ADV MATH SCI JOURNAL
Advances in Mathematics: Scientific Journal **9** (2020), no.4, 1533–1539
ISSN: 1857-8365 (printed); 1857-8438 (electronic)
https://doi.org/10.37418/amsj.9.4.7 Spec. Issue on NCFCTA-2020

THREATS OF CANCER DUE TO MODERNIZED SOCIETY – A STUDY ON NEUTROSOPHIC APPROACH

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ABSTRACT. Globally, cancer is a huge adversity of diseases. Each and every year, thousands of millions of people are identified with cancer around the world and more than half of the people are dying from the dreadful disease. In particular, the vast and fast growth in technology and influences of money minded society reduced the health conscious in people's minds. In this study, the causes of cancer in modern society are identified. Introduced the neutrosophy approach in cancer to overcome the indeterminacy concept in preference with positive and negative influencing factors. The advancement of Fuzzy Cognitive Map is Neutrosophic Cognitive Map which was introduced by Florentine Samarandache and W. B. Vasantha Kandasamy [5].

1. INTRODUCTION

Cancer is an anomalous growth of cells which leads to propagate in an uncontrolled way [1, 7]. It is a combination of more than 100 conflicting and discrete diseases. In the early stages of life normal cells grow and divide faster to allow person's growth. After some stage attained by a person, For ex: If a person entered into the adolescence, most cells divide only to replace or to repair injuries [3, 4]. In this paper, the advancement of fuzzy cognitive map considers the

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2010 *Mathematics Subject Classification.* 03E72.

Key words and phrases. Cancer, Fuzzy approach, Fuzzy Extension, FCM (Fuzzy Cognitive Map), NCM (Neutrosophic Cognitive Map).

threats of cancer disease due to modern society. Connections and importance among the attributes are discussed based on the expert's idea.

The extended tool of CM (Cognitive Maps) which was introduced by Kosko (1986) named as Fuzzy Cognitive Map to study the strength of the influence among the imprecise information or data. It takes the fuzzy values between -1 and 1. i.e., [-1,1] or likert scale as low, medium, high etc. in case of the expert's understanding. The concept of fuzzy is to measure the membership and non-membership repeatedly. It is failed to measure the relationships among the concepts or nodes are indeterminate [2].

To cope up the above issue, a developed concept namely Neutrosophic logic (Florentine Samarandache) [5], which is a combination/advancement of fuzzy logic to deal with the indeterminacy concept.

2. Preliminaries and Definitions

In Fuzzy cognitive bimaps, the two nodes are fuzzy sets then it is called fuzzy binodes. The edge weights or strength of influence from the set $\{-1, 0, 1\}$ are called simple FCMs. Consider the binodes $F_1, F_2, \ldots, F_n$ and $F_1^{'}, F_2^{'}, \ldots, F_n^{'}$ of FCBM. In the directed graph, the edge weight e_{ij} is drawn $\in \{-1, 0, 1\}$. The adjacency matrix E be defined by M= $e_{ij}{}^{P}$, where $e_{ij}{}^{P}$ is the weight of the directed edge C_iC_j. All the bimatrices connected with FCBMs are square matrices with diagonal entries as zero. Consider two nodes of the FCBM. A is called the instantaneous state bivector and it denotes the on-off position

$$a_j^* = \begin{cases} 1 & \text{if } j^{th} \text{ state is ON} \\ 0 & \text{if } j^{th} \text{ state is OFF} \end{cases}$$

$$a_j^+ = \begin{cases} 1 & \text{if } j^{th} \text{ state is ON} \\ 0 & \text{if } j^{th} \text{ state is OFF for every } j = 1, 2, \ldots, n. \end{cases}$$

When the causal relationships among the factors flow through a cycle in a repeated way, the FCBM is said to be a dynamical system. When the dynamical system is a unique state vector (i.e., equilibrium state) then it is called the fixed point. If the state bivectors flow repeatedly, then the equilibrium is called limit cycle [6].

3. MAIN RESULTS

3.1. **Proposed algorithmic approach.**

Step 1: The two sets of attributes have been given by the experts by analyzing the research articles and American cancer society.

Step 2: The experts were asked to indicate the relationships among the factors using Neutrosophic approach.

Step 3: The adjacency bimatrices E_1 and E2 are obtained from the experts opinion between the values $[0, 1, I]$.

Step 4: Consider the state vector (F_1) which is in ON position.Find $F \times E$. Update and threshold the resultant vectors at each step.

Step 5: Assigning 1 for the highest values to be in ON state and other values in OFF state as 0. Then the new vector Y is obtained.

Step 6: In the Y vector, proceed step 4 and 5. The other resultant vector is obtained considered as Y_1.

Step 7: when the same threshold value occurs twice, then the resultant vector is considered as the fixed point.

Step 8: Consider the state vector F_2 in ON state in terms of F_1. Proceed the calculation as per in the step 4 to 7.

Step 9: Continue all the above steps for the remaining attributes and find the hidden pattern.

3.2. **Adaptation of the problem.** Consider the two set of attributes (factors) say $A_1, \ldots, A_n, P_1, \ldots, P_p$ where n, p are finite and that are connected with the cancer threats due to modern society. Adjacency bi-matrix is denoted as E. First passing the state vector F into Connection Matrix E. By applying the thresholding process, the fixed point are obtained by converting the resultant vector into signal function and taking the highest values to be in ON state as 1 and other values in OFF state as 0. It gives a new vector Y. The process has been repeated until limit bicycle is obtained.

3.3. **Factors given by first expert.**

A_1 – Dietary Factors

A_2 – Environmental Pollution

A_3 – Chronic Infections with some types of viruses HV, HPV, HCV, HBV etc.,

A_4 – Overweight and Obesity
A_5 – Cellular phones and Electrical devices
A_6 – Hereditary Factors

3.4. **Factors given by a second expert.**

P_1 – Tobacco and Alcohol usage
P_2 – Hormonal and Reproductive factors
P_3 – Occupational risks
P_4 – UV and other types ofradiations
P_5 – Cosmetics (Skin moisturizers,antiperspirants,facial makeups,hair colors, lipstick,nail polish etc.)
P_6 – Psychological stress.

Based on the expert's opinion, the corresponding adjacency matrices E_1 and E_2 are given below ie., $E = E_1 \cup E_2$.

$$\begin{array}{c} \\ A_1 \\ A_2 \\ A_3 \\ A_4 \\ A_5 \\ A_6 \end{array} \begin{array}{c} \begin{array}{cccccc} F_1 & F_2 & F_3 & F_4 & F_5 & F_6 \end{array} \\ \begin{pmatrix} - & 0.9 & 0.8 & 1 & I & 0.6 \\ 0.88 & - & 0.7 & 0.9 & 0.4 & 0.7 \\ 0.99 & I & - & 0.98 & I & 0.85 \\ 1 & 0 & 0.9 & - & 0.5 & 0.8 \\ 0.71 & 0.6 & 0.79 & 0.89 & - & 0.31 \\ 0.8 & I & 1 & 1 & 0 & - \end{pmatrix} \end{array} \bigcup \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \\ P_6 \end{array} \begin{array}{c} \begin{array}{cccccc} P_1 & P_2 & P_3 & P_4 & P_5 & P_6 \end{array} \\ \begin{pmatrix} - & 0.6 & 0.9 & 0.8 & I & 0.7 \\ 0.3 & - & I & 0.6 & I & 0.4 \\ 0.9 & I & - & 0.85 & 0.4 & 0.8 \\ 0.8 & 0.6 & 0.7 & - & I & 0.1 \\ 0.2 & I & 0.5 & 0.4 & - & 0.3 \\ 0.7 & 0.2 & 0.6 & 0.1 & 0.2 & - \end{pmatrix} \end{array}$$

3.5. **Calculation.**

Let us consider a factor F is in ON state and other binodes are in OFF state

$$\begin{aligned} F &= \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \cup \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \\ &= (F_1 \cup F_2) \end{aligned}$$

