

## **Model for diagnosis of Diabetes type 2, Hypertension, Hepatitis & Tuberculosis by using Fuzzy Matrices**

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### **Abstract**

The use of Fuzzy Mathematics in medical science is one of the knowledge based systems which is used here in this project. The knowledge based systems are the types of artificial intelligence that use a database to provide assistance to users.

The project deals with 4 diseases, Diabetes type 2, Hypertension, Hepatitis & Tuberculosis. This project is done specially for common man because the expert doctors are generally well paid for their specialized knowledge. So they are expensive for common man. In some rural areas there is lack of experts. So people from that area usually come to cities just to refer an expert which may be inconvenient to them. So somehow we are trying to capture expert knowledge & make it available to everyone with the help of an android application. This is the actual theme. In this project I have generated database for 4 diseases referring to various doctors. The symptoms of these 4 diseases & their respective gradations are my database. Here making use of Fuzzy matrices which will lead for diagnosis of diseases. I am not claiming that this is the only accurate method to diagnose the disease or it is a substitutional work for experts' knowledge. But this model would be the primary tool for common man to criticize the observed symptoms.

**Keywords:** Fuzzy Mathematics, medical science, knowledge based systems, 4 diseases Diabetes type 2, Hypertension, Hepatitis & Tuberculosis, lack of experts, android application, Fuzzy matrices, primary tool

### **INTRODUCTION**

Fuzzy mathematics and fuzzy logic form the basis of KNOWLEDGE BASED SYSTEMS. The knowledge based systems are the types of Artificial Intelligence that use a database to provide assistance to users. Without fuzzy mathematics knowledge based systems are just impossible. The use of fuzzy mathematics in medical science is one of such systems.

**Reasons of Uncertainty in Medical Diagnosis:**

- 1) Exaggerated information.
- 2) Less amount of information provided by patients.
- 3) Not knowing exact history of patients. The physical reports, medical tests are not ideal.
- 4) The Knowledge based systems help in reducing uncertainty during diagnosis.

**METHODOLOGY**

First I chose 4 diseases to work on it. Those diseases were Diabetes Type 2, Hypertension, Hepatitis, Tuberculosis .Then I collected database of these 4 diseases which include various symptoms of these diseases by referring to different expert doctors. I also asked the experts to grade these symptoms according to their stages. Then I formed 5 matrices i.e. matrix relation for occurrence [Ro], matrix relation for confirmation [Rc], matrix relation for non occurrence [1-Ro] , matrix relation for non confirmation [1-Rc], matrix relation for gradations entered by doctors[R<sub>s</sub>]. Then I took product of these fuzzy matrices by using max-min, max product, and max average method. These calculations led towards diagnosis of the disease.

**DATABASE**

Sr. No.	Symptoms	Diabetes type 2		Hypertension		Hepatitis		Tuberculosis	
		<u>Occurrence</u>	<u>Confirmation</u>	<u>Occurrence</u>	<u>Confirmation</u>	<u>Occurrence</u>	<u>confirmation</u>	<u>Occurrence</u>	<u>confirmation</u>
1	Polydipsia	0.80	0.50	0	0	0	0	0	0
2	Polyphagia	0.60	0.50	0	0	0	0	0	0
3	Polyurea	0.80	0.65	0	0	0	0	0	0
4	Itching	0.50	0.35	0	0	0	0	0	0
5	Tingling & Numness	0.60	0.40	1	1	0	0	0	0
6	Delayed wound healing	0.50	0.40	0	0	0	0	0	0
7	Condition of vision	0.45	0.35	0	0	0	0	0	0
8	Nephropathy	0.45	0.35	0	0	0	0	0	0
9	Atherosclerosis	0.25	0.15	0	0	0	0	0	0
10	Restlessness & Palpitation	0.45	0.20	0.50	0.35	0	0	0	0
11	Giddiness	0	0	0.85	0.10	0	0	0	0
12	Hemiparasis	0	0	1	1	0	0	0	0
13	Diplopia	0	0	0.35	0.50	0	0	0	0
14	Slurred speech	0	0	0.80	0.85	0	0	0	0
15	Headache	0	0	0.90	0.20	0.84	0.59	0.25	0.26
16	Insomnia	0	0	0.75	0.15	0	0	0	0
17	Unconsciousness	0	0	0.50	0.40	0.87	0.82	0	0
18	Pale tongue	0	0	0	0	0.3	0.18	0.17	0.19
19	Yellowish tongue	0	0	0	0	0.3	0.18	0.17	0.19
20	Loss of weight	0	0	0	0	0.74	0.54	0.45	0.3

