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Predictors of interest in cosmetic surgery – An analysis using induced fuzzy cognitive maps (IFCMs)

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Abstract. Cosmetic surgery has been a growing fascination for many people over the last couple of decades. There are number of qualitative factors predicts interest towards cosmetic surgery. This study analyses the possible factors such as interpersonal, social and intrapersonal factors and empirical factors like Appearance based rejection sensitivity, Personal rejection sensitivity etc. Hence, this research investigates the most predicting / impactful factor of predicting interest in cosmetic surgery using Induced Fuzzy Cognitive Maps (IFCMs). IFCMs are a fuzzy-graph modeling approach based on expert's opinion. This is the non-statistical approach to study the problems with imprecise information.

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1. Introduction

In recent years, the rate of cosmetic surgery procedures has sky rocked in the developed countries. Statistically, there has been a dramatic increase in all cosmetic procedures performed annually since 1978 [1]. Recent work has reported that women are much more willing than men to undergo cosmetic procedures [4]. Moreover 21% of these procedures were performed on individuals between 19 and 34 years of age and 27% of 18–24 year olds reported that they would consider undergoing cosmetic surgery now or in the future [1].

This revolution in cosmetic surgery interest evolves much more attention of not only the psychologists but also the researchers towards it. Over the past decade, many psychologists have focused their attention on correlating interest in cosmetic surgery. Many factors also have been developed and analysed for creating interest

towards cosmetic surgery [12]. This study reveals many interpersonal factors such as body image dissatisfaction [10, 11]; Sarwer, Wadden, Pertschuk, & Whitaker, 1998), low self rated attractiveness [4], Psychological investment in appearance [8, 15, 13], attachment anxiety [7], body dsymorphic disorder [6, 14] and previous experience with cosmetic surgery [18] predict acceptance of interpersonal factors, such as appearance–related teasing [13] and internalization of socio-cultural appearance messages and ideals from the media and entertainment industries [8, 10, 18] have also been implicated in the desire for cosmetic surgery.

Also the latest study [12] added some factors to the growing body of literature by examining the role of a new personality construct in predicting cosmetic surgery interest : Appearance–based rejection sensitivity (Appearance–RS, Park, 2007). Appearance–RS refers to the dispositional tendency to anxiously expect, readily perceive and over react to signs of rejection based on one's physical appearance.

Given these developments, it is no surprise that psychologists have focused their attention on measuring willingness to undergo cosmetic surgery [4]. Perhaps the most reliable is Henderson King and Henderson–King's Acceptance of Cosmetic Surgery Scale (ACSS, 2005). The ACSS measures three aspects of attitudinal dispositions toward cosmetic surgery. The extent literature has documented significant associations between these ACSS subscales and body image disturbance, exposure to reality cosmetic surgery television programmes [16], the big five personality factors [18], Celebrity Worship [19] materialist values and paternal attitudes [10].

The current study examines some intrapersonal, social and interpersonal and empirical factors for creating interest in cosmetic surgery and analyses the most impactful factor for creating interest in cosmetic surgery using Induced Fuzzy Cognitive Maps (IFCMs). An efficient knowledge-based approach utilizing the method of Fuzzy Cognitive Maps (FCMs) is presented in this research work.

Fuzzy Cognitive Maps (FCMs) is a well established technique for prediction and decision making especially for situations where fuzziness and uncertainty exists. To deal imprecise information, Lofti A. Zadeh, 1965, introduced the notion of fuzziness. In 1986, Kosko [3], the guru of fuzzy logic introduced the Fuzzy Cognitive Maps. It was a fuzzy extension of the Cognitive Map pioneered in 1976 by Political Scientist Robert Axelrod, who used it to represent knowledge as an interconnected, directed, bilevel-logic graph. Thus the FCM plays a vital role in modeling system. This paper describes the method of analyzing the most predicting factor in cosmetic surgery using Induced Fuzzy Cognitive Maps (IFCMs) which is the advanced study of FCM [17].

It is worth mentioning here, the book entitled 'FCMs and Neutrosophic Cognitive Maps' by Vasantha and Smarandache2003 [20]. This book infers that FCMs strongly resemble neural networks and powerful for reaching consequences as a mathematical tool for modeling complex systems.

