Reasons for Adolescent’s Social Network addiction and its impact on Academics - An Analysis using Induced Linked Fuzzy Relational Mapping Using Hexagonal Fuzzy number

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ABSTRACT

Educational Institution is a home away from home and it is a place of knowledge acquisition. It aims in developing the adolescents to fulfill the requirements of the needs of the society. It strives hard in implementing new tactics to enhance the academics, but it still fails in achieving it due to many reasons one among is, addiction to social networks. As we are living in techno world, we are bound to be a member of social networks (SN) and the adolescents are not an exception to it. In this present scenario we are highly dominated by our inventions and the best example is social networks. Though it is featured with many beneficial attributes its impact on adolescent’s academics is worse which indeed troubles the parents and bring them to a conclusion that social networks has connection with adolescent’s academic performance which is considered significant by the educational institution. To find the attribute which cause a strong impact on adolescent’s academic performance, induced linked fuzzy relational mapping using hexagonal fuzzy number approach is used which is a novel method.

This was again extended further to Induced Linked Fuzzy Relational maps by Pathinathan. T . In all these works the weightage of one factor over the other is represented by either 0 or 1. But in this paper the weightage is assigned by linguistic variable and it is quantified by hexagonal fuzzy number. This new approach is made to be more precise than just assigning 1 or 0.

This paper aims in formulating solutions for the problems of SN addiction of adolescents so as to pave way for their enhancement of academic standards. The paper is organized as follows: Section 2 consists of basic definitions; section 3 describes the methodology; section 4 analyzes the reasons for SN addiction and section 5 concludes the work

2. Basic Definitions

2.1 Fuzzy Relational Maps (FRM)

A FRM is a map like structure enclosing the causal relationships between the real vector space elements of domain of dimension n and range of dimension m. The nodes of the domain space is denoted by D1,D2,…Dn where Di = \{ (x1,x2,…,xn) / xi = 0 or 1, i = 1,…n \}. If xi = 1 or 0 then it implies Di is in ON or OFF state respectively. The nodes of the range space is denoted by R1,R2,…,Rm where Rj = \{ (x1,x2,…,xm) / xj = 0 or 1, i = 1,…m \}. If xj = 1 or 0 then it implies Rj is in ON or OFF state respectively.

2.2 Relational Matrix of FRM

The matrix M = (mij) is called as the relational matrix of the FRM, where mij is the weight associated with the directed edge DiRj or RjDi.

2.3 Hidden Pattern

Let D, D2,…,Dn (R1,R2,…,Rm) be a cycle when is switched on Di (Rj) and if the causality flows through the edges of a cycle and if it again causes Di (Rj), We say that the dynamical system goes round and round.
This is true for any node Di (Rj) for \( i = 1, 2, \ldots, n \). The equilibrium state for this dynamical system is called the hidden pattern.

### 2.4 A Fixed Point attractor of FCM

If the equilibrium state of a dynamical system is a unique state vector, then it is called a fixed point. Consider a FRM with \( D_1, D_2, \ldots, D_n \) as nodes. For example, let us start the dynamical system by switching on \( D_i \) (Rj). Let us assume that the FRM settles down with \( D_1 \) (R1) on, i.e. the state vector remains as \((1, 0, 0, \ldots, 0, 1)\). This state vector \((1, 0, 0, \ldots, 0, 1)\) is called the fixed point.

### 2.5 Limit Cycle

If the equilibrium state of the dynamical system is a unique state vector, then it is called a fixed point.

