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SELECTION OF PATIENT FOR TREATMENT UNDER MULTI CRITERIA DECISION MAKING USING FUZZY LOGIC

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Abstract:

Nowadays the use of computer technology in the fields of medicine area diagnosis, treatment of illnesses and patient pursuit has highly increased . The objective of this paper is to find out the person in the order from most affected to least affected and find out the disease by using Fuzzy Expert System. The designed system based on the Lab data base. The system consists of 6 input fields and two output field. Input fields are chest pain, cholesterol, heart rate, blood pressure, blood sugar, old peak. The output field detects the presence of particular disease in the patient and precautions accordingly. It is integer valued from 0 to 1. The treatment is taken for the risk in the order of priority vectors using Analytic Hierarchy Process.

Key Words: Fuzzy Logic, Rule Based System, Defuzzification and Analytic Hierarchy Process and Moderate Analytic Hierarchy Process

Introduction:

Using a Database is a well-known method for storing information. In regular database systems, sometimes because of existence of huge data it is not possible to fulfill the user's criteria and to provide them with the exact the information that they need to make a decision. Nowadays the use of computer technology in the fields of medicine area diagnosis, treatment of illnesses and patient pursuit has highly increased. Despite the fact that these fields, in which the computers are used, have very high complexity and uncertainty and the use of fuzzy logic ,the intelligent systems have been developed. There are huge data management tools available within health care systems, but analysis tools are not sufficient to discover hidden relationships amongst the data. Most of the medical information is vague, imprecise and uncertain. Medical diagnosis is a complicated task that requires operating accurately and efficiently. In fact, any one of the inputs is one of the main reasons behind adult death. In order to decrease the mortality rate it is necessary for the disease to be diagnosed at an early stage. So having so many factors are analyzed to diagnose the disease of a patient makes the physician's job difficult. So, experts require an accurate tool that considering these risk factors and show certain result in uncertain term. In this study, we designed an expert system to diagnose the diseases at which the designed expert system based on Fuzzy Logic.

The designed system aims to achieve the following:

- ✓ Detection of particular diseases, risks and precautions using fuzzy logic
- ✓ Systems have 6 inputs and 2 outputs and they have fuzzy variables.
- ✓ Each fuzzy Variable is associated with membership function
- ✓ The rules strength is calculated based on the membership function of the fuzzy variable.
- ✓ Analytic hierarchy process is used to priorities the patients.

Input Variables:

The purpose of this input variables is to diagnose the presence or absence of disease given the results of various medical tests carried out on a patient. This system uses 6 attributes as input and 2 attribute as output for result. Input fields (attributes) are chest pain type, blood pressure, cholesterol, blood sugar, heart rate, old peak , . The output field refers to the presence of disease in the patient and the precautions according to the risk. It is integer value from 0 to 1. In this dataset, fields divide to some sections and each section has a value

- ✓ **Chestpain:** In Chest pain there are five different membership functions. The five different types are very low, low, moderate, high and very high. The range of chest pain is 0-1.
- ✓ **Cholesterol:** Cholesterol has salient affect on the result and can change it easily. For this input field, we use the value of low density lipoprotein (LDL) cholesterol. In cholesterol there are five different membership functions. The five different types are very low, low, medium, high and very high. The range of cholesterol is 100-400.
- ✓ **Maximum Heart Rate:** In Maximum Heart Rate there are five different membership functions. The five different types are very low, low, medium, high and very high. The range of Maximum Heart is 70-150.
- ✓ **Blood pressure:** In Blood pressure there are five different membership functions. The five different type are very low, low, medium, high and very high. The range of blood pressure id given by 60-200.
- ✓ **Blood Sugar:** Blood sugar field is one of the most important factors in this system that changes the result. In Blood Sugar there are five different membership functions. The five different types are very low, low, medium, high and very high. Thus the range of Blood Sugar is 50-250.
- ✓ **Old Peak:** This input field means ST depression induced by exercise relative to rest. Old peak field has 5 fuzzy sets (Very Low, Low, Medium, Terrible and risk). In Old Peak, there are five different membership function, they are very low, low, medium, high and very high. The range for old peak is given by 0-1.