Implications for interdisciplinary Reading: National Implication by Calais [5], FCM based tool for prediction of infectious diseases by Elpiniki et al. [9], Benefits of literacy in Bhutan by Devadoss et al. [22], Problem faced by bonded laborers near Kodaikanal forests discussed and solution given by Vasantha [21] are notable studies in this area of research. In all the above studies, the various real life problems

with imprecise information taken and the precise solutions given by FCM and its advanced studies.

In the current study, section 1 overviews the Fuzzy Cognitive Maps theory, its influence and its necessity. Section 2 explains the Algorithmic approach of IFCM models. Section 3 discusses the possible components (attributes) predicts the interest in cosmetic surgery. Section 4 gives implementation of IFCM model and Section 5 reveals the discussion of the proposed work.

2. Fuzzy Cognitive Maps

Fuzzy Cognitive Maps (FCMs) are digraphs that capture the cause / effect relationships in a system. Nodes of the graph stand for the concepts representing the key factors and attributes of the modeling system, such as inputs, variable states, components, factors, events, actions of any system. Signed weighted arcs describe the casual relationships, which exists among concepts and interconnect them, with a degree of casuality. The constructed graph clearly shows how concepts influence each other and how much the degree of influence is.

Cognitive Maps (CMs) were proposed for decision making by Axelrod [2] for the first time. Using two basic types of elements; concepts and casual relationship, the cognitive map can be viewed as a simplified mathematical model of a belief system. FCMs were proposed with the extension of the fuzzified casual relationships. Kosko [3], introduced FCMs as fuzzy graph structures for representing casual reasoning. When the nodes of the FCM are fuzzy sets then they are called fuzzy nodes. FCMs with edge weights or causalities from the set $\{-1, 0, 1\}$ are called simple FCMs.

Consider the nodes / concept P_1, P_2, ..., P_n of the FCM. Suppose the directed graph is drawn using edge weight l_{ij} from $\{-1, 0, 1\}$. The matrix M be defined by $M = \{e_{ij})$ where the e_{ij} is the weight of the directed edge P_iP_j. M is called the adjacency matrix of the FCM, also known as connection matrix.

The directed edge e_{ij} from the casual concept P_i to concept P_j measures how much P_i causes P_j. The edge e_{ij} takes values in the real interval $[-1, 1]$.

$e_{ij} = 0$ indicates no casuality. $e_{ij} > 0$ indicates casual increase / positive casuality.

$e_{ij} < 0$ indicates casual decrease / negative casuality.

Simple FCMs provide quick first-hand information to an expert's stated casual knowledge. Let P_1, P_2, ..., P_n be the nodes of FCM. Let $A = (a_1, a_2, \ldots, a_n)$ is called a state vector where either $a_i = 0$ or 1. If $a_i = 0$, the concept c_i is in the ON state, for $i = 1, 2, \ldots, n$. Let P_1P_2, P_2P_3, ..., P_iP_j be the edges of the 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 with cycles is said to have a feedback, when there is a feedback in an FCM, i.e., when the casual relations flow through a cycle in a revolutionary way, the FCM is called a dynamical system. The equilibrium state for the dynamical system is called the hidden pattern.

If the equilibrium state of a dynamical state is a unique state vector, it is called a fixed point or limit cycle. Inference from the hidden pattern summarizes the joint effects of all interacting fuzzy knowledge.

3. Algorithmic Approach in IFCM

Even though IFCM is an advancement of FCM it follows the foundation of FCM, it has a slight modification only in Algorithmic approaches. To derive an optimistic solution to the problem with an unsupervised data, the following steps to be followed:

Step 1: For the given model (problem), collect the unsupervised data that is in determinant factors called nodes.

Step 2: According to the expert opinion, draw the directed graph.

Step 3: Obtain the connection matrix, M_1, from the directed graph (FCM). Here the number of rows in the given matrix = number of steps to be performed.

Step 4: Consider the state vector C_1 which is in ON position. Find $C_1 \times M_1$. The state vector is updated and threshold at each stage.

Step 5: Threshold value is calculated by assigning 1 for the values > 1 and 0 for the values < 0. The symbol '$\rightarrow$' represents the threshold value for the product of the result.

Step 6: Now each component in the C_1 vector is taken separately and product of the given matrix is calculated. The vector which has maximum number of one's is found. The vector with maximum number of one's which occurs first is considered as C_2.

Step 7: When the same threshold value occurs twice. The value is considered as the fixed point. The iteration gets terminated.

