

The Study of Gas Pollutants in Kodungaiyur Using Fuzzy Model

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Abstract- The Chennai's largest garbage dump is situated at Kodungaiyur. Burning and accumulation of garbage produce nineteen types of toxic chemicals. Inhalation of polluted gas causes respiratory problems, skin diseases and also affects central nervous system. This paper deals with the study of causes, health hazards and the remedy for Kodungaiyur project using Fuzzy Relational Maps (FRM).

Keywords: Fuzzy Relational Maps (FRM), Kodungaiyur garbage.

I. INTRODUCTION

Pollution is the introduction of chemicals, any particular matter or biological materials that cause harm to humans, other living organisms, natural environment and also to the atmosphere. The atmosphere is a dynamical natural gaseous system that is essential to support life on planet earth. Ozone depletion due to air pollution as long recognized as a threat to human health as well as to the earth ecosystem.

The city of Chennai generates around 3200 tones of garbage every day. Most of this waste is dumped into landfills demarcated for the purpose by the city administration. Started back in 1989, Kodungaiyur is one of the main dumping grounds operated by the corporation of Chennai. Located in northern most part of Chennai, kodungaiyur is mainly a residential colony with a population of 100,000. This makes the area into unlivable. The ground water and air in the areas surrounding the yard are heavily polluted. Rag pickers in kodungaiyur pick waste metals and sell it for rupees 100 to 200 per day by heating it. A few rag pickers bring their children to accompany them. Because of this, their education and health are affected. The US environment production agency, which tested the air samples at kodungaiyur at the request of the residents, stated that 19 chemicals were identified in the air in the neighborhood.

The air sample taken by Members of the Community Environmental Management (CEM) and Global Alliance for Incinerator Alternatives (GAIA) and the tests had been conducted at the labs of Colombia analytical services in california ,US, which also produced the report. Carbon disulphide, acrolein, acetone, methyl ethyl ketone, benzene, toluene, 1,2dichlorobenzene and d-Limonene, which target the eyes, skin, central nervous system, kidneys, liver, reproductive system, cardio-vascular system, bone marrow and peripheral nervous system. Benzene, a Carcinogen, was found to be present a Whopping fifty times above the levels considered safe for long-term exposure by the USEPA. Another carcinogen, 1-3 Butadiene, was present eight times above the USEPA safety limit. Both these chemicals are known to cause cancer over long exposure. The paper analysis the causes and health hazards of Kodungaiyur pollution. Using various fuzzy

models, the causes for pollution have been studied so far. In this paper Fuzzy Relational Maps (FRM) is used to analyze the health hazards and remedy for Kodungaiyur garbage pollution. Section two presents the basic definitions and section three Presents the analysis using the FRM model. In fourth section we draw the conclusions from our study and proposed remedial measures.

II. BASIC NOTION AND DEFINITIONS

We proceed to state the definitions of FRM model. In FRMs we divide the very causal associations into two disjoint units, like for example the relation between the pollution emissions (Domain space) and the causes (Range space) of it.

We denote by D , the nodes D_1, \dots, D_n of the domain space where $D_i = \{(x_1, \dots, x_n) / x_j = 0 \text{ or } 1\}$ for $i = 1, \dots, n$.

Similarly R , the set of nodes R_1, \dots, R_m of the range space, where $R_i = \{(x_1, x_2, \dots, x_m) / x_j = 0 \text{ or } 1\}$ for $i = 1, \dots, m$. When $x_i = 1$ or 0 then the node R_i is in the ON state or OFF state respectively.

Definition 2.1. 1

The FRM is a directed graph or a map from D to R with concepts like policies or events etc, as nodes and causalities as edges. It represents causal relations between spaces D and R .

Let D_i and R_j denote the two nodes of an FRM.

The directed edge from D to R denotes the causality of D on R , called relations. Every edge in the FRM is weighted with a number in the set $\{0, 1\}$. Let e_{ij} be the weight of the edge $D_i R_j$, $e_i = \{0, 1\}$

The weight of the edge $D_i R_j$ is positive if increasing D_i implies increase in R_j or decrease in D_i implies decrease in R_j . That is, causality of D_i on R_j is 1. If $e_{ij} = 0$ then D_j does not have any effect on R_j . We do not discuss the cases when increase in D_i implies decrease in R_j or decrease in D_i implies increase in R_j .

Relational matrix of the FRM:

Let D_1, \dots, D_n be the nodes of the domain space D of an FRM and R_1, \dots, R_m be the nodes of the range space R of an FRM. Let the matrix E be defined as:

$E = (e_{ij})$ where e_{ij} is the weight of the directed edge $D_i R_j$ (or $R_j D_i$), E is called the relational matrix of the FRM. Let $A = (a_1, \dots, a_n)$, $a_i = \{0, 1\}$. A is called the instantaneous state vector of the domain space and it denotes the on-off position of the nodes at any instant. Similarly let $B = (b_1, \dots, b_m)$, $b_i = \{0, 1\}$. B is called the instantaneous state vector of the range space and it denotes the on-off position of the nodes at any instant. When $a_i = 0$ or 1 , if a_i is on or off respectively, for $i = 1, \dots, n$. Similarly $b_i = 0$ or 1 if b_i is on or off respectively, for $i = 1 \dots m$.

