



# **iJRASET**

International Journal For Research in  
Applied Science and Engineering Technology



---

# **INTERNATIONAL JOURNAL FOR RESEARCH**

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

---

**Volume: 6      Issue: I      Month of publication: January 2018**

**DOI: <http://doi.org/10.22214/ijraset.2018.1352>**

**[www.ijraset.com](http://www.ijraset.com)**

**Call: ☎ 08813907089**

**E-mail ID: [ijraset@gmail.com](mailto:ijraset@gmail.com)**

# Fuzzy Matrix with Application in Automata

J. Vimala<sup>1</sup>, P. Elavarasi<sup>2</sup>, C.Venkatesan<sup>3</sup>

<sup>1</sup>Assistant Professor, Department of Mathematics, Srinivasan College of Arts and Science, Perambalur.

<sup>2</sup>Assistant Professor, Department of Mathematics, Dhanalakshmi Srinivasan College of Arts and Science for Woman, Perambalur.

<sup>3</sup>Associate Professor, Meenakshi Academy of Higher Education and Research, Faculty of Engineering and Technology, Chennai.

**Abstract:** A sequential machine is a dynamic system operating in discrete time that transforms sequence of input states received at the input of the system to sequence of output states produced at the output of the system. The produce large sequence of fuzzy internal states and output states for any given sequences of fuzzy input states of a fuzzy automation.

**Keywords:** Fuzzy internal states, Fuzzy automation, Transition relation, Fuzzy input and output state

## I. INTRODUCTION

The sequences may be finite (or) count ably infinite. The transformation is accomplished by the concept of the dynamically changing interval state. At the same time, a new internal state is determined, which replaces its predecessor. The new internal state is stored in the system to be used subsequently. A finite state machine is called fuzzy automata when its states are characterized by fuzzy sets, the production of responses and next states is facilitated by suitable fuzzy relations.

## II. PRELIMINARIES

### A. Definition 3.1 Fuzzy Matrices

Let  $F_{mn}$  denote the set of all  $m \times n$  matrices over  $F$ . If  $m = n$ , we write  $F_n$ . Elements of  $F_{mn}$  are called as membership value matrices binary fuzzy relation matrices (or) Fuzzy Matrices. Boolean matrices over the Boolean algebra  $\{0,1\}$  are special types of fuzzy matrices.

### B. Definition 3.2 Multiplication on Fuzzy Matrices

Let  $A = (a_{ij}) \in F_{mp}$  and  $B = (b_{ij}) \in F_{pn}$ .

The max - min product

$$AB = \left( \sup_k \{ \inf \{ a_{ik}, b_{kj} \} \} \right) \in F_{mn}$$

The product  $AB$  is defined if and only if the number of column of  $A$  is the same as the number of rows of  $B$ ;  $A$  and  $B$  are said to be conformable for Multiplication.

### 1) Example

$$\text{Let } A = \begin{bmatrix} 0.8 & 0.1 \\ 0.2 & 0.7 \end{bmatrix} \text{ and } B = \begin{bmatrix} 0.6 & 0.5 \\ 0.4 & 0.3 \end{bmatrix}$$

Find  $AB$ .

### 2) Solution

$$AB = \begin{bmatrix} [0.8 \ 0.1] \begin{bmatrix} 0.6 \\ 0.4 \end{bmatrix} & [0.8 \ 0.1] \begin{bmatrix} 0.5 \\ 0.3 \end{bmatrix} \\ [0.2 \ 0.7] \begin{bmatrix} 0.6 \\ 0.4 \end{bmatrix} & [0.2 \ 0.7] \begin{bmatrix} 0.5 \\ 0.3 \end{bmatrix} \end{bmatrix}$$