Step 8: Consider the state vector C_1 by setting C_2 in ON state that is assigning the second component of the vector to be 1 and the rest of the components as 0. Proceed the calculations discussed in Steps 4 to 6.

Step 9: Continue Step 9 for all the state vectors and find hidden pattern.

4. Predicting factors in Cosmetic Surgery – Undetermined Factors (Strategies)

We have made a sample survey of around 5–7 plastic surgeons in Tamil Nadu, India. They were interviewed using a questionnaire and some research papers relevant to the topic.

According to their views, some of the factors as indicators are considered for our studies are given as follows:

P-1 Body image dissatisfaction
P-2 Body dysmorphic disorder
P-3 Anxious expectations of rejection sensitivity from parents/peers.
P-4 Previous experience with cosmetic surgery
P-5 Vicarious experiences of cosmetic surgery via family and friends
P-6 Ideals from the media and entertainment industries
P-7 Accidents/Fire Victims
P-8 Internalization of socio-cultural appearance message
P-9 Appearance based rejection sensitivity (Appearance–RS)
P-10 Self perception of attractiveness
P-11 Fear of becoming unattractive due to disordered eating

P-12 Negative comments about the appearance from peers/friends/romantic partners.
P-13 Cosmetic surgery reality shows
P-14 Personal Rejection Sensitivity (Personal – RS)
P-15 Hope in cosmetic surgery results.
P-16 Deriving self-esteem from the appearance.

5. Implementation of IFCM Model to the study

Based on the Experts' opinion, the directed diagram is drawn and the corresponding connection matrix M is given as

$$M = \begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 10 \\ 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \end{array} \begin{array}{c} \begin{array}{cccccccccccccccc} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 & 11 & 12 & 13 & 14 & 15 & 16 \end{array} \\ \begin{pmatrix} 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \end{array}$$

Step 1:

Let us consider C_1 in the step 1, by setting the concept C_1 to ON state i.e., the first component of the vector is set to be 1 and the rest are assigned to 0.

$$C_1 = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

(Product of C_1 and M is calculated)

$$C_1 \times M = \begin{pmatrix} 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \end{pmatrix}$$
$$\rightarrow \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \end{pmatrix} = C_1^1$$

Threshold value is calculated by assigning 1 for the values > 1 and 0 for the values < 0. The symbol '$\rightarrow$' represents the threshold value for the product of the result.

Now

$$C_1^1 = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \end{pmatrix}$$
$$C_1^1 \times M = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \end{pmatrix} \times M$$

Now as per the Induced Fuzzy cognitive Map methodology, each component in the C_1^1 vector is taken separately and product of the given matrix is calculated. The vector which has the maximum number of one's which occurs first is considered as

C_2. The symbol $\sim$ denotes the calculation performed with the respective vector, here C_1^1.

$$
\begin{aligned}
C_1^1 \times M \sim & \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \times M \\
& \to \begin{pmatrix} 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \end{pmatrix} \\
= & \begin{pmatrix} 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \times M \\
& \to \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix} \\
= & \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \times M \\
& \to \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix} \\
= & \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \times M \\
& \to \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \end{pmatrix} \\
= & \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \times M \\
& \to \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \\
= & \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \times M \\
& \to \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \\
= & \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix} \times M \\
& \to \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \end{pmatrix} \\
= & \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix} \times M \\
& \to \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \\
\text{Therefore } C_2 = & \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \end{pmatrix} \\
C_2 \times M = & \begin{pmatrix} 2 & 0 & 1 & 0 & 0 & 2 & 0 & 4 & 3 & 2 & 2 & 2 & 2 & 2 & 3 & 1 \end{pmatrix}
\end{aligned}
$$

(Product of C_2 and M is calculated)

$$
\begin{aligned}
& \to \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix} \\
C_2^1 = & \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix}
\end{aligned}
$$

Similar to the above computation, the vector which has the maximum number of ones is found and let it be C_3.

$$C_3 = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \end{pmatrix} = C_2.$$

The fixed point is $C_3 = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \end{pmatrix}$.

When the same threshold value occurs twice, the value is considered as the fixed point. The iteration gets terminated and the calculation gets terminated and the calculation for step 2 is performed. Similar to the step 1, consider C_1 by setting C_2 in ON state, i.e., assigning the second component of the vector to be 1 and the rest of the components as 0.

