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Vehicles Pollution: Causes, Effects-A Fuzzy Approach

K.Ponnivalavan,T.Pathinathan
Department of Mathematics, Loyola College, Chennai, India
E-mail:Ponnivalavan1986@gmail.com

Abstract - India is the second most populated country in the world. So we need rapid economic development to face the growing population. Economic development has always accompanied by the problems of environmental pollution. Production and use of large number of vehicles accounts high percentage of air pollution in India. Inthis paper, we analyzethehealth hazards of human beings and environmental damage due to emissions from vehicles using Induced Fuzzy Associative Memories.

Keywords: Induced fuzzy Associative Memories(IFAMS), Vehicles Pollution, Health Hazards.

I. INTRODUCTION

Air pollution is one of the major problems which affect our environment nowadays. Air pollution emanates from sources like industries, factories, volcanic eruptions, Vehicular emissions etc., disturbs the nature very often.It increases due to rapid economic development, increasing traffic and high energy consumption [1]. Vehicular emissions are of particular concern since these are ground level sources and thus have the maximum impact on the general population. Motor vehicle emissions are composed of the by-products that come out of the exhaust system or other emissions like gasoline evaporation. These emissions contribute to air pollution and are a major ingredient in the creation of smog in some large cities. The pollutants in vehicle emissions are known to damage lung tissue, and can lead to and aggravate respiratory diseases, such as asthma. [6] Motor vehicle pollution also contributes to the formation of acid rain and adds to the greenhouse gases that cause climate change [3].Pollutants emitted directly from vehicles are not the only cause for concern. On warm, sunny days, hydrocarbons react with oxides of nitrogen to create a secondary pollutant, ozone. In many urban areas, motor vehicles are the single largest contributor to ground-level ozone which is a common component of smog.

The Madras ENT Research Foundation (MERF), which registered 823 cases of respiratory illnesses in 2011, saw more than 1,472 cases last year with asthma and chronic obstructive pulmonary disease (COPD) topping the list [5]. Currently, in India, air pollution is widespread in urban areas where vehicles are the major contributors and in a few other areas with high concentration of industries and thermal power plants. Tightening of emission norms, fuel quality specifications, strengthening of inspection and maintenance will reduce these harmful emissions. This paper deals withthe Emissions, health hazards and some remedial measures for vehicles pollution using Induced Fuzzy AssociativeMemories(IFAM) based on gathered information. Section two presents the basic definitions and section three presents the analysis using the IFAM model. In fourth section we draw the conclusions from our analysis and proposed remedial measures.

II. BASIC NOTION AND DEFINITIONS

We proceed to state the definitions of IFAMS model.

2.1 Fuzzy Associative Memories (FAM)
A fuzzy set is a map μ: X → [0, 1] where X is any set called the domain and [0, 1] the range. That is to every element x ∈ X, μ assigns membership value in the interval [0, 1]. Fuzzy theorists often picture membership functions as two-dimensional graphs with the domain X represented as a one-dimensional axis. The geometry of fuzzy sets involves both domain $X = (x_1, x_2, \ldots x_n)$ and the range [0, 1] of mappings μ: X → [0, 1]. A fuzzy subset equals the unit hyper cube $I^n = [0,1]^n$. The fuzzy set is a point in the cube I^n. Vertices of the cube I^n define a non-fuzzy set. Now within the unit hyper cube $I^n = [0,1]^n$ we are interested in distance between points, which led to measures of size and fuzziness of a fuzzy set and more fundamentally to a measure. Thus within cube theory directly extends to the continuous case when the space X is a subset of R^n.

The next step is to consider mappings between fuzzy cubes. A fuzzy set defines a point in a cube. A fuzzy system defines a mapping between cubes. A fuzzy system S maps fuzzy sets to fuzzy sets. Thus a fuzzy system S is a transformation $S : I^n \to I^p$. The n-dimensional unit hyper cube I^n houses all the fuzzy subsets of the domain space or input universe of discourse $X = (x_1, x_2, \ldots x_n)$. I^p Houses all the fuzzy subsets of the range space or output universe of discourse, $Y = (y_1, y_2, \ldots, y_p)$. X and Y can also denote subsets of R^n and R^p. Then the fuzzy power sets $F(2^X)$ and $F(2^Y)$ replace I^n and I^p. In general a fuzzy system S maps families of fuzzy sets to families of fuzzy sets thus $S : I^{n_1} \times \ldots \times I^{n_r} \to I^{p_1} \times \ldots \times I^{p_s}$. Here too we can extend the definition of a fuzzy system to allow arbitrary products or arbitrary mathematical spaces to serve as the domain or range spaces of the fuzzy sets. We shall focus on fuzzy systems $S : I^n \to I^p$ that map balls of fuzzy sets in I^n to balls of fuzzy set in I^p. These continuous fuzzy systems behave as associative memories. The map close inputs to close outputs. We shall refer to them as Fuzzy Associative Maps or

