow A_2 \rightarrow \dots \rightarrow A_i \rightarrow A_1$ then this equilibrium is called a limit cycle.

Definition (xii): The edges e_{ij} take values in the fuzzy causal interval [-1, 1]. $e_{ij} = 0$ indicates no causality, $e_{ij} > 0$ indicates causal increase C_j increases as C_i increases (or C_j decreases as C_i decreases). $e_{ij} < 0$ indicates causal decrease or negative causality. C_j decreases as C_i increases (and or C_j increases as C_i decreases). Simple FCMs have edge values in {-1, 0, 1}.

A Procedure to find hidden pattern of a dynamical system

Let $C_1, C_2, \dots, C_n$ be the nodes of an FCM, with feedback. Let E be the adjacency matrix. Consider C_1 is switched on to find the hidden pattern. When an input is given as vector $A_1 = [1, 0, 0, \dots ,0]$, which means only C_1 is in on state and all other nodes are in off state, then data should pass through relation matrix E by multiplying A_1 by matrix E. Let $A_1E = [a_1, a_2, \dots , a_n] = A_2$ with threshold operation which means replace a_i by 1 if $a_i > k$ and a_i by 0 if $a_i < k$ (where k is some positive integer). Threshold signal functions synchronously update each concept after each pass through connection matrix. Now, $A_1E \rightarrow A_2$ is next input vector, pass thorough adjacency matrix E and update the resulting concept. Similarly, consider $A_2E \rightarrow A_3$ and repeat the above procedure until we get a limit cycle or a fixed point. implementation of problem using fuzzy cognitive map (fcm) Based on linguistic questionnaire and expert's opinion we have taken following concepts $C_1, C_2, \dots, C_{10}$ as nodes to describe causal relationship between them.

Node C_1: Stress

It is a state of mental or emotional strain or tension resulting from adverse circumstances. It is physical response to events that makes one feel upset. Stress in children may result in increased heart rate, blood pressure, anxiety, anger and depression [1].

Node C_2: Anger

Children when unable to communicate their feelings or they do not have control over circumstances, often get frustrated and shows anger. It becomes harder for them to control their emotions and are prone to anger and violence. They may use their anger on siblings or friends or later in their life when they become parents.

Node C_3: Frequent breaking rules – defying parents or teachers

When children do not receive enough parental attention because parents are occupied in their own problems, then they become angry, sad and aggressive making them disobedient. The middle childhood is a vulnerable period of life where, they misinterpret themselves to be the cause of conflict which lowers their self-esteem and they start reacting inappropriately to the events happening around them.

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Volume: 03 Issue: 03 December 2014 Pages: 312-315
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Node C_4: Depression

Depression is a reaction to life's struggle, loss of interest and sad feelings. Depressed mood may lead to insomnia, an inability to sleep, lowers self-esteem, feelings of guilt. It is more likely for a child to develop depression if one of the parents is depressed due to conflicts.

Node C_5: Increased isolation or withdrawal from family or friends

If the child feels helpless about their parent's conflicts, they may start ignoring it and keep distance from them which increases isolation and they get withdrawn from family or friends. They start turning inward and become reserved.

Node C_6: Increased likelihood of early drinking, smoking or drug usage

Chronic conflict of parents increases frustration, anxiety and depression in children. They may avoid being at home to keep themselves away from conflict, liking to spend more time with friends and may start consuming alcohol or drug which leads to greater vulnerability to conduct disorders and crime.

Node C_7: Thoughts of suicide

Children when exposed to parental disputes and observes a discord between them then they may find themselves to be the cause of it and feels guilty about themselves which degrades their self-esteem and are more likely to have behavioral problems which may include thoughts of suicide thinking that killing his existence would make everything perfect. This affects his academic performance badly.

Node C_8: Difficulties to concentrate or decreasing cognitive abilities

Due to frequent heated and hostile argument between parents, children are at higher risk of having difficulty in focusing. This decreases their cognitive abilities because they experience stress related physiological reactions that may have negative influence to their brain development leading to poor academic performance.

Node C_9: Lack of social competence

Social competence refers to social, emotional, cognitive skills and behaviors that a child needs for successful social adaption. When a child feels socially isolated then his social competency skill deteriorates. They feel neglected or rejected and find difficulty in making friends.