$$= \begin{bmatrix} \text{Sup}\{\inf\{0.8,0.6\}, \inf\{0.1,0.4\} & \text{Sup}\{\inf\{0.8,0.5\}, \inf\{0.1,0.3\}\} \\ \text{Sup}\{\inf\{0.2,0.6\}, \inf\{0.7,0.4\} & \text{Sup}\{\inf\{0.2,0.5\}, \inf\{0.7,0.3\}\} \end{bmatrix}$$

$$= \begin{bmatrix} \text{Sup}\{0.6,0.1\} & \text{Sup}\{0.5,0.1\} \\ \text{Sup}\{0.2,0.4\} & \text{Sup}\{0.2,0.3\} \end{bmatrix}$$

$$AB = \begin{bmatrix} 0.6 & 0.5 \\ 0.4 & 0.3 \end{bmatrix}$$

### C. Definition 3.3 Fuzzy Automata

A finite fuzzy automation A is a fuzzy relational system defined by the quintuple  $A = \langle X, Y, Z, R, S \rangle$

where

X is a non- empty finite set of input states

Y is a non- empty finite set of output states

Z is a non- empty finite set of internal states

R is a fuzzy relation on  $X \times Y$

S is a fuzzy relation on  $X \times Y \times Z$

## III. DERIVATION

Let us consider  $X = \{x_1, x_2, \dots, x_{n-1}, x_n\}$ ,  $Y = \{y_1, y_2, \dots, y_{n-1}, y_n\}$  and  $Z = \{z_1, z_2, \dots, z_{n-1}, z_n\}$  as the set of input states, output states and internal states respectively. Let  $A_t, B_t, C_t$  and  $E_t$  denote the fuzzy sets that characterize respectively, the stimulus response, response, current internal state and emerging internal state (next state) of the automation at time t. Given  $A_t$  and  $C_t$  at some time t, then by using fuzzy relations R and S, we can determine  $B_t$  and  $E_t$ . Clearly  $A_t \in F(X)$ ,  $B_t \in F(Y)$  and  $C_t, E_t \in F(Z)$ . Where  $F(\cdot)$  is the set of fuzzy sets on the set  $(\cdot)$ . A fuzzy set  $C_1$  which characterizes the initial state must be given to make fuzzy automation operate. Then  $C_t = E_{t-1}$  for each time  $t \in N - \{1\}$ . The equation  $C_t = E_{t-1}$  is assumed to be implemented by the block called storage. Its role is to store the produced fuzzy set  $E_t$  at time t and release it the next time under the label  $C_t$ . Given a sequence  $A_1, A_2, \dots$  and an initial characterization  $C_1$  of the internal state, fuzzy response relation R and state transition relation  $\delta$  allow us to generate the corresponding sequences  $B_1, B_2, \dots$  and  $C_2=E_1, C_3=E_2$ . Now let us describe the operator of a fuzzy automation as follows. For any given fuzzy input state  $A_t$ , the ternary state – transition relation  $\delta$  is converted into a binary relation  $\delta_{A_t}$  on  $Z \times Z$  by the formula

$$\delta_{A_t}(z_i, z_j) = \max_{k \in N_n} (\min[A_t(x_k), \delta_{x_k}(z_i, z_j)]) \quad \dots (1)$$

Then assuming the present fuzzy state  $C_t$  is given. The fuzzy next state  $E_t$  and the fuzzy output state  $B_t$  are determined by the max-min compositions

$$E_t = C_t \delta_{A_t} \text{ and } B_t = C_t R \quad \dots (2)$$

Equations (1) and (2) are sufficient to handle the sequences of fuzzy states. For instance a sequence  $A_1, A_2, \dots, A_r$  of r- fuzzy input state applied to a given initial fuzzy state  $C_1$ , the fuzzy automata produces the sequence of fuzzy internal states.

$$E_1 = C_1 \delta_{A_1}, E_2 = E_1 \delta_{A_2} \text{ and } E_r = E_{r-1} \delta_{A_r}$$

