



A STUDY ON THE PEOPLE AFFECTED BY DENGUE IN TAMIL NADU USING FUZZY RELATIONAL MAP

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A B S T R A C T

RESEARCH ARTICLE

In this paper, we are discussed about the fuzzy relation map and the method of finding the hidden pattern. Importantly in this paper, we are taken a report about the people affected by dengue in Tamil Nadu. Then, we are analyzed the causes of dengue and also how to prevent the people from dengue using fuzzy relational map.

Keywords:

Dengue, Fuzzy relational map, Hidden pattern

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1. Introduction

Dengue fever is a mosquito-borne tropical disease caused by the dengue virus. Symptoms typically begin three to fourteen days after infection. This may include a high fever, headache, vomiting, muscle and joint pains, and a characteristic skin rash. Recovery generally takes two to seven days. In a small proportion of cases, the disease develops into the life-threatening dengue hemorrhagic fever, resulting in bleeding, low levels of blood platelets and blood plasma leakage, or into dengue shock syndrome, where dangerously low blood pressure occurs. Dengue is spread by several species of mosquito of the Aedes type, principally *A. aegypti*. The virus has five different types; infection with one type usually gives lifelong immunity to that type, but only short-term immunity to the others. Subsequent infection with a different type increases the risk of severe complications. A number of tests are available to confirm the diagnosis including detecting antibodies to the virus or its RNA.

Dengue has become a global problem since the Second World War and is common in more than 110 countries. Each year between 50 and 528 million people are infected and approximately 10,000 to 20,000 die. The spread of the dengue virus cannot happen directly from one person to another. It is not contagious and cannot spread through direct human contact. It needs an Aedes mosquito for the virus to be transferred.

A Times of India report (on 11.10.2017) said that public health officials have confirmed 40 deaths due to dengue and an equal number of casualties due to viral haemorrhagic fever or shock syndrome, triggered by dengue, since January. According to the directorate of National Vector Borne Disease Control Programme (NVBDCP), 11,552 cases have been reported in Tamil Nadu this year, a 350% increase in the number of cases compared to last year.

Now, we analyze the report on the people affected by dengue in Tamil Nadu and discuss the necessary steps to be taken by the government and the people using fuzzy relational map technique. First let us discuss the basic concepts of Fuzzy relational map and hidden pattern from [1], [2], [5] and [7].

Definition 1.1 A FRM is a directed graph or a map from domain space D to range space R with concepts like policies or events etc, as nodes and causalities as edges. It represents casual relations between spaces D and R .

Let D_i and R_j denote that the two nodes of an FRM. The directed edge from D_i to R_j denotes the causality of the D_i on R_j 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_iR_j , $e_{ij} \in \{0,1\}$. The weight of the edge D_iR_j is positive if increase in D_i implies increase in R_j or decrease in D_i implies decrease in R_j i.e., causality of D_i on R_j is 1. If $e_{ij}=0$ then 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

Definition1.2 Let D_1, D_2, \dots, D_n be nodes of the domain space D and let R be the nodes of the range space R for a Fuzzy Relational Map. The Relational matrix M for this Fuzzy Relational Map model is defined as $M = (e_{ij})$, where e_{ij} is the weight of directed edge D_iR_j .

Let $A = (a_1, a_2, \dots, a_n)$, where $a_i \in \{0,1\}$. 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 $B = (b_1, b_2, \dots, b_m)$, where $b_i \in \{0,1\}$. B is called the instantaneous state vector of the range space and it denotes the ON-OFF position of the nodes at any instant, $a_i=0$ or 1 if a_i is ON or OFF respectively, for $i = 1,2,\dots,n$. Similarly $b_i=0$ or 1 if b_i is ON or OFF respectively, for $i = 1,2,\dots,m$.

Definition1.3 An FRM with cycles is said to have a feedback. When there is a feedback in an FRM, the FRM is called a dynamical system. The equilibrium state for this dynamical system is called the hidden pattern.

In other words, let $D_i R_j$ (or $R_j D_i$), $1 < j < m$, $1 < i < n$. when R_j (or D_i) is switched ON and if causality flows through edges of the cycle and if it again causes R_j (or D_i), then it is said that the dynamical system goes round and round. This is true for any node R_j (or D_i) for $1 < i < m$, (or $1 < j < n$) the equilibrium state of this dynamical system is called the hidden pattern.

2. Method of Finding the Hidden Pattern

Let R_1, R_2, \dots, R_m and D_1, D_2, \dots, D_n be the nodes of FRM. Let us assume D_1 is switched on i.e., when an input is given as vector $A_1 = (1, 0, \dots, 0)$ in D and the relational matrix is E . Now $A_1 E = (r_1, r_2, \dots, r_m)$ after thresholding and updating the resultant vector $A_1 E \in R$. Now let $B = A_1 E$ passing into E^T and obtain BE^T . After threshold and update the vector $BE^T \in D$. This procedure is repeated till we get a fixed point or limit cycle.

