A NOVEL APPROACH TO DIAGNOSIS OF DIABETES WITH PREVALENT FACTOR CONCENTRATION

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Abstract - Present day medical diagnosis requires various kinds of factors understanding and x-ray analysis which can be considered as base to give the final diagnoses. Whenever a diagnosis is given, different factors has to be deeply understood and be compared depending on different situations and factor combinations to place the final verdict. Due to the different levels of concentrations or strengths of the various factor, there is a probability of getting best as well as worst combinations. The factors need to be analysed with their concentration values according to different case, and is one of the most tedious task. In this paper, fuzzy set theory is incorporated to handle uncertainties. The fuzzy logic provides a mathematical framework for representation and processing of expert knowledge. The concept of if-then rules plays a role in approximation of the variables like cross over point. The proposed technique is able to improve the decision-making power of the diagnosis prediction. This algorithm converts various factors to fuzzy data and fuzzy data into de-fuzzification.

Index Terms – Fuzzy inference system (FIS), Insulin-dependent diabetes mellitus (IDDM), Non-insulin-dependent diabetes mellitus (NIDDM), Interval Type-2 Neuro-Fuzzy Inference System (IT2FIS), Quality of Service (QoS)

I. INTRODUCTION

Whenever some diagnosis is made, the variation in the strengths of various factors lead to changes in the identification of the disease. Fuzzy processing is the collection of all approaches that understand, represent and process the input factors, their segments and features as fuzzy sets. The representation and processing depend on the selected fuzzy technique and on the problem to be solved. The idea of fuzzy sets is simple and natural. For instance, we want to define a set of grey levels that share the property dark. In classical set theory, we have to determine a threshold, say the level 100. All grey levels between 0 and 100 are element of this set; the others do not belong to the set.But the darkness is a matter of degree.So, a fuzzy set can model this property much better. The basis for fuzzy logic is the basis for human communication. This observation finds many of the other statements about fuzzy logic. Because fuzzy logic is built on the structures of qualitative description used in everyday language, fuzzy logic is easy to use. A filtering system needs to be capable of reasoning with vague and uncertain information; this suggests the use of fuzzy logic [1].

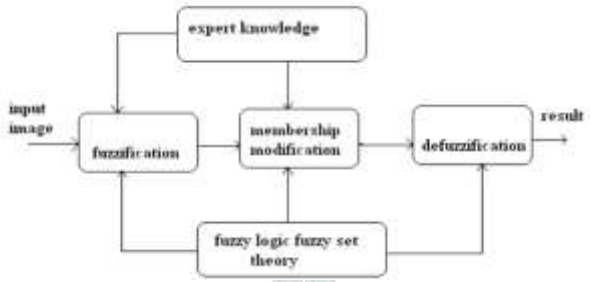

Fig.1. Fuzzy Inference System [3]

Fuzzy Inference System

Fuzzy inference is the process of formulating the mapping from a given input to an output using fuzzy logic. The mapping then provides a basis from which decisions can be made, or patterns discerned. The process of fuzzy inference involves all of the pieces that are:

1) Membership Functions
2) Logical Operations
3) If-Then Rules.

There are two types of fuzzy inference systems that can be implemented in Fuzzy Logic Toolbox: Mamdani- type and Sugeno-type. These two types of inference systems vary somewhat in the way outputs are determined.

Fuzzy inference systems have been successfully applied in fields such as automatic control, data classification, decision analysis, expert systems, and computer vision. Because of its multidisciplinary nature, fuzzy inference systems are associated with a number of names, such as fuzzy-rule-based systems, fuzzy expert systems, fuzzy modeling, fuzzy associative memory, and fuzzy logic controllers, and simply (and ambiguously) fuzzy systems.

Mamdani's fuzzy inference method is the most commonly seen fuzzy methodology. Mamdani's method was among the first control systems built using fuzzy set theory. It was proposed in 1975 by Ebrahim Mamdani [7] as an attempt to control a steam engine and boiler combination by synthesizing a set of linguistic control rules obtained from experienced human operators. Mamdani's effort was based on Lotfi Sade's 1973 paper on fuzzy algorithms or complex systems and decision processes [8]. Although the inference process described in the next few sections differs somewhat from the methods described in the original paper, the basic idea is much the same.

