

# Nonlinear Identification and Medical Diagnosis System Using Functional-Type MIMORM (Multi Input Multi Output Rule Module) Connected Fuzzy Inference Method

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**Abstract:** Expert systems are capable of performing at the level of human expert in a specific problem domain called the computer programs. Uncertainty management is the most important issue in the development of the expert system. This expert system is used for the medical diagnosis. It is implemented for the diseases related to human body, whether it is blood diseases, liver diseases, nose diseases, throat diseases, related to ear problems, related to nerve system, eye diseases. This expert system deals with the individual specialist. This is a combination of all the expert system which had been developed for as single specialist. This expert system used to performed some statically operation on patient's symptoms. It is able to diagnosing the particular disease. The aim of this expert system is that it can be used by the physician in our daily practice to diagnose the diseases. Artificial intelligence techniques are to be used to develop best expert system that represent the various stages of the diagnose process.

**Keywords:** Diagnosis human diseases, Fuzzy logic, Medical record of patients, Suggest specialist.

## 1. Introduction

In a medical field diagnosis is a methodology for identification or recognition of a disease based on the some signs and symptoms that appears. One of the major issues in the diagnosis of disease is risk stratification. This MIMORM is use for simplifying the task of physician. MIMORM checks the initial stage of patient and find out the result on basis of sign and symptoms and tell the corresponding diseases and also suggest the corresponding specialist. This

medical expert system starts with asking some symptoms to the patient, if the system is able find the disease then it provide the name that particular disease on the basis of available cumulative information and refer to a appropriate specialist. If the system is not capable of identifying the disease on basis of symptom, it will ask some sign and symptoms to the patients. MIMORM not only simplifies task of the doctors but it will also helps the patients by providing initial medicines for small diseases in emergency.

## 2. Knowledge Representation and Acquisition for Analysis

There is a significant difference between the subjective and the objective levels. The "subjective level", that considered vital sign and symptoms of the patient and also considered as the medical records. Objective level is considered the conformation of lab tests, image processing and studies known as physician examination. The decision was providing by intelligence system relevant to physician examination. In the proposed expert system to diagnose the human disease, the symptoms of employed a scoring system to reach a diagnosis results. The patient comes with the sign and symptoms, there are 25 diseases related to different body part are chosen that covers the frequently occur and the severe forms of diseases. There are basically two scoring

that is calculated. A Symptom score is calculated based on the range of these symptoms and the information. A history score is calculated based on the past medical record of the patient. Fuzzy rules are used then for the confirmation of the disease and determine whether disease is on 1<sup>st</sup> stage, 2<sup>nd</sup> stage or the 3<sup>rd</sup> stage and develop a separate fuzzy set for each fuzzy set. It is able to easily modify the rules. To implement these rules, the FIRST ADD THEN AGGREGATE (FATA) method is used. Most of intelligence techniques are based on the subjective analysis including Fuzzy set, Bayesian network. The simple scoring system is better represent on this stage of diagnose. The scoring system is best to medical professionals because it is easily to understand and closes to pattern matching. In this system, a list of diseases is developed. This list covers the most common and chronic diseases of human. Once the disease is finalized it suggest the specialist for treatment.

**Table 1:** Record of learning Diagnose

Patient ID	Symptoms(Y/N)				Diagnose Disease	Objective Diagnose (%)	Expert Verification (Y/N)
	Symptom 1	Symptom 2	.....	Symptom n			
P1	1	0	0	1	ICD#11	65%	0
P2	0	0	0	1	ICD#12	85%	1
P3	1	0	0	1	ICD#21	68%	0
Pn	1	0	0	1	ICD#19	95%	1

### 3. Methodology

Fuzzy Logic was developed by Zahed in 1965. The reasoning of the human which is imprecise needed to be handled efficiently. Fuzzy logic gives the kind of logic which became more important day to day lives. Fuzzy is a multi valued logic deal with the reasoning. Fuzzy logic applied in the different fields from a small embedded system to large controller. In medical applications it is widely use include Predicting the disorder of liver functioning, disorder of eye , disorder of kidney, disorder of the nerve system, disorder of blood, disorder of ear nose throat(ENT). There are so many papers which deal with the fuzzy logic in medical applications. These papers deal within the particular field.