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FAMs. The simplest FAM encodes the FAM rule or association (A_i, B_i), which associates the p-dimensional fuzzy set B_i with the n-dimensional fuzzy set A_i.These minimal FAMs essentially map one ball in I^n to one ball in I^p. They are comparable to simple neural networks. But we need not adaptively train the minimal FAMs. In general a FAM system $F : I^n \rightarrow I^b$ encodes the processes in parallel a FAM bank of m FAM rules $(A_1, B_1)\ldots(A_m, B_m)$. Each input A to the FAM system activates each stored FAM rule to different degree.

The minimal FAM that stores (A_i, B_i) maps input A to B_i' a partly activated version of B_i. The more A resembles A_i, the more B_i' resembles B_i. The corresponding output fuzzy set B combines these partially activated fuzzy sets $B_1^1, B_2^1, \ldots, B_m^1$. B equals a weighted average of the partially activated sets $B = w_1 B_1^1 + \ldots + w_n B_m^1$ where w_i reflects the credibility frequency or strength of fuzzy association (A_i, B_i). In practice we usually defuzzify the output waveform B to a single numerical value y_j in Y by computing the fuzzy centroid of B with respect to the output universe of discourse Y .

More generally a FAM system encodes a bank of compound FAM rules that associate multiple output or consequent fuzzy sets $B_i^1, \ldots, B_i^s$ with multiple input or antecedent fuzzy sets $A_i^1, \ldots, A_i^r$. We can treat compound FAM rules as compound linguistic conditionals. This allows us to naturally and in many cases easily to obtain structural knowledge. We combine antecedent and consequent sets with logical conjunction, disjunction or negation. For instance, we could interpret the compound association (A^1, A^2, B) ; linguistically as the compound conditional "IF X^1 is A^1 AND X^2 is A^2, THEN Y is B " if the comma is the fuzzy association (A^1, A^2, B) denotes conjunction instead of say disjunction.
We specify in advance the numerical universe of discourse for fuzzy variables X^1, X^2 and Y . For each universe of discourse or fuzzy variable X, we specify an appropriate library of fuzzy set values $A_1^r, \ldots A_k^2$ Contiguous fuzzy sets in a library overlap. In principle a neural network can estimate these libraries of fuzzy sets. In practice this is usually unnecessary.

The library sets represent a weighted though overlapping quantization of the input space X. They represent the fuzzy set values assumed by a fuzzy variable. A different library of fuzzy sets similarly quantizes the output space Y. Once we define the library of fuzzy sets we construct the FAM by choosing appropriate combinations of input and output fuzzy sets Adaptive techniques can make, assist or modify these choices.

2.2 Induced Fuzzy Associative Memories
Suppose that there are n attributes, say $x_1, x_2, \ldots, x_n$, where n is finite, associated with the effects of climate change and let $y_1, y_2, \ldots, y_p$be the attributes associated with the health system. The connection matrix M of order n X p is obtained through the expert. Let C_1 be the initial input vector. A particular component, say c_1, is kept in ON state and all other components in OFF state and we pass the state vector C_1 through the connection matrix M. To convert the resultant vector as a signal function, choose the first two highest values to ON state and other values to OFF state with 1 and 0 respectively. Denote this process by the symbol. The resulting vector is multiplied with M^T and thresholding yields a new vector D_1. This vector is related with the connection matrix and that vector which gives the highest number of attributes to ON state is chosen as C_2 [11]. That is, for each positive entry we get a set of resultant vectors; among these vectors the one which contains maximum number of 1s is chosen as C_2. If there are two or more vectors with equal number of 1s in ON state, choose the first occurring one as C_2. Repeat the same procedure till a fixed point or a limit cycle is obtained. This process is done to give due importance to each vector separately as one vector induces another or many more vectors into ON state. Get the hidden pattern by the limit cycle or by getting a fixed point.