Mamdani-type inference, as defined for fuzzy logic toolbox, expects the output membership functions to be fuzzy sets. After the aggregation process, there is a fuzzy set for each output variable that needs defuzzification. It is possible, and in many cases, much more efficient, to use a single spike as the output membership functions rather than a distributed fuzzy set. This type of output is sometimes known

as a singleton output membership function, and it can be thought of as a pre-defuzzified fuzzy set. It enhances the efficiency of the defuzzification process because it greatly simplifies the computation required by the more general Mamdani method, which finds the centroid of a two- dimensional function. Rather than integrating across the two-dimensional function to find the centroid, you use the weighted average of a few data points. Sugeno-type systems support this type of model. In general, Sugeno-type systems can be used to model any inference system in which the output membership functions are either linear or constant.

II. LITRETURE SURVEY

Chandgude, Nilam, Suvarna Pawar et al. Diabetes is worldwide problem. It is rapidly increase disease in the world. Diabetes, referred as diabetes mellitus it is organic process in which the person has increase blood glucose (blood sugar), either because insulin origination is deficient, or body's cells do not behave properly to insulin which is produce. Early investigate of diabetes is an important objection. Existing system had so many drawbacks. In previous system are many classification techniques or methodologies for diagnosis of diabetes like Neural Network, Naïve Bayes, and Support vector machine. But performance is idle of existing system. In early stage, existing methodologies do not diagnosis diabetes. In this paper, we are proposing a quicker and more valuable technique to diagnosis of diabetes using distinct classification technique and Fuzzy Inference System.

Chen, Po-Chen, and Mladen Kezunovic. et al Weather impacts are one of the main causes of distribution outages. To devise strategies to mitigate weather impacts, a fuzzy logic system for decision making is introduced. It allows utility operators to achieve more precise outage predictions and optimize real time operation and maintenance scheduling. A novel approach for weather-driven risk framework is applied to process the data and produce risk maps for better decision making. The use of weather data in reducing FL time, an important performance improvement in outage management, is also presented.

Das, A. K., Anh, N., Suresh, S., et al. A Meta-Cognitive Interval Type-2 Neuro-Fuzzy Inference System (McIT2FIS) based classier and its projection based learning algorithm is presented in this paper. McIT2FIS consists of two components, namely, a cognitive component and a meta-cognitive component. The cognitive component is an Interval Type-2 Neuro-Fuzzy Inference System (IT2FIS) represented as a six-layered adaptive network realizing Takagi-Sugeno-Kang type inference mechanism. A self-regulatory learning mechanism forms the meta-cognitive component. IT2FIS begins with zero rules, and rules are added and up- dated depending on the prediction error and relative knowledge contained the current sample. As each sample is presented to the network, the meta-cognitive component monitors the hinge-loss error and class-specific spherical potential of the current sample to decide what-to-learn, when-to-learn and how-to-learn them, efficiently.

Fitzgerald, James T., Robert M. Anderson, and Wayne K. Davis This study focused on three questions: Is there a difference in men's and women's diabetes attitudes? Do health professionals give different recommendations to men and women? Is there a difference between men and women in care adherence? A total of 1201 patient with diabetes were surveyed; 65% of these patients were women. Differences in diabetes attitudes (three of seven attitudes) were most evident between men and women with insulin-dependent diabetes mellitus (IDDM). No differences were found in the attitudes of men and women with non-insulin-dependent diabetes mellitus (NIDDM) using insulin, and only one attitude was different for patients with NIDDM not using insulin. Gender differences in adherence to the components of self-care also were minimal.

Qu, C., & Buyya, R. et al. Cloud computing is a utility computing paradigm that allows users to flexibly acquire virtualized computing resources in a pay-as-you-go model. To realize the benefits of using cloud, users need to first select the suitable cloud services that can satisfy their applications' functional and non-functional requirements. However, this is a difficult task due to large number of available services, users' unclear requirements, and performance variations in cloud. In this paper, we propose a system that evaluates trust of clouds according to users' fuzzy Quality of Service (QoS) requirements and services' dynamic performances to facilitate service selection. We demonstrate the effectiveness and efficiency of our system through simulations and case studies.