Thus  $E_r = C_1 \delta_{A_1} \dots \delta_{A_r}$ . The corresponding sequence of fuzzy output states

$$B_1 = C_1 R, B_2 = E_1 R \text{ and } B_r = E_{r-1} R$$

$$\text{Thus } B_r = C_1 \delta_{A_1}, \delta_{A_2}, \dots \delta_{A_{r-1}} \cdot R.$$

#### IV. ILLUSTRATIVE EXAMPLE

Consider a fuzzy automation with  $x = \{x_1, x_2\}$ ,  $y = \{y_1, y_2, y_3\}$  and  $z = \{z_1, z_2, z_3, z_4\}$  whose output relation

$$y_1 \quad y_2 \quad y_3 R = \begin{matrix} z_1 \\ z_2 \\ z_3 \\ z_4 \end{matrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0.5 & 1 & 0.3 \end{bmatrix}$$

State transition relation  $\delta$  are defined by the following matrices respectively for the input states  $x_1$  and  $x_2$ .

$$\delta_{A1}(z_i, z_j) = \begin{matrix} z_1 & z_2 z_3 & z_4 \\ \begin{matrix} z_1 \\ z_2 \\ z_3 \\ z_4 \end{matrix} \end{matrix} \begin{bmatrix} 0 & 0.4 & 0.2 & 1 \\ 0.3 & 1 & 0 & 0.2 \\ 0.5 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\delta_{A2}(z_i, z_j) = \begin{matrix} z_1 \\ z_2 \\ z_3 \\ z_4 \end{matrix} \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0.2 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 0.3 & 0 & 0.6 \end{bmatrix}$$

Generate sequence of two fuzzy initial states and output states under the following conditions:

The initial fuzzy states is  $C_1 = [1, 0.8, 0.6, 0.4]$  the input fuzzy states are  $A_1 = [1, 0.4]$  and  $A_2 = [0, 1]$ .

Solution: Let us assume that the initial state of the automation is  $C_1 = [1, 0.8, 0.6, 0.4]$  and fuzzy input  $A_1 = [1, 0.4]$  is given.

By using the equation

$$\delta_{At}(z_i, z_j) = \max_{k \in \{1, 2\}} \{ \min[A_t(x_k), \delta_k(z_i, z_j)] \}$$

Let us compute the equation  $\delta_{A1}$

$$\begin{aligned} \delta_{A1}(z_1, z_1) &= \max\{ \min[A_1(x_1), \delta_{x1}(z_1, z_1)], \min[A_1(x_2), \delta_{x2}(z_1, z_1)] \} \\ &= \max\{ \min(1, 0), \min(0.4, 0) \} \\ &= 0 \\ \delta_{A1}(z_1, z_2) &= \max\{ \min[A_1(x_1), \delta_{x1}(z_1, z_2)], \min[A_1(x_2), \delta_{x2}(z_1, z_2)] \} \\ &= \max\{ \min(1, 0.4), \min(0.4, 0) \} \\ &= 0.4 \\ \delta_{A1}(z_1, z_3) &= \max\{ \min[A_1(x_1), \delta_{x1}(z_1, z_3)], \min[A_1(x_2), \delta_{x2}(z_1, z_3)] \} \\ &= \max\{ \min(1, 0.2), \min(0.4, 1) \} \\ &= 0.4 \\ \delta_{A1}(z_1, z_4) &= \max\{ \min[A_1(x_1), \delta_{x1}(z_1, z_4)], \min[A_1(x_2), \delta_{x2}(z_1, z_4)] \} \\ &= \max\{ \min(1, 1), \min(0.4, 0) \} \\ &= 1 \end{aligned}$$