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Output Variables:

- ✓ **Result:** The "goal" field refers to the presence of particular disease in the patient. It is integer value from 0 to 1. By increasing this value, find out disease risk increases in the patient. In this system, we have considered a different output variable, which divides to 5 fuzzy sets Healthy, Low risk, Moderate risk, Risk, and High risk.
- ✓ **Precautions:** The output variable is precautions and take the treatment to the patient; this system gives the precautions according to the risk and result of the patient. The range of precaution is set from 0-1. The table-1 for the input and output values as follows

Table 1

Alternative	Input Values						Output Values	
	Chest Pain	Cloistral	Heart rate	Blood Pressure	Blood Sugar	Old Peak	Result	Precaution
A	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Healthy	0-1
B	Low	Low	Low	Low	Low	Low	Low risk	0-1
C	Medium	Medium	Medium	Medium	Medium	Medium	Moderate risk	0-1
D	High	High	High	High	High	High	Risk	0-1
E	Very High	Very High	Very High	Very High	Very High	Very High	High Risk	0-1
Value	0-1	100-400	700-150	60-200	50-250	0-1		

Rule Base and Defuzzification:

Rule base is the main part in fuzzy inference system and quality of result in a fuzzy system depends on the fuzzy rules. Membership functions are used to retranslate the fuzzy output into a crisp value. A sample of the five persons as alternatives with corresponding six criteria are given. Prioritization is obtained with each criterion. In the final table, priority vectors are found to each alternative using Analytic Hierarchy Process also with Moderate Analytic Hierarchy Process corresponding tables below.

Table 2: Analytic Hierarchy Process and Moderate Analytic Hierarchy Process Evaluation

Test No	Chest Pain	Cholesterol	Heart Rate	Blood Pressure	Blood Sugar	Old Peak
	0-1	**100-400**	**70-150**	**60-200**	**50-250**	**0-6**
	0.5	**250**	**110**	**130**	**150**	**3**
A	0.16	156.5	95.0	140	135	4
B	0.50	240	120	125	170	2
C	0.35	370	135	170	140	1
D	0.89	245	115	90	200	5
E	0.52	280	105	150	162	3
Total	**2.45**	**1291.5**	**570**	**675**	**807**	**15**

Table 3

Test No	Chest Pain	Cholesterol	Heart Rate	Blood Pressure	Blood Sugar	Old Peak
	0.0008	**0.3885**	**0.1711**	**0.2021**	**0.2332**	**0.0047**
A	0.0661	0.1212	0.1667	0.2074	0.1673	0.2667
B	0.2066	0.1858	0.2105	0.1852	0.2107	0.1333
C	0.1446	0.2865	0.2368	0.2519	0.1735	0.0667
D	0.3678	0.1897	0.2018	0.1333	0.2478	0.3333
E	0.2149	0.2168	0.1842	0.2222	0.2007	0.2000

AHP is an approach to decision making that involves structuring multiple choice criteria assessing the relative importance of these criteria and determining an overall ranking of the alternatives given in tables-4 and table-5.

Table 4

	Chest Pain	Cloistral	Heart Rate	Blood Pressure	Blood Sugar	Old Peak	Priority Vector
	0.0008	**0.3885**	**0.1709**	**0.2020**	**0.2331**	0.0047	
A	0.0000	0.0471	0.0285	0.0419	0.0389	0.0013	0.1577
B	0.0002	0.0722	0.0360	**0.2374**	0.0491	0.0006	0.1955
C	0.0001	0.113	**0.0405**	0.0509	0.0404	0.0003	0.2435
D	**0.0003**	**0.0737**	0.03545	0.0269	**0.0578**	**0.0016**	0.1948
E	0.0002	0.0842	0.0315	0.0449	0.0468	0.0009	0.2085

Table 5

	Chest Pain	Cloistral	Heart Rate	Blood Pressure	Blood Sugar	Old Peak	Total	Priority Vector
A	0.0000	0.1980	0.0578	0.0828	0.0934	0.0013	0.4333	0.1818
B	0.0001	0.2231	0.0653	0.0783	0.1035	0.0065	0.4768	0.2001
C	0.0001	0.2621	0.0698	0.0918	0.0948	0.0003	0.5189	0.2177
D	0.0003	0.2246	0.0638	0.0678	0.1122	0.0016	0.4703	0.1973
E	0.0002	0.2352	0.0608	0.0858	0.1010	0.0010	0.4840	0.2031

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Conclusion:

Thus we can check the diseases and risks in the patient according to the values of the attributes. If the values of the attributes or inputs are high then the patient has high risk and if the values or inputs are low than the patient has low heart risk. And similarly if the values are normal then the patient and results shows that the patient is normal. From the table 4, the person D has high chest pain, Cholestrol, blood surgar, Old beak, C has high heart rate, B has high blood pressure indicating that persons have heart problem.

Table 6

Alternative	Output Values	
	Result	Precaution
C	Healthy	0.2435
E	Low risk	0.2085
B	Moderate risk	0.1955
D	Risk	0.1948
A	High Risk	0.1577

From the AHP and Moderate AHP evaluation, eventhough the person D has high density value of chest pain, cloistral, Blood sugar and old peak, the treatment should be taken in the order of priority vector of the alternative for the person from Table -6. The high risk on alternative of person A will be taken emergency situation.

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