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Fatigue of Driver on Roads Using Combined Disjoint Block Fuzzy Cognitive Maps (CDBFCMS)

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Abstract- Everybody seems to be running short of time nowadays so people are in the state of rush when they are on Roads. . The growing number of vehicles, population and indiscipline attitude of road users are some of the concerns for the road accidents. In recent years the number of road accidents growing rapidly.In this paper we use Combined Disjoint Block Fuzzy Cognitive Maps (CDBFCMs) to study the attitudes of road users in fatigue related accidents.This paper has four sections. Section one gives the basic notations and definitions. Section two describes the hidden pattern of CDBFCMs. Section three deals with the Description of the problem and analysis using Combined Disjoint Block Fuzzy Cognitive Maps (CDBFCMs). In the final section gives the conclusion based on our study.

Keywords:Road, fatigue, Combined Disjoint Block Fuzzy Cognitive Maps (CDBFCMs)

I. INTRODUCTION

Sleepiness can be defined as the neuro-biological need to sleep, resulting from physiological wake and sleep drives. Fatigue leads to a deterioration of driving performance, manifesting itself in slower reaction time, diminished steering performance, lesser ability to keep distance to the car in front, and increased tendency to mentally withdraw from the driving task.In this paper we discuss on various factors related to fatigue of drivers leads to road crashes using Combined Disjoint Block Fuzzy Cognitive Maps. The purpose of this paper is to review the scale of the sleep related road accident problem and the causes of driverfatigue. Sleep loss and sleep disruption can be caused by a wide range of factors, some of which are beyond the individual's control, but some of which are personal choices (1) hours of work, including long hours and shift work (2) family responsibilities (3) social activities (4) illness, including sleep disorders (5) medication (6) stress.

II. BASIC DEFINITION AND NOTATIONS

Fuzzy cognitive maps (FCMs) are more applicable when the data in the first place is an unsupervised one. The FCMs work on the opinion of experts. FCMs model the world classes and causal relations between classes.FCMs are fuzzy signed directed graphs with feedback. The directed edge e_{ij} from causal concept C_i to concept C_j measures how much C_i causes C_j. The time varying concept function $C_i(t)$ measures the non-negative occurrence of some fuzzy event, perhaps the strength of political sentiment , historical trend . The edges e_{ij} take values in the fuzzy causal interval [–1, 1]. $e_{ij} = 0$ indicates no causality, $e_{ji} > 0$ indicates causal increase, C_j increases as C_i increases (or C_j decreases as C_i decreases). $e_{ji} < 0$ indicates causal decrease or negative causality. C_j decreases as C_i increases (or C_j increases as C_i decreases) simple FCMs have edges values in {–1, 0, 1}.

2.1. Definition
An FCM is a directed graph with concepts like policies, events etc. as nodes and causalities as edges.It represents causal relationship between concepts they are called as fuzzy nodes.

2.2. Definition
FCMs with edge weights or causalities from the set {–1, 0, 1}, are called simple FCMs.

2.3. Definition
Consider the nodes/ concepts $C_1, \ldots, C_n$ 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_iC_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.

2.4. Definition
Let $C_1, C_2, \ldots, C_n$ be the nodes of an FCM. $A = (a_1, a_2, \ldots, a_n)$ 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 $i = 1, 2, \ldots, n$.

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

2.6. Definition
If the FCM settles down with a state vector repeating in the form $A_1 \rightarrow A_2 \rightarrow \ldots \rightarrow A_i \rightarrow A_1$ then this equilibrium is called a limit cycle.

2.7. Definition
Finite number of FCMs can be combined together to produce the joint effect of all the FCMs. Let $E_1, E_2, \ldots, E_p$ be the adjacency matrices of the FCMs with nodes $C_1, C_2, \ldots, C_n$ then the combined FCM is got by adding all the adjacency matrices $E_1, E_2, \ldots, E_p$.
We denote the combined FCM adjacency matrix by $E = E_1 + E_2 + \ldots + E_p$.

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Suppose A = (a_1, … , a_n) is a vector which is passed into a dynamical system E. Then AE = (a'_1, … , a'_n) after thresholding and updating the vector suppose we get (b_1, … , b_n) we denote that by (a'_1, a'_2, … , a'_n) ↪ (b_1, b_2, … , b_n). Thus the symbol '↪' means the resultant vector has been thresholded and updated.

2.8. Definition

Let C_1, C_2, …, C_n be n distinct attributes of a problem n very large and a non- prime. If we divide n into k equal classes i.e., k/n and if n/k=t which are disjoint and if we find the directed graph of each of there classes of attributes with t attributes each then their corresponding connection matrices are formed and these connection matrices are joined as blocks to form a n x n matrix. The n x n connection matrix forms the combined disjoint block FCM of equal classes If the classes are not divided to have equal attributes but if they are disjoint classes we have n x n connection matrix called the combined disjoint block FCM of unequal classes / size. Here we approach the problem through attributes using Combined Disjoint Block Fuzzy Cognitive Maps (CDBFCMs) that are basically matrices which predict the feelings of all the attributes under certain conditions. Before we proceed to apply Combinedo Disjoint Block Fuzzy Cognitive Maps (CDBFCMs) to this problem we define a set of 10 attributes given by experts . We work with analyzing them using directed graph and its connection matrices.