Thus the First row of  $\delta_{A1}$  is  $[0 \quad 0.4 \quad 0.4 \quad 1]$

$$\begin{aligned} \delta_{A1}(z_2, z_1) &= \max\{ \min[A_1(x_1), \delta_{x1}(z_2, z_1)], \min[A_1(x_2), \delta_{x2}(z_2, z_1)] \} \\ &= \max\{ \min(1, 0.3), \min(0.4, 0.2) \} \\ &= 0.3 \\ \delta_{A1}(z_2, z_2) &= \max\{ \min[A_1(x_1), \delta_{x1}(z_2, z_2)], \min[A_1(x_2), \delta_{x2}(z_2, z_2)] \} \\ &= \max\{ \min(1, 1), \min(0.4, 0) \} \\ &= 1 \\ \delta_{A1}(z_2, z_3) &= \max\{ \min[A_1(x_1), \delta_{x1}(z_2, z_3)], \min[A_1(x_2), \delta_{x2}(z_2, z_3)] \} \\ &= \max\{ \min(1, 0), \min(0.4, 0) \} \end{aligned}$$

$$\begin{aligned}
 &= 0 \\
 \delta_{A1}(z_2, z_4) &= \max\{\min[A_1(x_1), \delta_{x1}(z_2, z_4)], \min[A_1(x_2), \delta_{x2}(z_2, z_4)]\} \\
 &= \max\{\min(1, 0.2), \min(0.4, 1)\} \\
 &= 0.4
 \end{aligned}$$

Thus the Second row of  $\delta_{A1}$  is [0.3 1 0 0.4]

$$\begin{aligned}
 \delta_{A1}(z_3, z_1) &= \max\{\min[A_1(x_1), \delta_{x1}(z_3, z_1)], \min[A_1(x_2), \delta_{x2}(z_3, z_1)]\} \\
 &= \max\{\min(1, 0.5), \min(0.4, 0)\} \\
 &= 0.5
 \end{aligned}$$

$$\begin{aligned}
 \delta_{A1}(z_3, z_2) &= \max\{\min[A_1(x_1), \delta_{x1}(z_3, z_2)], \min[A_1(x_2), \delta_{x2}(z_3, z_2)]\} \\
 &= \max\{\min(1, 0), \min(0.4, 0)\} \\
 &= 0
 \end{aligned}$$

$$\begin{aligned}
 \delta_{A1}(z_3, z_3) &= \max\{\min[A_1(x_1), \delta_{x1}(z_3, z_3)], \min[A_1(x_2), \delta_{x2}(z_3, z_3)]\} \\
 &= \max\{\min(1, 0), \min(0.4, 0)\} \\
 &= 0
 \end{aligned}$$

$$\begin{aligned}
 \delta_{A1}(z_3, z_4) &= \max\{\min[A_1(x_1), \delta_{x1}(z_3, z_4)], \min[A_1(x_2), \delta_{x2}(z_3, z_4)]\} \\
 &= \max\{\min(1, 1), \min(0.4, 1)\} \\
 &= 1
 \end{aligned}$$

Thus the Third row of  $\delta_{A1}$  is [0.5 0 0 1]

$$\begin{aligned}
 \delta_{A1}(z_4, z_1) &= \max\{\min[A_1(x_1), \delta_{x1}(z_4, z_1)], \min[A_1(x_2), \delta_{x2}(z_4, z_1)]\} \\
 &= \max\{\min(1, 0), \min(0.4, 1)\} \\
 &= 0.4
 \end{aligned}$$

$$\begin{aligned}
 \delta_{A1}(z_4, z_2) &= \max\{\min[A_1(x_1), \delta_{x1}(z_4, z_2)], \min[A_1(x_2), \delta_{x2}(z_4, z_2)]\} \\
 &= \max\{\min(1, 0), \min(0.4, 0.3)\} \\
 &= 0.3
 \end{aligned}$$

$$\begin{aligned}
 \delta_{A1}(z_4, z_3) &= \max\{\min[A_1(x_1), \delta_{x1}(z_4, z_3)], \min[A_1(x_2), \delta_{x2}(z_4, z_3)]\} \\
 &= \max\{\min(1, 0), \min(0.4, 0)\} \\
 &= 0
 \end{aligned}$$

$$\begin{aligned}
 \delta_{A1}(z_4, z_4) &= \max\{\min[A_1(x_1), \delta_{x1}(z_4, z_4)], \min[A_1(x_2), \delta_{x2}(z_4, z_4)]\} \\
 &= \max\{\min(1, 1), \min(0.4, 0.6)\} \\
 &= 1
 \end{aligned}$$