Next we choose the vector with its second component in ON state and repeat the same to get another cycle. This process is repeated for all the vectors separately. We observe the hidden pattern of some vectors found in all or many cases. Inference from this hidden pattern highlights the causes.

III.ANALYSIS USING IFAMS MODEL

3.1 We take the following attributes in the case of Vehicles Emissions:

C_1- Usage of high level of petroleum products in the form of vehicles is the major source of emission to the atmosphere.
C_2- Increase in the number of vehicles releases the petrochemicals (nitrogen dioxide) which forms petrochemical smog is the major cause of air pollution.
C_3- Excessive increase of private/personal vehicles, high volume of traffic and urban population constitute major percentage of environment pollution.
C_4- Carbon dioxide, mono-nitrogen oxides, carbon monoxide, benzene and volatile organic compounds are the main chemicals emitted by motor vehicles.
C_5- Poor maintenance of vehicles results in spewing out of noxious fumes in the atmosphere.
C_6-Vehicles contribute to water pollution from discarded tires and stripped down auto bodies provide vector breeding habitat for mosquitoes.

3.2 We take the following attributes in the case of Hazards:
H_1- Continuous and increased emissions from vehicles affect the ozone layer, contribute acid global climatic change, and affect the ecosystem of our planet.
H_2- Burning sensation in eyes, allergy and chronic obstructive pulmonary diseases are commonly seen in ENT hospitals due to rapid contribution of vehicular air.

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H_3-Inhalation of carbon particles emitted by vehicles cause wheeling, nasal bleeding and inflammation.

Number	Attribute ON state	Fixed point
Step1	C_1(1 0 0 0 0 0)	(0 1 1 0 0 0 0), (1 0 1 0 1 1)
Step2	C_2(0 1 0 0 0 0)	(0 1 1 0 0 0 0), (1 0 1 0 1 1)
Step3	C_3(0 0 1 0 0 0)	(0 1 1 0 0 0 0), (1 0 1 0 1 1)
Step4	C_4(0 0 0 1 0 0)	(0 1 1 0 0 0 0), (1 0 1 0 1 1)
Step5	C_5(0 0 0 0 1 0)	(0 1 1 0 0 0 0), (1 0 1 0 1 1)
Step6	C_6(0 0 0 0 0 1)	(0 1 1 0 0 0 0), (1 0 1 0 1 1)

H_4-Carbon monoxide combines with hemoglobin to produce car-boxy hemoglobin which is ineffective for delivering oxygen to body tissues and affect the normal functioning of the organs.

Table 3.1 Induced Patterns by IFAM

H_5-Diesel engines emit very fine particles that deeply penetrate lungs and inflame the circulating system, damaging cells, and causing respiratory problems and Asthma.

H_6- Lung cancer, chronic bronchitis damage of lung tissues, depression of immune system and blood cancer are the diseases caused by long term exposure of chemical emitted by diesel engines

H_7- Air pollution from vehicles can be considerable in localized area and become an occupational hazard for drivers, traffic police and vehicle service employee.

According to an Expert opinion, the same set of attributes has been converted into a connection matrix M.

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

Analysis using IFCMS:

Step 1:

Let C_1 (1 0 0 0 0 0)

C_1 M= (1 0 1 0 1 0 1) = C_1'

$C_1'M^T \approx$

(1 0 1 0 1 0 1)M^T= (4 1 2 1 2 1)↪ (1 1 1 1 1 1) = C_2

(1 0 0 0 0 0)M= (1 0 1 0 1 0 1)= C_2'

$C_2'M^T \approx$

(1 0 1 0 1 0 1)M^T= (4 1 2 1 2 1)↪ (1 1 1 1 1 1) = C_3

(0 1 0 0 0 0)M= (1 0 0 1 0 0 0)= C_3'

$C_3'M^T \approx$

(1 0 0 1 0 0 0)M^T= (1 2 1 1 0 0) ↪ (1 1 1 1 0 0) = C_4

(0 0 1 0 0 0)M= (1 1 1 0 0 0 0)= C_4'

$C_4'M^T \approx$

(1 1 1 0 0 0 0)M^T= (2 1 3 0 2 2)↪ (1 1 1 0 1 1) = C_5

(0 0 0 1 0 0)M= (0 0 0 1 1 1 0)= C_5'