Sr. No.	Symptoms	Diabetes type 2		Hypertension		Hepatitis		Tuberculosis	
		<u>Occurrence</u>	<u>Confirmation</u>	<u>Occurrence</u>	<u>Confirmation</u>	<u>Occurrence</u>	<u>confirmation</u>	<u>Occurrence</u>	<u>confirmation</u>
21	Low grade evening ever	0	0	0	0	0.69	0.42	0.62	0.59
22	Headache and Nausea	0	0	0.90	0.20	0.84	0.59	0.25	0.26
23	Pain in abdomen	0	0	0	0	0.8	0.7	0.08	0.07
24	Loss of Appetite	0	0	0	0	0.9	0.63	0.57	0.41
25	Yellowish urine	0	0	0	0	0.9	0.7	0.04	0.01
26	White Stool	0	0	0	0	0.48	0.63	0	0
27	Bad long living cough	0	0	0	0	0	0	0.85	0.72
28	Night sweats	0	0	0	0	0	0	0.36	0.42

**MATRICES:**

*Matrix relation for Occurrence (Ro)*

*Matrix relation for Confirmation (Rc)*

0.80	0	0	0	0.50	0	0	0
0.60	0	0	0	0.50	0	0	0
0.80	0	0	0	0.65	0	0	0
0.50	0	0	0	0.35	0	0	0
0.60	1	0	0	0.40	1	0	0
0.50	0	0	0	0.40	0	0	0
0.45	0	0	0	0.35	0	0	0
0.45	0	0	0	0.35	0	0	0
0.25	0	0	0	0.15	0	0	0
0.45	0.50	0	0	0.20	0.35	0	0
0	0.85	0	0	0	0.10	0	0
0	1	0	0	0	1	0	0
0	0.35	0	0	0	0.50	0	0
0	0.80	0	0	0	0.85	0	0
0	0.90	0.84	0.25	0	0.20	0.59	0.26
0	0.75	0	0	0	0.15	0	0
0	0.50	0.82	0	0	0.40	0.82	0
0	0	0.87	0	0	0	0.82	0
0	0	0.30	0.17	0	0	0.18	0.19
0	0	0.30	0.17	0	0	0.18	0.19

0	0	0.74	0.45	0	0	0.54	0.30
0	0	0.69	0.62	0	0	0.42	0.59
0	0	0.80	0.08	0	0	0.70	0.07
0	0	0.90	0.57	0	0	0.63	0.41
0	0	0.90	0.04	0	0	0.70	0.01
0	0	0.48	0	0	0	0.63	0
0	0	0	0.85	0	0	0.85	0.72
0	0	0	0.36	0	0	0.36	0.42

**Matrix relation for non-occurrence(1-Ro)      Matrix relation for non-confirmation(1-Rc)**

0.20	1	1	1	0.50	1	1	1
0.40	1	1	1	0.50	1	1	1
0.20	1	1	1	0.35	1	1	1
0.50	1	1	1	0.65	1	1	1
0.60	0	1	1	0.60	0	1	1
0.50	1	1	1	0.60	1	1	1
0.55	1	1	1	0.65	1	1	1
0.55	1	1	1	0.65	1	1	1
0.75	1	1	1	0.85	1	1	1
0.55	0.50	1	1	0.80	0.65	1	1
1	0.15	1	1	1	0.90	1	1
1	0	1	1	1	0	1	1
1	0.65	1	1	1	0.50	1	1
1	0.20	1	1	1	0.15	1	1
1	0.10	0.16	0.75	1	0.80	0.41	0.74
1	0.25	1	1	1	0.85	1	1
1	0.50	0.18	1	1	0.60	0.18	1