### 2.6 Hexagonal fuzzy number

A hexagonal fuzzy number is specified by 6-tuples, \( AH = (a_1, a_2, a_3, a_4, a_5, a_6) \) such that all \( a_i \)'s are real numbers and \( a_1 \leq a_2 \leq a_3 \leq a_4 \leq a_5 \leq a_6 \) where the membership function is [1]

\[
\mu(\tilde{A}x) = \begin{cases} 
\frac{1-x-a_1}{2a_2-a_1} & \text{for } a_1 \leq x \leq a_2 \\
\frac{1}{2} + \frac{x-a_2}{2a_3-a_2} & \text{for } a_2 \leq x \leq a_3 \\
1 & \text{for } a_3 \leq x \leq a_4 \\
1 - \frac{1-x-a_4}{2a_5-a_4} & \text{for } a_4 \leq x \leq a_5 \\
\frac{1}{2} \frac{a_5-x}{a_6-a_5} & \text{for } a_5 \leq x \leq a_6 \\
0 & \text{otherwise}
\end{cases}
\]

### 3. Method of finding the hidden pattern in Induced Linked Fuzzy Relational Maps using Hexagonal fuzzy number

The steps followed in this method are same as that of the Induced linked Relational Maps. The difference lies in step 6.

1. Consider \( D_1, D_2, \ldots, D_n \) and \( R_1, R_2, \ldots, R_m \), the concepts be the nodes of FCM with the responses of the experts.
2. Form the relational matrix \( M \) with linguistic variables.
3. Keep \( D_1 \) in ON state and all other components in OFF state.
4. Pass \( C_1 \) through \( M \) and find \( C_1' \).
5. Convert into Signal Function by choosing the first two highest value to ON state and other values to OFF state with 1 and 0 respectively.
6. Pass each component of \( C_1' \) through \( M \) repeatedly and choose the first vector as \( C_2 \) containing maximum number of 1’s after applying threshold function that is assign 1 for the values greater than 1 and 0 for others.
7. Repeat the same procedure for \( C_2 \) until we get a fixed point or a limit cycle.
8. Find the hidden pattern in the similar way by keeping the second component in ON state.

### 4. Analysis using Induced Linked Fuzzy Relation Map Model

The following attributes of the SN are represented as nodes are as follows:

- **HSN1**: Highly interesting and fascinating
- **HSN2**: Enhances the social status
- **HSN3**: Rapid acquisition and Transform of information
- **HSN4**: Enable to live a virtual life by creating groups
- **HSN5**: Boosts the rate of communication and interactiveness

The following attributes of parents are represented as nodes are as follows:

- **HP1**: Inability to control their children’s usage of SN
- **HP2**: Feeling proud of their excellence in SN usage
- **HP3**: Encouraging the replacement of playing games by SN
- **HP4**: Relax by making their children to be busy with their works which make them to engage in SN
- **HP5**: Rendering excess of freedom and joining hands with them

The following attributes of Adolescents are represented as nodes are as follows:

- **HA1**: They wish to raise themselves high among their peer group
- **HA2**: They want their views to be expressed to others
- **HA3**: They are crazy about delightful things
- **HA4**: They desired to do adventurous acts
- **HA5**: They are interested to act independently

The linguistic values of the Hexagonal Fuzzy number are

The relational matrix between the domain (Media) attributes and the range (Parents) attributes are represented as

\[
\begin{array}{ccccccc}
\text{SNP} & \text{SN} & \text{HP} & \text{HP} & \text{HP} & \text{HP} & \text{HP} \\
\text{HSN1} & \text{VL} & \text{L} & \text{VL} & \text{L} & \text{M} & \\
\text{HSN2} & \text{VL} & \text{H} & \text{H} & \text{VL} & \text{H} & \\
\text{HSN3} & \text{VL} & \text{L} & \text{VL} & \text{L} & \text{VL} & \\
\text{HSN4} & \text{L} & \text{VL} & \text{L} & \text{H} & \text{H} & \\
\text{HSN5} & \text{VL} & \text{VL} & \text{L} & \text{H} & \text{H} & \\
\end{array}
\]