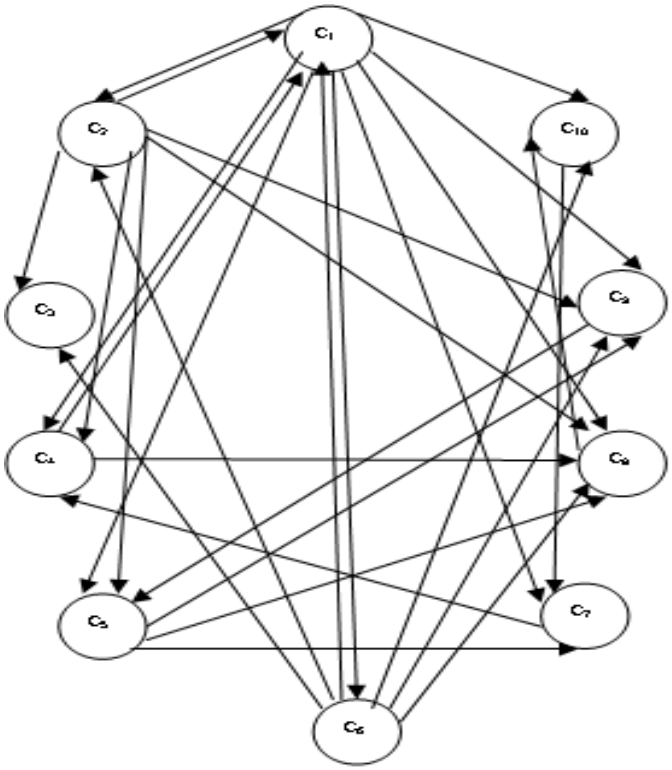
Node C_{10}: Poor academic performance

When children do not get parental attention due to their interpersonal problems, they feel stressed and are more likely to have difficulty in concentration which results in poor academic performance. They lose their self-confidence and cognitive abilities.

Based on expert's opinion, the directed digraph for our problem is given below:

Let the connection matrix corresponding to the directed digraph be denoted by E and is given as:

$$E = \begin{bmatrix} 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{bmatrix}$$



Let us consider the initial state vector be A_1 = [1 0 0 0 0 0 0 0 0 0] which means only the node C_1 i.e. 'stress' is in on state and all other nodes are in off state. Then passing state vector A_1 to connection matrix E, we get

A_1E = [0 1 0 1 1 1 1 1 1 1] = A_2
Now passing the vector A_2 to connection matrix E, we get
A_2E = [2 2 2 2 2 0 2 4 3 2]
→ [1 1 1 1 1 0 1 1 1 1] = A_3
Note that the symbol '→' indicates the threshold value for resulted product.

Similarly passing the vector A_3 to connection matrix E, we get
A_3E = [1 2 1 3 3 1 3 4 3 2]
→ [1 1 1 1 1 1 1 1 1 1] = A_4
Now passing vector A_4 to connection matrix E, we get

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A_4E = [2 3 2 3 3 1 3 5 4 3]
→ [1 1 1 1 1 1 1 1 1 1] = A_4

It is observed that the hidden pattern is a fixed point which shows that stress in children hinders their growth and development.

Now let us consider the state vector given by A_1 = [1 0 0 1 0 0 0 0 0 0] which means that nodes C_1 and C_4 i.e. 'stress' and 'depression' are in on state and rest are in off state. Thus, passing the state vector A_1 to connection matrix E, we get

A_1E = [0 2 0 1 1 1 1 2 1 1]
→ [0 1 0 1 1 1 1 1 1 1] = A_2
A_2E = [2 2 2 2 2 0 2 4 3 2]
→ [1 1 1 1 1 0 1 1 1 1] = A_3
A_3E = [1 2 1 3 3 1 3 4 3 2]
→ [1 1 1 1 1 1 1 1 1 1] = A_4
A_4E = [2 3 2 3 3 1 3 5 4 3]
→ [1 1 1 1 1 1 1 1 1 1] = A_4

Again the result shows that hidden pattern is a fixed point.
Now let us consider a state vector to be A_1 = [1 1 0 1 0 0 0 0 0 0] which indicates the nodes C_1, C_2 and C_4 i.e. 'stress', 'anger' and 'depression' to be in on state and rest are in off state. Let us analyze the impact of these three factors together by passing state vector A_1 to connection matrix E,

A_1E = [1 2 1 2 2 1 1 3 2 1]
→ [1 1 1 1 1 1 1 1 1 1] = A_2
A_2E = [2 3 2 3 3 1 3 5 4 3]
→ [1 1 1 1 1 1 1 1 1 1] = A_2

This result indicates that the hidden pattern is a fixed point. Stress and anger are interrelated. The result shows stress and anger along with depression has negative impact on children's mental health and development. Similar results were obtained with different state vectors. One state vector with stress and anger being in on state and rest in off state gave same results. Another state vector with anger and depression in on state and rest in off state again gave the same results.

III. CONCLUSION

It is believed that children learn problem solving best in low-conflict homes. Conversely, they have adverse impact in high-conflict homes. It is observed that children, who witness the intense hostile and frequent parental discord, are more susceptible to stress-related health problems. The analysis is performed for children of age group 6 to 17 years using Fuzzy Cognitive Maps (FCMs). From the hidden pattern, it is clear that children remain stressed in response to an overt due to which they are likely to have anger towards themselves and others which make them depressed. When either stress, anger or depression is observed or all three, children are more prone to have major negative impact which makes them disobedient, isolated and being bullied, increased likelihood of early drinking, smoking or drug usage, negative thoughts of killing or harming oneself, decreasing cognitive abilities, lack of social competency and poor academic performance which may drive them to anti-social activities.

IV. SUGGESTIONS

Ideally one wish to have conflict-free, healthy and happy parental relationship, but practically it may not happen. In that case, parents can try to reduce it to maximum possible extent while developing more understanding between each other and reacting in a mature manner. Because it is not about lives of two of them, but their children's behavioral development and as a whole their life is connected to their parents. If they cannot avoid conflict, they should avoid it in front of children.Most often a question arises that due to chronic conflicts, should parents get apart? The answer is NO, because divorce itself has a negative impact on children's lives. A remarriage can also have negative impact. So parents should think wisely before taking any step. Better than divorce, they should take a challenge to learn communicate better, reduce conflicts between themselves and learn to solve problems in an atmosphere of courtesy and respect. They will be happier and so will their children.

REFERENCES

[1] Fredric N. Busch, "Anger and Depression", Advances in Psychiatric Treatment- Journal of contuniuing Professional Development, APT 2009, 15:271-278.
[2] Laura Ann McCloskey, Aurelin Jose Figueredo and Mary P. Koss, "The Effects of Systemic Family Violence on Children's Mental Health", Child Development, Vol. 66, No. 5 (Oct., 1995), pp. 1239-1261.
[3] Nan Marie Astone and Sara S. McLanahan, "Family Structure, Parental Practices and High School Completion", America Sociological Review, Vol. 56, No. 3 (June., 1991), pp. 309-320.
[4] R. Axelrod, "Structure of Decision, The Cognitive Maps of Political Elites", Princeton, NJ: Princeton University Press, 1976.
[5] B. Kosko, "Fuzzy Cognitive Maps", International Journal of Man-Machine Studies, January 1986, pp., 65-75.
[6] Gerald J. Calcais, "Fuzzy Cognitive Maps Theory: Implications for Interdisciplinary Reading", National Publication FOCUS On Colleges 2(2008), pp.,1-15.
[7] B. Kosko, "Fuzzy Cognitive Maps", International Journal of Man-Machine Studies, January, 1988, pp., 62-75.
[8] W. B. Vasantha Kandasamy and Florentin Smarandache, "Fuzzy Cognitive Maps and Neutrosophic Cognitive Maps", Xiquan, Phoenix (2003).
[9] W. B. Vasantha Kandasamy, S. Narayanmoorthy and Mary John, "Study of Problems faced by Bonded Labourers near Kodaikanal Forests Using FCMs", Mathematical Modeling, ane Books India, 2007, pp.,297-304.
[10] A. Victor Devadoss, K. Sudha, "The Empowerment of Women in Promoting Happiness in Her Own Environment Using Fuzzy Cognitive Maps", Indo-Bhutan International Conference On Gross National Happiness, Vol. 02, October 2013, pp., 172-177.
[11] Lotfi A. Zadeh, "Fuzzy Set", Information and Control, 8, pp., 139-146, 1965.
[12] W. B. Vasantha Kandasamy, P. Pramodh, "Parent Children Model Using FCM to Study Dropouts in Primary Education", Ultra Scientist of Physical Sciences, Vol. 13(3), pp., 362-367,2001