#### 3.1 Identification of parameters

This is the most important part to take into the consideration. The symptoms play the significant role in cause of the disease. In this paper we find the different diseases that are associated with symptoms of each specialist.

#### 3.2 Choice of membership function

The efficiency of system is determine by the choice of membership function that is used for every input and output parameters. There are various symptoms that do not have a particular values and the membership function are chosen for each of the parameter which is used. These membership values are taken on the basis of intuition method. Besides the number of membership function used there are some another factors need to be take account and these factors are the conjunction, disjunction, aggregation, type of parameters and the range of the parameters. The characteristic of each fuzzy variable is represented using triangular (for the Outputs) and the trapezoidal(for the input variables such as symptoms). In this paper, the fuzzy set represented by a number of membership function.

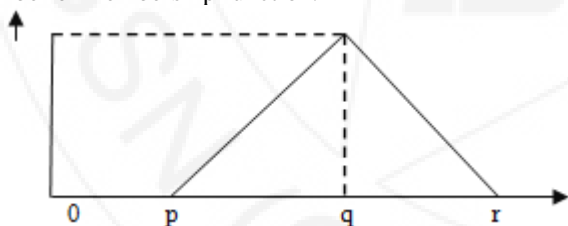


Figure 1: Triangular function

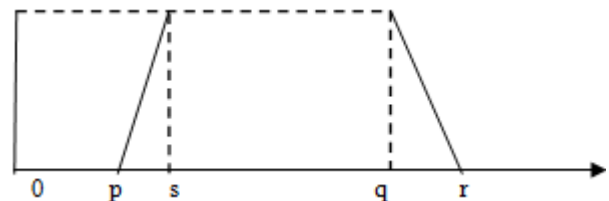


Figure 2: Trapezoidal function

#### 3.3 Fuzzy Sets

In this paper we considering the diseases of various specialist and these specialists are, **Gastroenterologist, Ophthalmologist, Nephrologists, Hematologist, Cardiologist, Neurologist, Dermatologist, MD, ENT**. This expert system will deal with the at least 50 diseases. Details of the specialist of Gastroenterologist is given below:

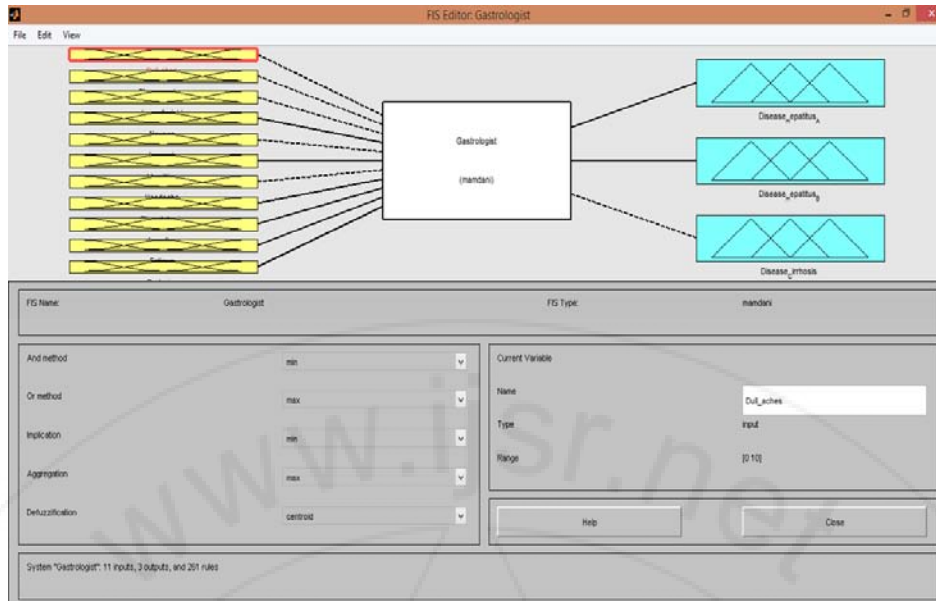
##### 1. Gastroenterologist

The liver is the largest organ in the body. It has weights about 1.5 kg. it situated beneath the right half of the diaphragm. The normal liver consists of masses of liver cells supported by framework of fiber. Running between the masses of liver cells are tinny bile channels. The liver plays an important role in many metabolic processes. It receives the blood from vein. Blood passes through the liver before entering the circulation.