III. ANALYSIS USING FRM MODEL

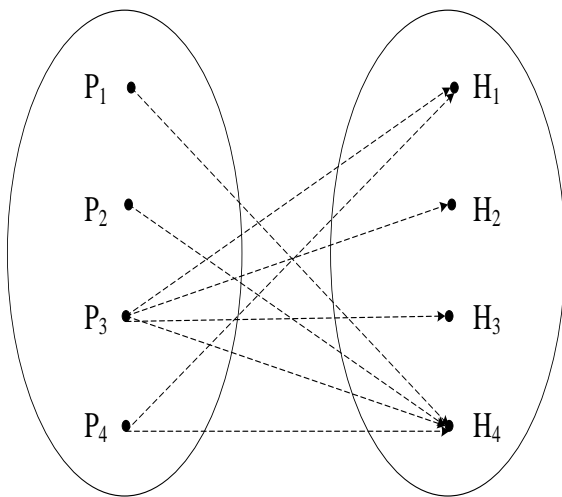
We take the following attributes in the case of Pollutants:

- P₁- Increase in population increases the vehicles, which increases the pollution level in the air causes lung cancer in human beings.
- P₂- Production of electricity, dumping of industrial waste into water bodies, releases carbondi-oxide which pollutes environment and affects Ozone layer.
- P₃- Continuous dumping of garbage in the same place, burning of garbage, releases Bencene,1-3 butadiene a carcinogen, can cause cancer over long exposure.
- P₄- Waste products released by power plants creates soil pollution.

We take the following attributes in the case of Hazards:

- H₁- Rag pickers involves their children’s to accompany them to earn money for their daily needs. This affects children education.
- H₂- Dumping of wastes from industrial, power plants, and garbage into the land contaminates the ground water.
- H₃- Continuous dumping, no proper safety measures produces unsanitary condition, which creates breeding ground for flies and pests.
- H₄- Spoils the basic needs i.e air, water etc., and affects the health of human beings in living area.

The relational mapping between attributes is given below.



An expert, a lady doctor, presents the following relation between the pollutants and hazards attributes and it is represented as relational matrix.

$$\begin{matrix}
 & H_1 & H_2 & H_3 & H_4 \\
 P_1 & \begin{bmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 \end{bmatrix} \\
 P_2 \\
 P_3 \\
 P_4
 \end{matrix}$$

Analysis using FRM

Case (i):Let $A_1 = (1\ 0\ 0\ 0)$.

$$A_1 M = (0\ 0\ 0\ 1) = A_2$$

$$B_1 M^T = (1\ 1\ 1\ 1) = A_2$$

$$A_2 M = (2\ 1\ 1\ 4) \xrightarrow{L} (1\ 1\ 1\ 1) = B_2$$

$$B_2 M^T = (1\ 1\ 4\ 2) \xrightarrow{L} (1\ 1\ 1\ 1) = A_3$$

$$A_3 M = (2\ 1\ 1\ 4) \xrightarrow{L} (1\ 1\ 1\ 1) = B_2$$

$$B_2 M^T = (1\ 1\ 4\ 2) \xrightarrow{L} (1\ 1\ 1\ 1) = A_3$$

$(1\ 1\ 1\ 1), (1\ 1\ 1\ 1)$ is the fixed point. Similarly,

$$\text{Case (i) - } C_1 (1\ 0\ 0\ 0) - (1\ 1\ 1\ 1) (1\ 1\ 1\ 1)$$

$$\text{Case (ii) - } C_2 (0\ 1\ 0\ 0) - (1\ 1\ 1\ 1) (1\ 1\ 1\ 1)$$

$$\text{Case (iii) - } C_3 (0\ 0\ 1\ 0) - (1\ 1\ 1\ 1) (1\ 1\ 1\ 1)$$

$$\text{Case (iv) - } C_4 (0\ 0\ 0\ 1) - (1\ 1\ 1\ 1) (1\ 1\ 1\ 1)$$

At State of equilibrium, we get $(1\ 1\ 1\ 1) (1\ 1\ 1\ 1)$ as fixed point and it highlights all the attributes on ON state .And also the interrelationship between the attributes reveals that P₃ (continuous dumping and burning of garbage) creates health hazards like cancer, Tuberculosis etc., spoils children’s life and affects basic needs of human beings in living area.

IV. CONCLUSION

It is said that dumping of garbage for a long time in a particular place creates many problems. The corporation has to maintain some safety measures and follow some steps to overcome this problem. We suggest the following remedial measures to have pollution less environment. The Corporation should have fire fighting facilities to put out fires. Installation of security cameras in and around the compound wall of garbage dump. Corporation must have integrated solid waste management to decrease the further pollution.

REFERENCES

- [1] Klir, G.J. and Folger, T.A., *Fuzzy Sets, Uncertainty and Information*, Prentice Hall, Englewood, Cliffs, N.J. 1988.
- [2] Pathinathan, T. Thirusangu, K. and John M. Mary “On causes for school dropouts- A fuzzy analysis”. (Accepted for publication in *Acta Ciencia Indica*).
- [3] Vasantha, W.B., and Pathinathan, T., “Linked Fuzzy Relational maps to study the relation between migration and school dropouts in TamilNadu”. *Ultra. Sci.* 17, 3(M), Dec., pp. 441-465, 2005.
- [4] Vasantha, W.B., Pathinathan, T. and John M. Mary, “ School environment: A cause for increase in School Dropouts – Fuzzy Analysis”, *Proc. of the State Level Seminar on Industrial Mathematics*, pp.127-136, Nov. 2005.
- [5] <http://thealternative.in/environment/trash-planet-kodungaiyur/>