## MATRIX CALCULATIONS

## Method 1

**MAX-MIN**

<i>Rs O Ro</i>					<i>Rs O Rc</i>				
	D1	D2	D3	D4		D1	D2	D3	D4
P1	0.50	0.80	0.50	0.45	P1	0.50	0.85	0.50	0.30
P2	0.45	0.50	0.25	0.25	P2	0.25	0.35	0.25	0.25
P3	0.25	0.25	0.69	0.75	P3	0.25	0.25	0.75	0.72
P4	0	0	0.25	0.25	P4	0	0	0.25	0.25
<i>Rs O (1-Ro)</i>					<i>Rs O (1-Rc)</i>				
	D1	D2	D3	D4		D1	D2	D3	D4
P1	1	0.50	1	1	P1	1	0.50	1	1
P2	0.50	0.50	0.50	0.50	P2	0.50	0.50	0.50	0.50
P3	1	1	1	0.64	P3	1	1	0.64	0.58
P4	0.25	0.25	0.25	0.25	P4	0.25	0.25	0.25	0.25

## Method 2

**MAX PRODUCT**

<i>Rs O Ro</i>					<i>Rs O Rc</i>				
	D1	D2	D3	D4		D1	D2	D3	D4
P1	0.40	0.80	0.37	0.23	P1	0.25	0.85	0.27	0.15
P2	0.23	0.25	0.21	0.06	P2	0.10	0.25	0.14	0.06
P3	0.20	0.23	0.69	0.64	P3	0.13	0.09	0.64	0.59
P4	0	0	0.23	0.14	P4	0	0	0.20	0.10
<i>Rs O (1-Ro)</i>					<i>Rs O (1-Rc)</i>				
	D1	D2	D3	D4		D1	D2	D3	D4
P1	1	0.50	1	1	P1	1	0.50	1	1
P2	0.28	0.25	0.05	0.05	P2	0.40	0.33	0.50	0.50
P3	1	1	1	0.64	P3	1	1	0.64	0.58
P4	0.25	0.25	0.18	0.25	P4	0.25	0.25	0.21	0.25

Method 3

# MAX AVERAGE

<i>Rs O Ro</i>					<i>Rs O Rc</i>				
	D1	D2	D3	D4		D1	D2	D3	D4
P1	0.65	0.90	0.62	0.50	P1	0.50	0.93	0.52	0.50
P2	0.48	0.63	0.54	0.43	P2	0.35	0.63	0.43	0.36
P3	0.53	0.58	0.85	0.81	P3	0.50	0.50	0.80	0.80
P4	0.40	0.50	0.58	0.43	P4	0.33	0.50	0.54	0.36
	<i>Rs O (1-Ro)</i>					<i>Rs O (1-Rc)</i>			
	D1	D2	D3	D4		D1	D2	D3	D4
P1	1	0.75	1	1	P1	1	0.75	1	1
P2	0.63	0.63	0.75	0.75	P2	0.65	0.63	0.75	0.75
P3	1	1	1	0.82	P3	1	1	0.82	0.79
P4	0.63	0.63	0.50	0.63	P4	0.63	0.63	0.54	0.62

**Gradations:**

- 1) Borderline presence =  $x < 0.30$
  - 2) Moderate presence =  $0.30 < x < 0.60$
  - 3) High presence =  $0.60 < x < 0.90$
  - 4) Extreme presence =  $0.90 < x$
- (Where x is the grade calculated for that disease)

**Calculations:**

<b>MAX MIN</b>		
(P1,D2)	0.85	High presence of Hypertension
(P2,D1)	0.45	Moderate presence of Diabetes
(P2,D2)	0.50	Moderate presence of Hypertension
(P2,D3)	0.25	Borderline presence of Hepatitis
(P2,D4)	0.25	Borderline presence of Tuberculosis
(P3,D4)	0.75	High presence of Tuberculosis
(P4,D1)	0.25	Borderline presence of Diabetes
(P4,D2)	0	Absence of Hypertension
(P4,D3)	0.25	Borderline presence of Hepatitis
(P4,D4)	0.25	Borderline presence of Tuberculosis
<b>MAX PRODUCT</b>		
(P1,D2)	0.85	High presence of Hypertension
(P2,D1)	0.23	Borderline presence of Diabetes
(P2,D2)	0.23	Borderline presence of Hypertension
(P2,D3)	0.21	Borderline presence of Hepatitis
(P2,D4)	0.06	Borderline presence of Tuberculosis
(P3,D1)	0.20	Borderline presence of Diabetes
(P3,D2)	0.23	Borderline presence of Hypertension
(P3,D3)	0.64	High presence of Hepatitis
(P3,D4)	0.64	High presence of Tuberculosis
(P4,D1)	0	Absence of Diabetes
(P4,D2)	0	Absence of Hypertension
(P4,D3)	0.23	Borderline presence of Hepatitis
(P4,D4)	0.14	Borderline presence of Tuberculosis
<b>MAX AVERAGE</b>		
(P1,D2)	0.90	High presence of Hypertension
(P2,D1)	0.50	Moderate presence of Diabetes
(P2,D2)	0.93	High presence of Hypertension
(P2,D3)	0.54	Moderate presence of Hepatitis
(P2,D4)	0.43	Moderate presence of Tuberculosis
(P3,D1)	0.53	Moderate presence of Diabetes
(P3,D4)	0.81	High presence of Tuberculosis

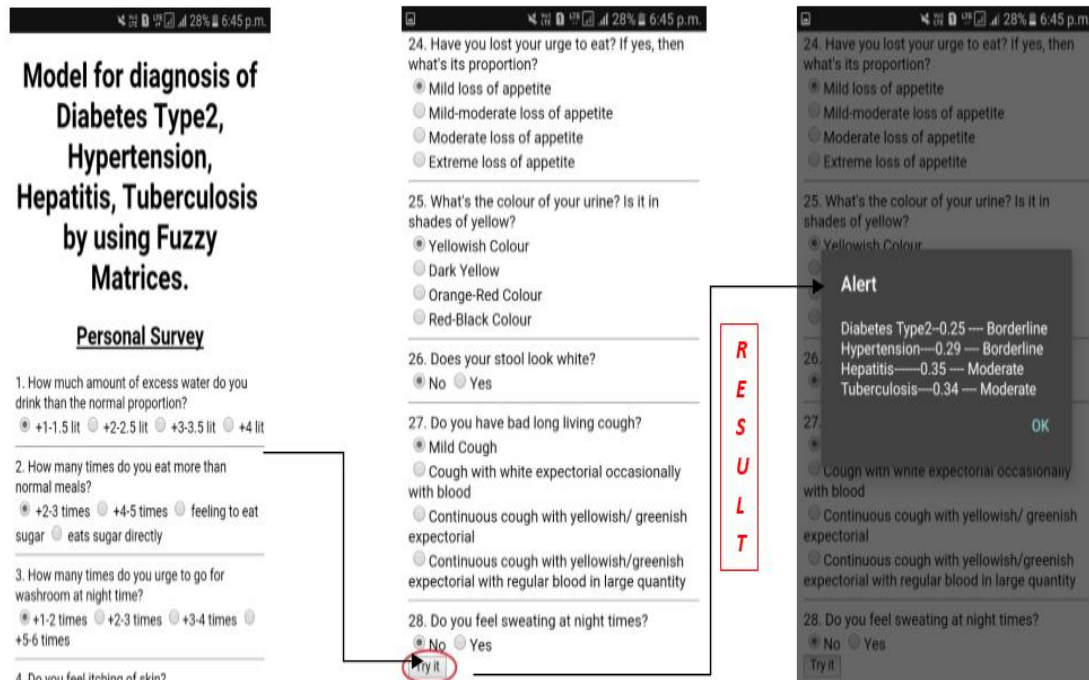


## CONCLUSION

By referring to experts' knowledge here we are claiming that Max product is the most accurate method to diagnose the diseases.

### Android Application:

### DiseaseAnalyser



## REFERENCES

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