3. Analysis on the People Affected by Dengue in Tamilnadu using Fuzzy Relational Map (FRM)

3.1 Description of the Problem

Here, we analyze the causes of dengue and what are the steps to be taken by the government to prevent the people from dengue using Fuzzy relational map technique. So we consider causes as domain and preventive measures as range space based on experts' opinion in the following parameters:

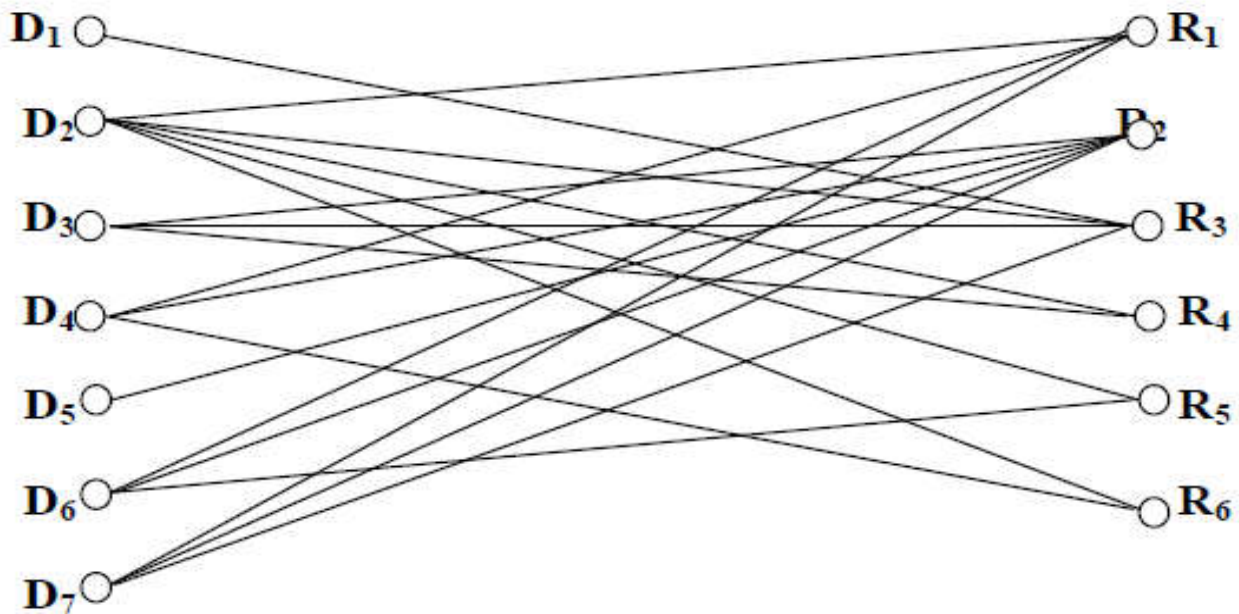
Domain:

- D_1 - Staying the unwanted things in home for long time,
- D_2 - Improper drainage system,
- D_3 - Things are opened,
- D_4 - Unawareness about Dengue,
- D_5 - Not taking serious about diseases,
- D_6 - Unclean Hospitals,
- D_7 - Unavailable of medicine

Range space:

- R_1 - Aware of Government about Dengue,
- R_2 - Doctor's proper guidance,
- R_3 - Government authority guidance,
- R_4 - Keeping cleanness in the house,
- R_5 - Clean our surroundings area,
- R_6 - Punishment from Government

Based on the experts' opinion, we get the following bipartite graph as follows:



Now, we find the relation matrix of order 7×6 where its row is $\{D_1, D_2, D_3, D_4, D_5, D_6, D_7\}$ and its column is $\{R_1, R_2, R_3, R_4, R_5, R_6\}$ for the above graph.

Relation matrix

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

Using this relation matrix of the FRM, we determine the hidden pattern in the following manner:

First let us assume that D_4 is on state.

i.e., assume

$$X_1 = (0 \ 0 \ 0 \ 1 \ 0 \ 0 \ 0)$$

Then

$$X_1 E = (1 \ 1 \ 0 \ 0 \ 0 \ 1) = Y_1$$

$$Y_1 E^T = (0 \ 2 \ 1 \ 3 \ 1 \ 2 \ 2)$$

$$\rightarrow (0 \ 1 \ 1 \ 1 \ 1 \ 1 \ 1) = X_2$$

$$X_2 E = (4 \ 5 \ 3 \ 2 \ 2 \ 2)$$

$$\rightarrow (1 \ 1 \ 1 \ 1 \ 1 \ 1) = Y_2$$

$$Y_2 E^T = (1 \ 5 \ 3 \ 3 \ 1 \ 3 \ 3)$$

$$\rightarrow (1 \ 1 \ 1 \ 1 \ 1 \ 1 \ 1) = X_3$$

$$X_3 E = (4 \ 5 \ 4 \ 2 \ 2 \ 2)$$

$$\rightarrow (1 \ 1 \ 1 \ 1 \ 1 \ 1) = Y_2$$

Here \rightarrow denotes the resultant vector after thresholding and updating

The resultant to be the fixed point is given by the binary pair

$$\{(1 \ 1 \ 1 \ 1 \ 1 \ 1 \ 1), (1 \ 1 \ 1 \ 1 \ 1 \ 1)\}.$$

Conclusion

When the on state is taken as node D_4 , we see the hidden pattern is the fixed point which is the same binary pair, which makes all the nodes to be in the on state in the domain space and also makes all the nodes in the range space to be in the on state.

Dengue fever is a severe, flu-like illness that affects infants, young children and adults, but seldom causes death. So we conclude that because of unawareness about dengue, so many people are affected by dengue in TamilNadu. We should make awareness about dengue; get doctor's proper guidance and government authority guidance. We should maintain the cleanness in the house and surroundings area. Also, Government should give punishment to the people and company for living with unclean.

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