Thus the Last row of  $\delta_{A1}$  is [0.4 0.3 0 1]

The matrix  $\delta_{A1}$  is

$$\delta_{A1} = \begin{bmatrix} 0 & 0.4 & 0.4 & 1 \\ 0.3 & 1 & 0 & 0.4 \\ 0.5 & 0 & 0 & 1 \\ 0.4 & 0.3 & 0 & 1 \end{bmatrix}$$

To calculate the fuzzy next set  $E_1$  and the fuzzy output state  $B_1$  of the automation

$$E_1 = C_1 \cdot \delta_{A1}$$

$$= [1 \quad 0.8 \quad 0.6 \quad 0.4] \begin{bmatrix} 0 & 0.4 & 0.4 & 1 \\ 0.3 & 1 & 0 & 0.4 \\ 0.5 & 0 & 0 & 1 \\ 0.4 & 0.3 & 0 & 1 \end{bmatrix}$$

$$E_1 = [\max(0, 0.3, 0.5, 0.4) \quad \max(0.4, 0.8, 0, 0.3) \quad \max(0.4, 0, 0, 0) \quad \max(1, 0.4, 0.6, 0.4)]$$

$$E_1 = [0.5 \quad 0.8 \quad 0.4 \quad 1]$$

$$B_1 = C_1 \cdot R$$

$$= [1 \quad 0.8 \quad 0.6 \quad 0.4] \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0.5 & 1 & 0.3 \end{bmatrix}$$

$$= [\max(1, 0, 0, 0.4) \quad \max(0, 0.8, 0, 0.4) \quad \max(0, 0, 0.6, 0.3)]$$

$$B_1 = [1 \ 0.8 \ 0.6]$$

Assume that the next fuzzy input state  $A_2 = [0,1]$  is given.

By using the equation

$$\delta_{A_2}(z_i, z_j) = \max_{k \in \{1,2\}} (\min[A_2(x_k), \delta_{xk}(z_i, z_j)])$$

Let us compute the equation

$$\begin{aligned} \delta_{A_2}(z_1, z_1) &= \max\{\min[A_2(x_1), \delta_{x1}(z_1, z_1)], \min[A_2(x_2), \delta_{x2}(z_1, z_1)]\} \\ &= \max\{\min(0,0), \min(1,0)\} \end{aligned}$$

$$= 0$$

$$\begin{aligned} \delta_{A_2}(z_1, z_2) &= \max\{\min[A_2(x_1), \delta_{x1}(z_1, z_2)], \min[A_2(x_2), \delta_{x2}(z_1, z_2)]\} \\ &= \max\{\min(0,0.4), \min(1,0)\} \\ &= \max\{0,0\} \end{aligned}$$

$$= 0$$

$$\begin{aligned} \delta_{A_2}(z_1, z_3) &= \max\{\min[A_2(x_1), \delta_{x1}(z_1, z_3)], \min[A_2(x_2), \delta_{x2}(z_1, z_3)]\} \\ &= \max\{\min(0,0.2), \min(1,1)\} \end{aligned}$$

$$= 1$$

$$\begin{aligned} \delta_{A_2}(z_1, z_4) &= \max\{\min[A_2(x_1), \delta_{x1}(z_1, z_4)], \min[A_2(x_2), \delta_{x2}(z_1, z_4)]\} \\ &= \max\{\min(0,1), \min(1,0)\} \end{aligned}$$

$$= 0$$

Thus the First row of  $\delta_{A_2}$  is  $[0 \ 0 \ 1 \ 0]$

$$\begin{aligned} \delta_{A_2}(z_2, z_1) &= \max\{\min[A_2(x_1), \delta_{x1}(z_2, z_1)], \min[A_2(x_2), \delta_{x2}(z_2, z_1)]\} \\ &= \max\{\min(0,0.3), \min(1,0.2)\} \end{aligned}$$