III. DESCRIPTION OF THE HIDDEN PATH USING COMBINED DISJOINT BLOCK FUZZY COGNITIVE MAPS

We take three experts opinion on the three disjoint classes so that each class has four attributes. Let the disjoint classes be classes be B_1, B_2, B_3 be divided by the following B_1={A_1,A_3,A_{10},A_{12}}B_2={A_6,A_7,A_8,A_{11}} and B_3 ={A_2,A_4, A_5, A_9 }. By expert opinion and explanation we take following as attributes related to Driver fatigue in accidents on roads

A_1: Long Journey/Night Journey
A_2: Sleep Deficit
A_3 :Stress/ Tension
A_4: Age and Experience
A_5: Poor Time Management
A_6:Family responsibilities
A_7:Hours of Working / Shift Works
A_8: Alcohol
A_9: Medication
A_{10}:Rheumatic Pain
A_{11} :Poor Eye Vision
A_{12}: Tiredness/Illness

The directed graph given by the first expert A_1,A_3,A_{10},A_{12}which forms the class B_1

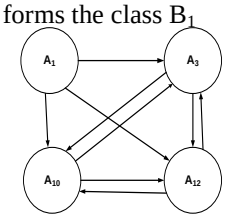

Fig.1

The related connection given by first expert opinion on A_1, A_3, A_{10}, A_{12}which forms the class B_1

B_1=

	A_1	A_3	A_{10}	A_{12}
A_1	0	1	1	1
A_3	0	0	1	1
A_{10}	0	1	0	1
A_{12}	0	1	1	0

The directed graph given by the expertA_6,A_7,A_8,A_{11}which forms the class B_2

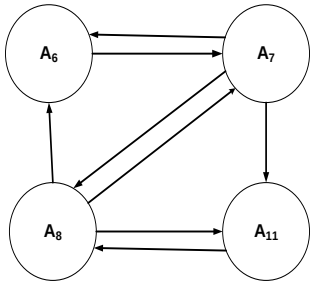

Fig.2

The related connection given by second expert opinion on A_6, A_7, A_8, A_{11} which forms the class B_2

B_2=

	A_6	A_7	A_8	A_{11}
A_6	0	1	0	0
A_7	1	0	1	1
A_8	1	1	0	0
A_{11}	0	0	0	0

The directed graph given by the third expert A_2,A_4,A_5,A_9 which forms the class B_3

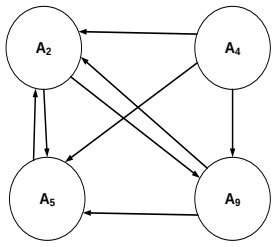

Fig.3

The related connection given by third expert opinion on A2, A_4, A_5, A_9 which forms the class B_3

B_3=

	A_2	A_4	A_5	A_9
A_2	0	1	1	0
A_4	0	0	0	1
A_5	0	1	0	1
A_9	0	1	1	0

Now we give the combined block disjoint fuzzy cognitive map (CDBFCMs) which forms the class S given as follows

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	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}
A_1	0	0	0	0	0	0	0	0	0	1	0	1
A_2	0	0	0	0	1	0	0	0	1	0	0	0
A_3	0	0	0	0	0	0	0	0	0	1	0	1
A_3	0	1	0	0	1	0	0	0	1	0	0	0
A_4	0	0	0	0	0	0	1	0	0	0	0	0
A_5	0	0	0	0	0	1	0	1	0	0	1	0
A_6	0	0	0	0	0	0	1	0	0	0	0	0
A_7	0	0	0	0	0	1	0	1	0	0	1	0
A_8	0	0	0	0	0	1	1	0	0	0	0	0
A_9	0	1	0	0	1	0	0	0	0	0	0	0
A_{10}	0	0	1	0	0	0	0	0	0	0	0	1
A_{11}	0	0	0	0	0	0	0	0	0	0	0	0
A_{12}	0	0	1	0	0	0	0	0	0	0	0	1

Let us consider the state column vector / initial vector be

P_1=(1 0 0 0 0 0 0 0 0 0 0 0)
P_1S ↪ (0 0 0 0 0 0 0 0 0 1 0 1)
(0 0 0 0 0 0 0 0 0 1 0 1) = P_2 (say)
P_2S ↪ (0 0 2 0 0 0 0 0 0 0 0 2)
↪ (0 0 1 0 0 0 0 0 0 0 0 1) = P_3 (say)
P_3S ↪ (0 0 1 0 0 0 0 0 0 1 0 2)
↪ (0 0 1 0 0 0 0 0 0 1 0 1) = P_4(say)
P_4S ↪ (0 0 2 0 0 0 0 0 0 1 0 3)
↪ (0 0 1 0 0 0 0 0 0 1 0 1) =P_5 =P_4

which is the fixed point for S.

IV. CONCLUSION

From our study we conclude that while driving for extended journey, drivers should not commit themselves with any sort of stress related works which leads to mental depression. Driver has to refresh their minds by listening to music, breaking up in cafeteria leads to peacefuljourney.

REFERENCES

[1] Axelrod. R. *Structure of decision.* The cognitive maps of political elites. Princeton University, 1976.
[2] Klir, G.J. and Folger, N.J. 1998 T.A. Fuzzy Sets Uncertainty and Information, Prentice Hall Englewood, Cliffs Bart Kosko. 2003.
[3] *Neural Networks and Fuzzy System prentice*Hall of India private Limited. New Delhi -110001
[4] Klir, G.J. and Folger, N.J. 1998 T.A. *Fuzzy Sets Uncertainty and Information*, Prentice Hall Englewood, Cliffs.
[5] W. B. Vasantha Kandasamy and Florentin Smarandache May 2004. *Analysis of Social Aspects of Migrant Labourers Living with HIV /AIDS using Fuzzy theory and Neutrosophic Cognitive Maps with Special Reference to Rural Tamilnadu in India.* Published by Xiquan, Phoenix, USA
[6] W.B. Vasantha Kandasamy , Florentin Smarandache and K.Ilanthenral 2007. *Elementary Fuzzy Matrix Theory and Fuzzy Models for Social Scientistis.* Published by Automaton. Los Angeles. USA