The impact of F on the dynamical system E is given by

$$\begin{aligned} F &= (F_1 \cup F_2)(E_1 \cup E_2) \\ &= (F_1 E_1) \cup (F_2 E_2) \end{aligned}$$

$$
\begin{aligned}
F.E &= \Big(1 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0\Big) \cup \Big(1 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0\Big) \cdot E \\
&\quad \Big(0 \quad 0.9 \quad 0.8 \quad 1 \quad I \quad 0.6\Big) \cup \Big(0 \quad 0.6 \quad 0.9 \quad 0.8 \quad I \quad 0.7\Big) \\
&\to \Big(1 \quad 1 \quad 1 \quad 1 \quad I \quad 1\Big) \cup \Big(1 \quad 1 \quad 1 \quad 1 \quad I \quad 1\Big) \\
&\quad = (F_1' \cup F_2') \\
F'.E &= (F_1' \cup F_2') \cdot E \\
&\to \Big(1 \quad 1 \quad 1 \quad 1 \quad I \quad 1\Big) \cup \Big(1 \quad 1 \quad 1 \quad 1 \quad I \quad 1\Big) = Y \\
Y \cdot E &= \Big(1 \quad I \quad 1 \quad 1 \quad I \quad 1\Big) \cup \Big(1 \quad I \quad I \quad l \quad I \quad 1\Big) \cdot E \\
&\to \Big(1 \quad I \quad 1 \quad 1 \quad I \quad 1\Big) \cup \Big(1 \quad I \quad 1 \quad 1 \quad I \quad 1\Big) = Y_1 \\
Y &= Y_1
\end{aligned}
$$

Y_1 is the fixed point.

3.6. **Discussion.** Hence the limit bipoint is:

$$\Big(1 \quad I \quad 1 \quad 1 \quad I \quad 1\Big) \cup \Big(1 \quad I \quad I \quad 1 \quad I \quad 1\Big) .$$

According to the opinion of first and second experts when dietary factors and Tobacco and Alcohol usage is kept in ON state, the attributes Chronic infections with some types of viruses, Overweight and Obesity, Hereditary factors, UV and other types of radiations, Psychological stress are the impacting factors for the threats of cancer and Environmental Pollution, Cellular phones and Electrical devices, Harmonal and reproductive factors, Occupational risks and Cosmetics are the indeterminate factors for the problem.

The set of limit points corresponding to different attributes is given in Table 1.

Input bivectors	Limit bicycle
$(100000), (100000)$	$\begin{pmatrix}1 & I & 1 & 1 & I & 1\end{pmatrix} \cup \begin{pmatrix}1 & I & I & 1 & I & 1\end{pmatrix}$
$(010000), (010000)$	$\begin{pmatrix}1 & I & 1 & 1 & I & 1\end{pmatrix} \cup \begin{pmatrix}1 & I & I & 1 & I & 1\end{pmatrix}$
$(001000), (001000)$	$\begin{pmatrix}1 & I & 1 & 1 & I & 1\end{pmatrix} \cup \begin{pmatrix}1 & I & I & 1 & I & 1\end{pmatrix}$
$(0000100), (000010)$	$\begin{pmatrix}1 & I & 1 & 1 & I & 1\end{pmatrix} \cup \begin{pmatrix}1 & I & I & 1 & I & 1\end{pmatrix}$
$(000010), (000010)$	$\begin{pmatrix}1 & I & 1 & 1 & I & 1\end{pmatrix} \cup \begin{pmatrix}1 & I & I & 1 & I & 1\end{pmatrix}$
$(000001), (000001)$	$\begin{pmatrix}1 & I & 1 & 1 & I & 1\end{pmatrix} \cup \begin{pmatrix}1 & I & I & 1 & I & 1\end{pmatrix}$

TABLE 1. Limit Points for different attributes

CONCLUSION

By using Neutrosophic Cognitive Bimaps it is observed that, while keeping all the attributes in ON state, the fixed point obtained are same.ie) the factors namely Dietary Factors, Chronic Infections with some types of viruses HV, HPV, HCV, HBV etc., Overweight and Obesity, Hereditary Factors, Tobacco and Alcohol usage, UV and other types of radiations, Psychological stress are the main implicated factors for the above problem. Similarly, the factors Environmental Pollution, Cellular phones and Electrical devices, Hormonal and Reproductive factors, Occupational risks, Cosmetics (Skin moisturizers, antiperspirants, facial makeups, hair colors, lipstick, nail polish etc are the indeterminate case. All the above implicated factors are responsible for the threats of cancer. It may be possible to reduce death of cancers by developing the awareness programmes to the public about these risks factors.

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