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A FUZZY LOGIC BASED CLASSIFICATION TECHNIQUE FOR CLINICAL DATASETS

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Abstract: *Data mining plays a vivacious role over the decision making condition under clinical data since huge volume of data are obtained day today form the medical field it becomes challenging to classify the data for each disease under certain criteria for the healthcare professionals. Ontology consists of hierarchical description of important classes in a particular domain; along with the description of the properties of each concept. In this paper a fuzzy ontology and fuzzy expert system consisting of fuzzification interface, fuzzy assessment K ratio algorithm and defuzzification interface are used. Using fuzzy ontology the data is solved effectively and handles knowledge with uncertainty and it includes fuzzy inference engine, fuzzy rule base for efficient classification of diabetes. The crisp data are converted into fuzzified data using fuzzification interface and defuzzification interface is used to convert the fuzzified value into crisp value. The fuzzy assessment K ratio is constructed using K ratio, correlation fuzzy logic and fact values to handle the uncertainty of rules. The K ratio technique is mainly used to overcome the overlapping of membership function by identifying the fuzzy mid value and fuzzy start value. The proficiency of the algorithm is carried out using the MATLAB Fuzzy logic toolbox to diagnosis diabetes.*

Keywords: *Fuzzy expert system, Fuzzy ontology, Fuzzy assessment k-ratio, Healthcare, Uncertainty of rules.*

INTRODUCTION

In the field of medicine the main problems are handling the vague data, uncertainty and extra knowledge is required to extract the massive volume of data. The proposed fuzzy expert system and fuzzy ontology mechanism pays ways for the healthcare professional for effective decision making under the classification of diabetes disease. Diabetes is a disease where the body does not produce insulin or use insulin properly. Ontology is a computational model and collection of key concepts and their inter-relations provides abstract view of an application domain [5].Diabetes is a common disease that affects 2%-6% of the population. The prevalence of diabetes is expected to double for next few decades [3]. Ontology based fuzzy inference system where the agent carries out the fuzzy inference

engine to infer the possibility of people suffering from diabetes. Pima Indian diabetes dataset is used to further classify the disease among the Pima Indians [4]. Fuzzy logic principles and ontology techniques to build up ontology based intelligent fuzzy agent to apply under the semantic decision making domain.FML parser analyses the definition and translates into desired file format [6].The GRNN is used for estimation of continuous variables, as in standard regression techniques. It is related to the radial basis function network and is based on a standard statistical technique called kernel regression [7]. Kalpana et al [2] proposed the S Fuzzy Assessment Methodology (SFAM) finds the similarity between the fuzzy set, fuzzy number and fuzzy rule and methods proposed compares the three fuzzy set at the time further the sets are reduced. The diabetes fuzzy assessment methodology using K ratio is developed the overlapping between the membership function is identified using the parameters of fuzzy mid value and fuzzy start value. Fact values are calculated using the measure of credulity an in credulity [1].

Back Propagation Network (BPN) with LM training algorithm for the prediction and classification of diabetes on Pima Indian Dataset repository. Other network type will be compared with the LM algorithm to answers the prediction accuracy on diabetes dataset [8].