##### 2. Disorder of Liver

various blood tests are available which helps to assess the functional state of liver. There are many diseases which occur with disorder of the liver function. The diseases may be:

1. Hepatitis A : Hepatitis A is spread by the faeco-oral route with period 4-5 weeks. It usually mild infection of children which goes unnoticed. In young adults it usually caused by the symptoms with fever, loss of appetite, nausea, pain behind the right rib margin, jaundice, dark urine.
2. Hepatitis B:- Hepatitis B is a very widespread infection with period 3-6 months. It is transmitted by blood, syringes, tattooing. It is probable that it can also be transmitted by kissing or sexual intercourse. It is usually caused by symptoms jaundice, joint pains or stomach pain, nausea, fatigue, vomiting.
3. Cirrhoses:- Hepatitis Cirrhoses follows when masses of liver dies. There are many causes of cirrhoses, but often the exact cause is unknown. Cirrhosis leads to liver failure. It also leads to obstruction to the flow of blood from the portal vein.



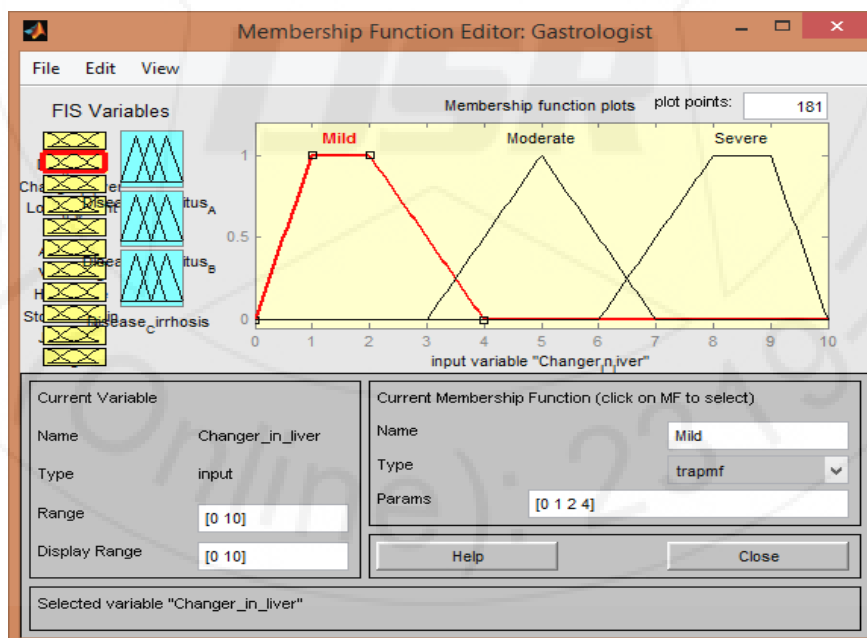
**Figure 3: FIS of Gastroenterologist**

Name= Gastroenterologist  
 Type='mandani'  
 Version=2.0  
 Number of Inputs=11  
 Number of Outputs=3  
 Number of rules Rules=261

For each input variables

- Range=[0 10]
- Number of MFs=3
- MF1='Mild': 'trapmf', [0 1 2 4]
- MF2='Moderate': 'trimf', [3 5 7]
- MF3='Severe': 'trapmf', [6 8 9 10]

For example the variable changes in liver can be divided into three categories Mild changes, Moderate Changes, Severe Changes. We define the range for individual variable from 0-10. If the variable value is from 0 – 4, the variable is grouped in 'mild changes' in the liver, if it is from 4 – 7, variable grouped into Moderate changes. If it ranges from 7 – 10, the variable grouped into severe changes. Each variable is combination of the triangular and trapezoidal membership function. The modifiers Mild and Severe linguistic variable represented as trapezoidal membership functions. It has truthiness value from 0 – 1. The modifier Moderate represented as the triangular membership function.