The relation matrix (SNP) is

\[
\begin{array}{ccccccc}
\text{SNP} & \text{SN} & \text{HP} & \text{HP} & \text{HP} & \text{HP} & \text{HP} \\
\text{HSN1} & 0.2 & 0.275 & 0.2 & 0.275 & 0.425 & \\
\text{HSN2} & 0.2 & 0.575 & 0.575 & 0.2 & 0.575 & \\
\text{HSN3} & 0.2 & 0.275 & 0.2 & 0.275 & 0.2 & \\
\text{HSN4} & 0.275 & 0.8 & 0.425 & 0.425 & 0.425 & \\
\text{HSN5} & 0.2 & 0.275 & 0.275 & 0.575 & 0.575 & \\
\end{array}
\]
The relational matrix between the domain (Parents) attributes and the range (Adolescents) attributes are represented as

\[
PA = \begin{pmatrix}
    H1A & H2A & H3A & H4A & H5A \\
    HP1 & L & L & M & M & H \\
    HP2 & H & H & H & H & VH \\
    HP3 & H & H & H & H & H \\
    HP4 & H & M & H & VH & M \\
    HP5 & H & VH & VH & VH & VH \\
\end{pmatrix}
\]

\[
(\text{PA}) = \begin{pmatrix}
    H1A & H2A & H3A & H4A & H5A \\
    HP1 & 0.275 & 0.275 & 0.425 & 0.425 & 0.575 \\
    HP2 & 0.575 & 0.575 & 0.575 & 0.575 & 0.8 \\
    HP3 & 0.575 & 0.575 & 0.575 & 0.575 & 0.575 \\
    HP4 & 0.575 & 0.425 & 0.575 & 0.8 & 0.425 \\
    HP5 & 0.575 & 0.575 & 0.8 & 0.8 & 0.8 \\
\end{pmatrix}
\]

The connection matrix relating media and adolescent is represented as \(M\) as follows

\[
\text{SNP oPA} = \begin{pmatrix}
    0.73 & 0.69 & 0.86 & 0.92 & 0.91 \\
    1.16 & 1.13 & 1.32 & 1.37 & 1.45 \\
    0.6 & 0.56 & 0.68 & 0.74 & 0.73 \\
    1.27 & 1.21 & 1.41 & 1.5 & 1.56 \\
    0.99 & 0.90 & 1.15 & 1.28 & 1.13 \\
\end{pmatrix}
\]

\[
\text{SNP oPA} = \begin{pmatrix}
    0.73 & 0.69 & 0.86 & 0.92 & 0.91 \\
    1.27 & 1.21 & 1.41 & 1.5 & 1.56 \\
    0.99 & 0.90 & 1.15 & 1.28 & 1.13 \\
\end{pmatrix}
\]

Step 1 Let \(C1 = (10000)\)

\[
C1 = (0.73 0.69 0.86 0.92 0.91) \times M^T = (3.42 5.34 2.75 5.77 4.53) \approx (1 1 1 1 1) = C1'
\]

\[
C1'M = (00010) \times M = (0.6 0.56 0.68 0.74 0.73) \approx (1 1 1 1 1) = C2
\]

\[
(4.53 7.07 3.65 7.65 6.02) \approx (1 1 1 1 1) = C2'
\]

Proceeding in the similar manner we get \(C3 = (11111)\)

\[
(0.73 0.69 0.86 0.92 0.91) \times M^T = (3.42 5.34 2.75 5.77 4.53) \approx (1 1 1 1 1) = C1'
\]

The graphical representation of the attributes is as follows

The interrelationship between the attributes of the social networks reveals that HSN4 (enabling to live a virtual life by creating groups) is the terminal node. The limit point corresponding to HSN4(0.73 0.69 0.86 0.92 0.91) \(= (11111)\) highlights the attributes HSN1, HSN2, HSN3, HSN4, HSN5 and H1A, H2A, H3A, H4A,H5A which together affects the adolescent’s academic performance.

**Conclusion**

It is very vivid that the academic performance of the adolescent’s is highly influenced by the social networks. To put it under control the parents must play an active role. We suggest the following remedial actions to be followed at homes which are as follows

- Spending time with them, sharing the day today happenings
- Explicating the limit and the need of SN
- Permitting them to play with their peer group
- Building up of friendly relationships

By practicing such things the adolescent will create a gap between them and SN.

**References**


[8] Carvalho, J.A. Tomé, Using interpolated linguistic term to express uncertainty in rule based fuzzy cognitive maps, in:


