

# Detection of diabetes using Neural Network and Fuzzy logic

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## Abstract:

In today's world the diabetes mellitus is a major health issue among people of all ages.

There are various of ways to predict diabetes, in spite of that the prediction rate of detection of diabetes is not so significant means various of techniques various of outcomes so that it is always unreliable to believe on the techniques ,but various techniques behaves on the way of getting better as approach. Most of the techniques associated with diabetes detection doesn't gives us accurate result as.

1. Some data sets and algorithm only good for pregnant women's and below 21 years
2. Some have good accuracy if only 1 data set is being used
3. Some needs dataset to be structured for good accuracy.
4. Some needs Normalization in Data.
5. Some developed systems also failed in showing performance.

## Introduction:

Diabetes prediction system works upon the given data in data set i.e. data provided is the blood pressure level, glucose level, insulin level , age of the patients to us and we have to train our model or make a model that will take this as input and gives an output to us whether it detected diabetes or not.

I have made this on two approaches :

1. Using Neural Network
2. Using Fuzzy Logic.

The main difference between Neural network and fuzzy logic is that neural network gives us binary answer either the person has detected diabetes or not, But the fuzzy logic approach gives us answer in more clear and better form i.e . whether the person have no chances of diabetes an whether it has some low chances that may be controlled and whether he/she is suffering from diabetes.

## Using Neural Network:

In this we have a dataset or user input of some constraint that we will use to detect the diabetes i.e. blood pressure level , insulin level. etc . In my data set I have taken 8 constraints which include diabetes function , age , pregnancy etc.

I have worked on it making a system of 2 hidden layers and they will train my data using back propagation technique which gives a pretty good result of detection of diabetes.

In my neural network build I have used sigmoid function as an activation function.

I built a total of 4801 parameters and I have binary cross entropy for losses and adam optimizer and I have running this up to 500 epochs for getting better accuracy.

## Applying Fuzzy concepts

Since fuzzy logic is a mathematical model, its concepts are implemented by preparing the fuzzy set, fuzzy expert system and defining decision rules. The concepts are briefed below.

### Fuzzy set

We need to define fuzzy sets for the prediction of diabetes. Fuzzy sets are helpful in describing input parameters. Attributes such as age, gender, background information about the family, having medicines for high blood pressure, found to have high blood glucose during illness, smoking or using tobacco products, , gestational diabetes, frequent intake of nonvegetarian food, and itching all over the body are made into a single set which are then fed as input to the system.

The fuzzy set for the proposed system is given as follows:

$D = \{ \text{Age, insulin level, Having medicines for high blood pressure, Found to have high blood glucose during illness, body mass index, Gestational diabetes, Frequent intake of non-vegetarian food, Itching all over the body} \}$ .

For this purpose each input parameter is given a value based on the comparison between a patient who is diagnosed with diabetes and one who is normal. The values have been assigned within a range based on the information provided for each input parameter. On successful completion of this process the analyzed parameters are then normalized.

### Fuzzy expert system

For the operation of a normal fuzzy expert system values are assigned to each attribute of the given input parameter. For example age has low chances for less than 35 years, intermediate

for 35 to 45 and high chances for greater than 45 and for gender, Similarly all the other input parameters have been assigned their respective points. The trained data set for few attributes such as age, gender are mentioned below.

## Define Decision rule

In order to define the decision rules we need to normalize the attribute values. For this purpose the decision parameters are divided into 3 fuzzy set. Fuzzy sets are “low”, “intermediate” and “high”.

age ['low'] -> if age < 35

age ['mid'] -> if 35 < age < 45

age ['high'] -> if age > 45

bmi ['low'] -> if bmi < 25

bmi ['mid'] -> if 25 < bmi < 40

bmi ['high'] -> if bmi > 40.

Similarly the attribute fuzzy membership expressions for the other parameters are derived. Some rules for the developing system are as follows

Rule 1: If low (age, high blood glucose level, ) then low (Diabetes).

Rule 2: if high(insulin,bmi) then high (Diabetes )

Rule 3: if low (age, bmi) and high (blood glucose) then intermediate (Diabetes )

## Comparison of two approaches

There is a lot of difference between fuzzy logic and neural network approach fuzzy logic is simply a better approach in terms of getting our output of detection of diabetes.

The main drawback of neural network is that it will give us only binary approach while Fuzzy approach gives us wide options of getting exact report of that person

In fuzzy we get a crisp data than we convert into fuzzy data .

i.e In neural network it will tell us whether the student is passed or not

whereas in fuzzy logic it will tell us that whether the student is failed ,passed,average ,above average as well as intelligent .

From this example it is understandable that how fuzzy logic is developed form of neural networks