**Figure 4: Membership values of a variable**

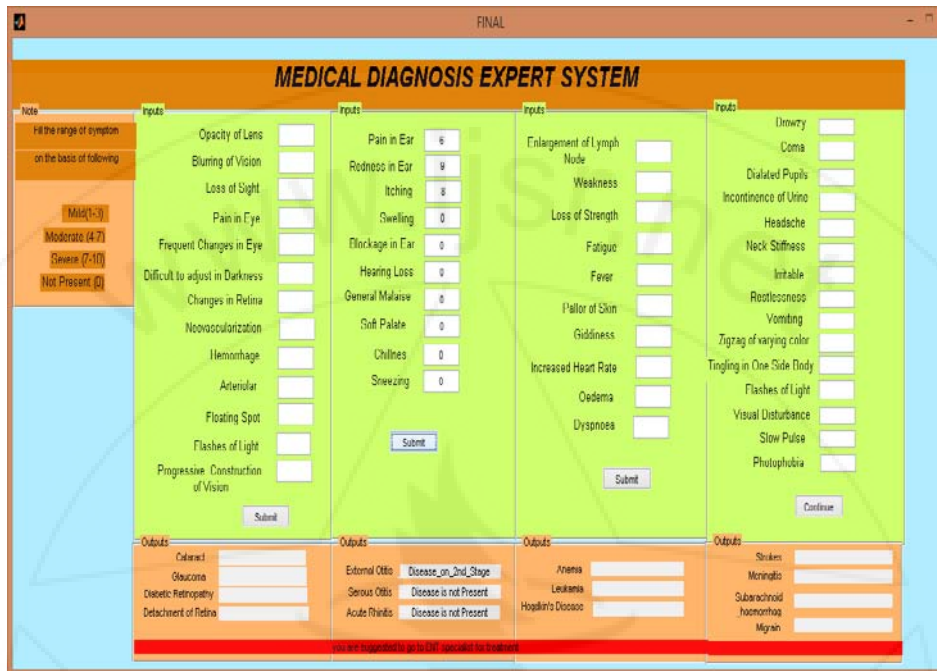
#### 4. GUI of Medical Diagnosis Expert System

This system is developed using the mat lab. The overall classification is done using the fuzzy logic toolbox. The GUI provides the communication between the user and system.

GUI also called the graphical display in one or two windows containing the different parts called components. The components contain the push button, static text, edit text, popup menu, slider etc. Graphical user interface showing the vital sign and symptoms which appears. In this GUI the

patient have to fill the range of symptoms according to the mild, moderate, and severe. After clicking on the button, the system will tell the disease whether it is present or not. If the disease is present then it will tell to the patient whether it is on first stage, second stage or third stage. And at the end it tells the corresponding specialist for patient's treatments. Inference engine where fuzzified value is defuzzified in the

model for decision making. The symptoms of the patient are fed into the system. And the based on the weights of the symptoms store into the database. After adding the symptoms the value is fuzzified. The structure of knowledge is combination of facts and rules of the diseases related to different part of human body.



**Figure 5: Medical Diagnosis Expert System**

In above GUI the patient fill the range of symptoms pain in ear is moderate (6), redness in ear is high (9), itching in ear is also high (8), the system tells the corresponding disease i.e. External otitis and also gives the stage of particular disease i.e. on the 2<sup>nd</sup> Stage. At last it suggests the expert that is ENT Specialist for their treatments. It saves the time of the patient as well as the doctor or physician.

## 5. Conclusion

we describe the fuzzy logic based medical expert system for diagnosing of the disease related to disorder of liver, disorder of blood, disorder to eye, disorder to kidney, disorder to ear nose throat, disorder of nervous system. We know there are many applications which are build on fuzzy data analysis but those which are build on current database are rare. This system can be used by the doctors, physician in our daily life. The proposed medical diagnosis expert system, one can allow the physician to follow the same process to diagnose the diseases and he/she will able to suggest the specialist in easy way. A lot of research has been done in medical field but more research increase the accuracy of the system. So many properties of this system remain to investigate. Future application for the database should be good. Now a day's most of the modern hospitals use the computer based records than paper based. Now it would be more easily to acquisition the data from records for the machine diagnosis. An expert should evaluate the quality performance of this system. This expert system succeeded in estimating the diseases of liver, diseases of eye, diseases of kidney, diseases of nerve. There are 35 cases in which

system perform perfect out of 45 cases. The future work, the more diseases will be added to the system and it will be tested.

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