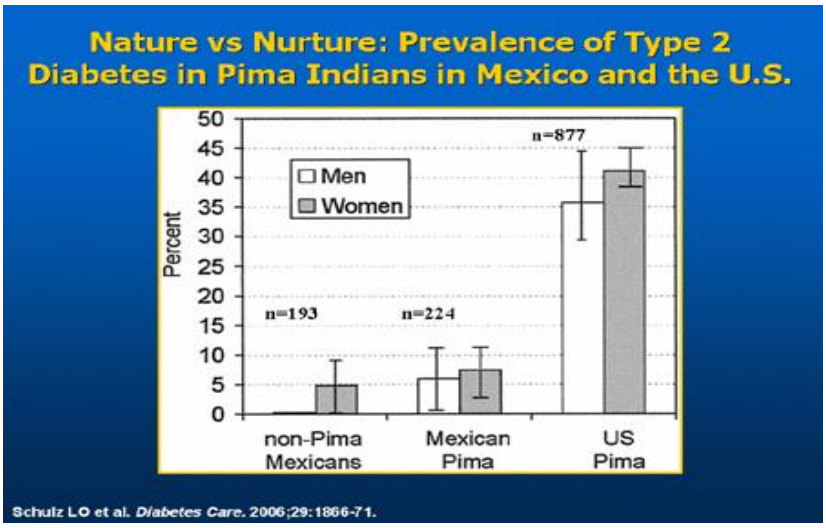


Figure 1: classification of Pima Indian diabetes in Mexico and US

EXISTING AND PROPOSED SYSTEM

a. Existing System

In the system [1] they use Fuzzy Assessment Methodology using K ratio for Pima Indian Diabetes database it includes three main phases the fuzzification interface, Fuzzy

Assessment Methodology using K ratio, defuzzification interface. The Fuzzification interface is mainly used to convert the crisp values into fuzzified values and using K ratio algorithm the overlapping of membership function is identified by using Fuzzy Mid value and Fuzzy Start value. The paper [3] proposes the usage of Fuzzy Logic principles and Ontology based Intelligent Fuzzy agent for classifying the diabetes disease. The agent carries out the fuzzy inference engine to infer the possibility of suffering from diabetes and finally the agent classifies the dataset into positive or negative diabetes based on the inference result. The result is stored in the diabetes database repository it works effectively for diabetes classification.

b. Proposed System

In the proposed the Fuzzy Assessment Methodology using K ratio and the Ontology based Intelligent Fuzzy agent are used for obtaining the higher accuracy in classifying the diabetes disease. Using the K ratio algorithm and correlation fuzzy logic idea to identify the overlap between the fuzzy number and membership function. The fact values are primarily used to handle the uncertainty in rules. K ratio executes rules to make a decision on individual's suffering from diabetes and to present the knowledge with descriptions. Ontologies is independent of the web ontologies play a special role in the architecture of the semantic web, fuzzy ontology can effectively help to handle and process uncertain data and knowledge. The diabetes database is classified in hierarchy manner as Type 1 and Type 2 diabetes based on the attributes, here the Pima Indian Diabetes dataset is taken from UCI repository

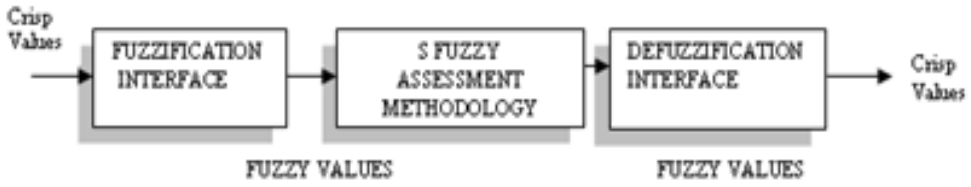


Figure 2: process of handling the fuzzy values

The crisp values are provided as input for Fuzzification interface then by using the K ratio algorithm the overlap is identified to improve the efficiency. S Fuzzy Assessment methodology builds the triangular membership function are used for each input variable and S fuzzy assessment method uses K ratio to identify the similarity between the fuzzy set, fuzzy number, fuzzy rule etc.