$$= 0.2$$

$$\begin{aligned} \delta_{A_2}(z_2, z_2) &= \max\{\min[A_2(x_1), \delta_{x1}(z_2, z_2)], \min[A_2(x_2), \delta_{x2}(z_2, z_2)]\} \\ &= \max\{\min(0,1), \min(1,0)\} \end{aligned}$$

$$= 0$$

$$\begin{aligned} \delta_{A_2}(z_2, z_3) &= \max\{\min[A_2(x_1), \delta_{x1}(z_2, z_3)], \min[A_2(x_2), \delta_{x2}(z_2, z_3)]\} \\ &= \max\{\min(0,0), \min(1,0)\} \end{aligned}$$

$$= 0$$

$$\begin{aligned} \delta_{A_2}(z_2, z_4) &= \max\{\min[A_2(x_1), \delta_{x1}(z_2, z_4)], \min[A_2(x_2), \delta_{x2}(z_2, z_4)]\} \\ &= \max\{\min(0,0.2), \min(1,1)\} \end{aligned}$$

$$= 1$$

Thus the Second row of  $\delta_{A_2}$  is  $[0.2 \ 0 \ 0 \ 1]$

$$\begin{aligned} \delta_{A_2}(z_3, z_1) &= \max\{\min[A_2(x_1), \delta_{x1}(z_3, z_1)], \min[A_2(x_2), \delta_{x2}(z_3, z_1)]\} \\ &= \max\{\min(0,0.5), \min(1,0)\} \end{aligned}$$

$$= 0$$

$$\begin{aligned} \delta_{A_2}(z_3, z_2) &= \max\{\min[A_2(x_1), \delta_{x1}(z_3, z_2)], \min[A_2(x_2), \delta_{x2}(z_3, z_2)]\} \\ &= \max\{\min(0,0), \min(1,0)\} \end{aligned}$$

$$= 0$$

$$\begin{aligned} \delta_{A_2}(z_3, z_3) &= \max\{\min[A_2(x_1), \delta_{x1}(z_3, z_3)], \min[A_2(x_2), \delta_{x2}(z_3, z_3)]\} \\ &= \max\{\min(0,0), \min(1,0)\} \end{aligned}$$

$$= 0$$

$$\begin{aligned} \delta_{A_2}(z_3, z_4) &= \max\{\min[A_2(x_1), \delta_{x1}(z_3, z_4)], \min[A_2(x_2), \delta_{x2}(z_3, z_4)]\} \\ &= \max\{\min(0,1), \min(1,1)\} \end{aligned}$$

$$= 1$$

Thus the Third row of  $\delta_{A_2}$  is  $[0 \ 0 \ 0 \ 1]$

$$\begin{aligned}\delta_{A2}(z_4, z_1) &= \max\{\min[A_2(x_1), \delta_{x1}(z_4, z_1)], \min[A_2(x_2), \delta_{x2}(z_4, z_1)]\} \\ &= \max\{\min(0,0), \min(1,1)\} \\ &= 1\end{aligned}$$

$$\begin{aligned}\delta_{A2}(z_4, z_2) &= \max\{\min[A_2(x_1), \delta_{x1}(z_4, z_2)], \min[A_2(x_2), \delta_{x2}(z_4, z_2)]\} \\ &= \max\{\min(0,0), \min(1,0.3)\} \\ &= 0.3\end{aligned}$$

$$\begin{aligned}\delta_{A2}(z_4, z_3) &= \max\{\min[A_2(x_1), \delta_{x1}(z_4, z_3)], \min[A_2(x_2), \delta_{x2}(z_4, z_3)]\} \\ &= \max\{\min(0,0), \min(1,0)\} \\ &= 0\end{aligned}$$

$$\begin{aligned}\delta_{A2}(z_4, z_4) &= \max\{\min[A_2(x_1), \delta_{x1}(z_4, z_4)], \min[A_2(x_2), \delta_{x2}(z_4, z_4)]\} \\ &= \max\{\min(0,1), \min(1,0.6)\} \\ &= 0.6\end{aligned}$$