$C_5'M^T \approx$

(0 0 0 1 1 1 0)M^T= (1 1 0 3 0 0)↪ (1 1 0 1 0 0) = C_6

(0 0 0 0 1 0)M= (0 1 1 0 0 0 1)= C_6'

$C_6'M^T \approx$

(0 1 1 0 0 0 1)M^T= (2 0 2 0 3 2)↪ (1 0 1 0 1 1) = C_7

(0 0 0 0 0 1)M= (0 1 1 0 0 0 0)= C_7'

$C_7'M^T \approx$(0 1 1 0 0 0 0)M^T= (1 0 2 0 2 2) ↪ (1 0 1 0 1 1) = C_7

(0 1 1 0 0 0 0),(1 0 1 0 1 1) is the fixed point and the triggering pattern is $C_1 \rightarrow C_1 \rightarrow C_6$when the first attribute is kept in on state.

The following table gives the fixed points when other attributes are kept in ON state consecutively.

The interrelationship between the attributes revealsthatC_1[Usage of high level of petroleum products in the form of vehicles is the major source of emission to the atmosphere] andC_3 [Excessive increase of private/personal vehicles, high volume of traffic and urban population constitute major percentage of environment pollution] and C_5[Poor maintenance of vehicles results in spewing out of noxious fumes in the atmosphere] playstheimportant rolein this study.Thelimitpoint highlightsmost oftheattributes which seems to be major cause for vehicles pollution.

IV. CONCLUSION

It requires care, concern and awareness of every individual towards our environment. Also, we have to follow some simple ways to solve this existing problem. So, we suggest the following remedial measures. Vehicles users should use high octane and unleaded fuels to reduce toxic emissions. Regular service, Reuse, Resale and proper maintenance of vehicles controls the harmful emissions. Eco-friendly mode of transport and fuel technologies should be adopted. Use of battery-electric vehicles, hybrid electric-cell vehicles and hydrogen fuels results in zero emissions of deadly chemicals. Banning of ten year old commercial vehicles and fifteen year old private vehicles will reduce the emission of nitrogen oxide. Vehicle users should be aware of the emissions from vehicles and they must adapt the government rules in checking the standards of vehicles. Road project component can assists in the safe disposal of transport waste. Traffic management project could provide high risk groups with protective measures, through protective barriers near market and stations. Vehicle users should Use Cleaner fuels like unleaded petrol, three percent benzene level, and low sulphur fuel have been introduced in major cities by government to reduce these dreadful emissions.

REFERENCES

[1] http:/www.ehhi.org/reports/exhaust/summary.shtml
[2] AruniBhatnagar, *Environmental Cardiology*, RSC Publishing, 2002.
[3] http:/timesofindia.indiatimes.com › City
[4] P.Aarnevesilind, *Controlling Environmental Pollution*, Destech Publications May2005.
[5] http:/www.environment.tn.nic.in/SoE/images/Pollution.pdf
[6] Partheeban.,P and Rani Hemamalini., *Vehicular Emission Monitoring Using Internet GIS, GPS and Sensors*, International conference on Environment, Energy and Biotechnology, IPCBEE., Vol- 33, 2012.
[7] Kosko, B., January, "Fuzzy Cognitive Maps", International journal of man-machine studies, pp.62-75, (1986).
[8] Klir, G.J. and Folger,T.A., *Fuzzy Sets, Uncertainty and Information*, Prentice Hall, Englewood, Cliffs. N.J.1988.
[9] James A.Listorti, And FadiM.Doumani., *Environmental Health Bridying the Gaps*, World Bank Publications, Volume- 422, May2004.

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[10] Vasantha, W.B., .Pathinathan,T. and John M.Mary, " *School environment: A cause forincrease in School Dropouts– Fuzzy Analysis*",*Proc. of the State Level Seminar on IndustrialMathematics*, pp.127-136, Nov.2005.
[11] Pathinathan, T., Arul M. Joseph, Thirusangu, K., and Mary John, M., "*On Tensions and Causes for School Dropouts - Induced Linked Fuzzy Relational Mappings (ILFRM) Analysis*". Proc. of the 9th Joint Conference on Information Sciences (JCIS-2006), Atlantic Press, France, 1160-1163 (2006).
[12] B.B Hosetti, Prospects *andPerspective of solid waste management*, New Age International Publishers, 2006.
[13] http:/www.dec.ny.gov › Chemical and Pollution Control› Air