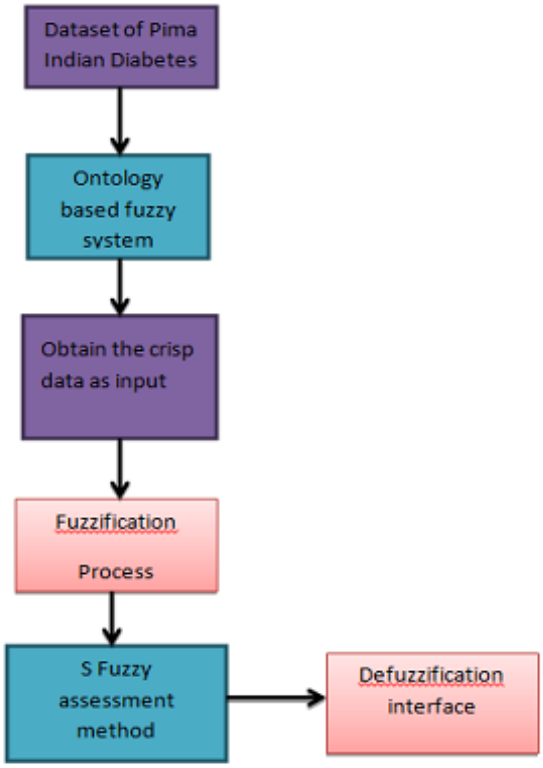
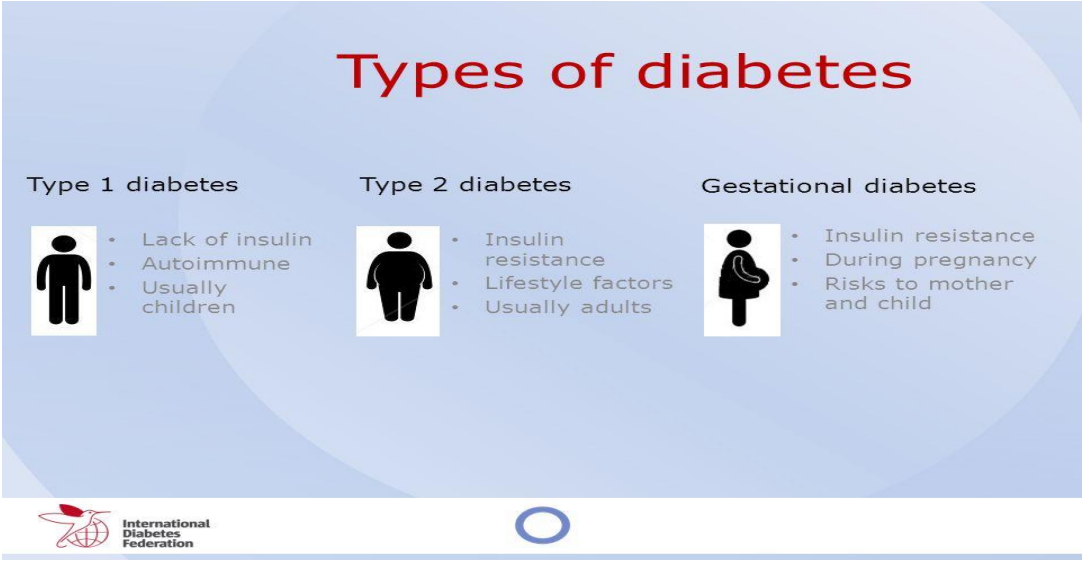


Figure 3: process of ontology and fuzzy assessment

In this above specified diagram 1 the process carried out using the fuzzy ontology and furthers the S Fuzzy Assessment method .These two mechanisms are proposed to improve the output result of diagnosis effective for the Healthcare Professional under decision making.

METHODOLOGY

Here we use fuzzy ontology and S fuzzy Assessment methodology for classification of Diabetes type in a hierarchy manner using fuzzy ontology. Fuzzy ontology can effectively help to handle and process uncertain data and knowledge. Study combines the domain knowledge of the ontology, agent and medicine with diabetes to propose ontology based fuzzy inference agent, including fuzzy rule base and fuzzy inference engine, for diabetes classification. Based on the classified data the S Fuzzy assessment methodology is applied to identify the overlap between the membership function and also to measure the similarity between the fuzzy set, fuzzy rule and fuzzy number. The main advantage of using the fuzzy ontology to reduce the complexity by defining the diabetes type in hierarchy manner.