Thus the Last row of  $\delta_{A2}$  is [1 0.3 0 0.6]

The matrix  $\delta_{A2}$  is

$$\delta_{A2} = \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0.2 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 0.3 & 0 & 0.6 \end{bmatrix}$$

To calculate the fuzzy next set  $E_2$  and the fuzzy output state  $B_2$  of the automation

$$E_2 = C_2 \cdot \delta_{A2} = E_1 \cdot \delta_{A2}$$

$$= [0.5 \quad 0.8 \quad 0.4 \quad 1] \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0.2 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 0.3 & 0 & 0.6 \end{bmatrix}$$

$$E_2 = [\max(0,0.2,1) \max(0,0,0,0.3) \max(0.5,0,0,0) \max(0,0.8,0.4,0.6)]$$

$$E_2 = [1 \quad 0.3 \quad 0.5 \quad 0.8]$$

$$B_2 = E_1 \cdot R$$

$$= [0.5 \quad 0.8 \quad 0.4 \quad 1] \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0.5 & 1 & 0.3 \end{bmatrix}$$

$$= [\max(0.5, 0, 0, 0.5) \max(0, 0.8, 0, 1) \max(0, 0, 0.4, 0.3)]$$

$$B_2 = [0.5 \quad 1 \quad 0.4]$$

Similarly we can produce large sequence of fuzzy internal states and output states for any given sequences of fuzzy input states of a fuzzy automation.

## V. CONCLUSION

The response of the system depends on the basis of the received stimulus and the internal state of the system, which in-turn results in a new internal state. The fuzzy automaton when characterized by fuzzy sets, the production of responses and next states are facilitated by suitable fuzzy relations.

## BIBLIOGRAPHY

- [1] Meenakshi .A.R(2008), "Fuzzy Matrix" Theory and Application, MJP publishers.
- [2] Bellman.R. and Zadeh.L.A. - "Decision making in a fuzzy environment." Management Science.
- [3] George J.Klir/Bo Yuan (2005) - "Fuzzy sets and Fuzzy Logic" Theory and Applications, prentice hall of India Private limited.
- [4] Kim, K.H and Roush, F.W - "Generalized fuzzy matrices." Fuzzy Sets Sys.
- [5] Meenakshmi.A.R. and Sriram,S (2003)- "Some Remakrs on Regular Fuzzy matrices" Annamalai University, Science Journal.
- [6] Mizumoto - Fuzzy Theory and its Applications. Science Publications.
- [7] M. Shimura, Fuzzy sets concept in rank ordering objects, J. Math. Anal.1 Appl., 43 (1973),
- [8] S. Elizabeth and L. Sujatha - Application Of Fuzzy Membership Matrix In Medical Diagnosis And Decision Making.
- [9] M. Shimura(1973) Fuzzy sets concept in rank ordering objects, J. Math. Anal. 1.Appl.,



- [10] Palaniyappan.N2005 - "Fuzzy topology" Second Edition, Narosa publishing house, on Allied Publishers Ltd, New Delhi.
- [11] Vasantha Kandasamy.W.B- "Elementary Fuzzy Matrix" Theory and Fuzzy models for social scientists, University of Microfilm International, USA.
- [12] Vasantha.W.B. Kandasamy "Elementary Fuzzy matrix theory and fuzzy models for social scientist"
- [13] Zimmermann.H.J – "Fuzzy set theory and its Applications", 2nd edition.



10.22214/IJRASET



45.98



IMPACT FACTOR:  
7.129



IMPACT FACTOR:  
7.429



# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089  (24\*7 Support on Whatsapp)