Step 2:

Let C_1 be,

$$C_1 = \begin{pmatrix} 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$C_1 \times M = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

(Product of C_2 and M is calculated)

$$\begin{aligned}
&\to \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix} = C_1^1 \\
C_1^1 \times M \sim &\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \times M \\
&\to \begin{pmatrix} 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \end{pmatrix} \\
&= \begin{pmatrix} 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \times M \\
&\to \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix} \\
&= \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \times M \\
&\to \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \\
&= \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix} \times M \\
&\to \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}
\end{aligned}$$

Now the vector with maximum number of 1's be C_2.

$$\begin{aligned}
C_2 &= \begin{pmatrix} 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \end{pmatrix} \\
C_2 \times M &= \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 2 & 3 & 2 & 1 & 1 & 2 & 2 & 2 & 0 \end{pmatrix} \\
&\to \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \end{pmatrix} = C_2^1
\end{aligned}$$

Now the vector with maximum number of 1's be C_3.

$$\begin{aligned}
C_3 &= \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \end{pmatrix} \\
\text{Now } C_3 \times M &= \begin{pmatrix} 2 & 0 & 1 & 0 & 0 & 2 & 0 & 4 & 3 & 2 & 2 & 2 & 2 & 2 & 3 & 1 \end{pmatrix}.
\end{aligned}$$

(Product of C_3 and M is calculated)

$$\begin{aligned}
&\to \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix} \\
C_3^1 &= \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix}
\end{aligned}$$

Now the vector with maximum number of 1's be C_4.

$$C_4 = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \end{pmatrix} = C_3.$$

The fixed point is C_4.

In the above manner, the other steps to be performed. By keeping each vector in ON position, the various fixed points are found.

6. Discussion

In this study, we have performed two steps. Result of Step 1 suggests, by keeping C_1 in ON state, we obtain the hidden pattern. That is, all the 1's in C_3 are the possible factors revealed from the first factor. More precisely, the factors viz, rejection sensitivity from parents/peers, internalization of socio-cultural appearance

message, Appearance-RS, self-perceptions of attractiveness and satisfaction, negative comments about the appearance from peers/friends/romantic partners, Cosmetic surgery reality shows, Personal-RS are the casual implications of Body image satisfaction.

In a similar manner, we can discuss the result of Step 2. In Step 2, we kept C_2 in ON position and we have derived C_4 as the hidden pattern. C_4 contains the factors in ON state are nothing but the factors which are discussed in Step 1. So by taking 'Body dysmorphic disorder' factor also we obtain the same implications. Likewise if we choose other factor in ON position, we derive corresponding implication factors.

Two further results are worthy of consideration in the present study. First, by observing the above calculation of IFCM done in Steps 1and 2, it is explicitly shown that the fixed point vector is taken as the vector which has the maximum number of 1's. In both the steps we obtain the fixed point vector as

$$(\ 1 \quad 0 \quad 0 \quad 0 \quad 0 \quad 1 \quad 0 \quad 1 \quad 1 \quad 1 \quad 0 \quad 1 \quad 1 \quad 1 \quad 0 \quad 0\ ).$$

That is the factors such as 1, 6, 8, 9, 10, 12, 13 and 14 are the main implicated factors so for any common factor as we have taken as attributes 1 to 16, the above are the casualties.

The second interesting result we can see that the above fixed point vector is nothing but the 12^{th} factor in the casual connection matrix M, 'Negative comments about the appearance from peers/friends/romantic partners'. So we can conclude that this factor as the most impactful factor in this study, even though many attributes present.

Earlier studies in this field, revealed results by concentrating one or two factors alone. But the unique contribution of this study is that various interpersonal, social, intrapersonal and empirical factors for predicting interest in cosmetic surgery have been taken and among them the most impactful factor also found.

Although this research is unique, it has a couple of limitations also. First, the limitation of IFCM. This model consists of lengthy procedure for calculation which is not suitable for calculation with the matrices which has higher number of rows and columns. Second, this manual calculation is fully based on the Expert's opinion. So, it may lead to personal bias. But to deal with an unsupervised data, the IFCM Model predicates the accurate results when comparing with FCM Model. The reason is, the vector yields more number of concepts is considered to be the best vector i.e., the fixed point which is not the case of FCM.

The present study is the first study that examining the effects and casualties of each attribute taken for the study. Also it yields the most impactful factor for predicting interest in cosmetic surgery.

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