FUZZIFICATION INTERFACE

The crisp inputs are transformed into fuzzy values or fuzzier set and fuzzy values are taken as input for Fuzzy assessment methodology K ratio .Membership function adopted is triangular function with the parameter set [a, b, c] as shown in eqn. (1). The parameter is fixed with Minimum value, Mean, Standard Deviation, Maximum value for each variable

$$\mu(x) = \begin{cases} 0, x \leq a \\ \frac{x-a}{b-a}, a < x \leq b \\ \frac{c-x}{c-b}, b < x < c \\ 0, x > c \end{cases}$$

Proposed Algorithm: Fuzzy Assessment Methodology using K Ratio (FAMK)

BEGIN

1. Input: Terms (D1, D2, D3, D4, and D5) are selected as fuzzy input variables
2. Output: Output term O as fuzzy output variables
3. Input PIDD with N cases
4. Initializei ←1

Method

Step 1: Create input fuzzy set D1(d11,d12,d13), D2(d21,d22,d23), D3(d31,d32,d33), D4(d41,d42,d43), D5(d51,d52,d53) and output fuzzy set O(O1, O2, O3, O4, O5)

Step 2: Calculate the value of min, max mean and standard deviation DO UNTIL (i > N) Di [min, max, mean-SD, mean+SD] using triangular membership function. END DO UNTIL

Step 3: Compute correlation coefficient ρ

Step 4: Calculate K ratio

$$K = \frac{P1 + P2}{LM - UM}$$

If (K ≥1) then

LMK =0.5 points are moved after LM

UMK=0.5 points are moved before UM

Else

LM and UM

Step 5: DO UNTIL (i > N)

If (D1i is d11) or (D2i is d21) or (D3i is d31) or (D4i is d41) or (D5i is d51) thenOi is O3 (FV)

END IF

END DO UNTIL

Step 6: Antecedent part (D1i is d11) or (D2i is d21) or (D3i is d31) or (D4i is d41) or (D5i is d51) into consequent (O is O3) by MIN operator

Step 7: Set rules output ——SUM OPERATOR——→{outputterm O} END

Attribute number	Mean	Standard Deviation
1.	3.8	3.4
2.	120.9	32.0
3.	69.1	19.4
4.	20.5	16.0
5.	79.8	115.2
6.	32.0	7.9
7.	0.5	0.3
8.	33.2	11.8

EXPERIMENTAL RESULTS

MATLAB fuzzy logic toolbox is used to appraise the performance of the proposed fuzzy expert system. From Pima Indian diabetes dataset knowledgecan be examined with the proposedFuzzy Assessment Methodologyusing K ratio and Fuzzy Ontology used to obtain

active diagnosis results. The acquiredresult are transferredinto knowledgeand presented in the human comprehensible form.

Table 1. Comparison of accuracy of proposed method with earlier methods

Method	Accuracy (%)	Author
Our study for Very Very Young (AGE:0-25)	83.08	M. Kalpana and Dr. A. V. Senthil Kumar
Logdisc	77.7	Statlog
IncNet	77.6	Norbert Jankowski
DIPOL 92	77.6	Statlog
A FES for Diabetes Decision very very young [12]	77.3	Lee and Wang
SMART	76.8	Statlog
ASI	76.6	Ster and Dobnikar

CONCLUSION

This study proposes ontology based fuzzy inference agent and Fuzzy Assessment methodology using K ratio is very effective to diagnosis the diabetes. Ontology-based intelligent fuzzy agent is proposed to represent the medical concepts and fuzzy relationships using the taxonomical knowledge and infer the possibility of suffering from diabetes of each instance followed by K ratio evaluates the number of membership function, K ratio and correlation fuzzy logic to identify are a overlap between fuzzy number and membership and fact value to manage uncertainty in rules. The Fuzzy Assessment Methodology using K ratio then executes rules to make a decision on individual's suffering from diabetes and to present the knowledge with descriptions. Future work should test other similar task or diabetes related dataset to evaluate its capability to produce the similar accuracy and some genetic algorithm can also be included to improve the performance and enables effective decision making for the healthcare professionals.

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