III. PROPOSED WORK

In this proposed work, a total of 12 factors have been incorporated to make final diagnosis for diabetes. The 12 main factors are equally efficient for male as well as female which was not in the previous work. The factors implemented in my work are Gender, Nationality, PCO Syndrome, Life style, Blood Amylase and Years Since Menopause.

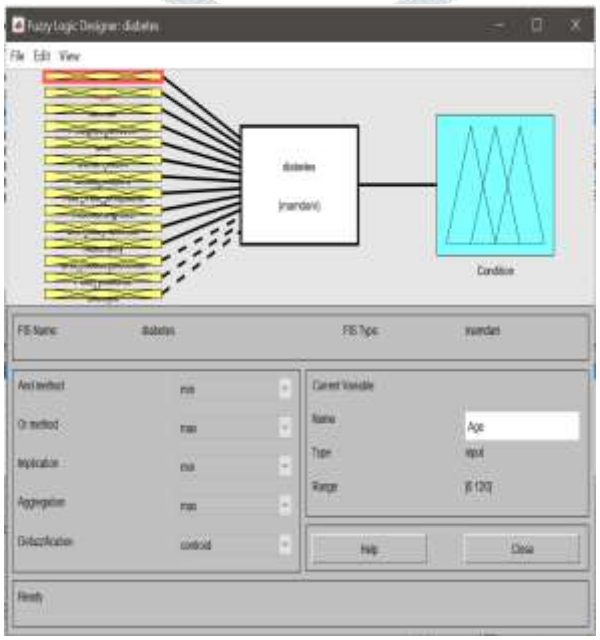

Fig.2. Input factor for Mamdani FIS

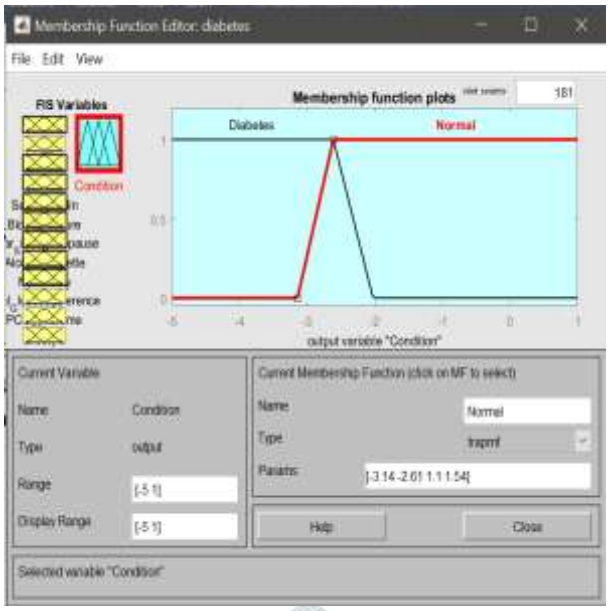

Fig.3. Output factor for Diabetic/Non-Diabetic results

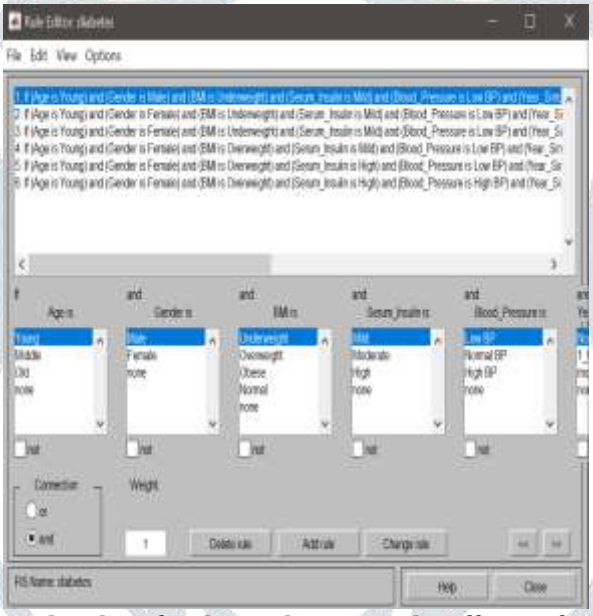

Fig.4 Rule Editor for the combination rules affecting factors.

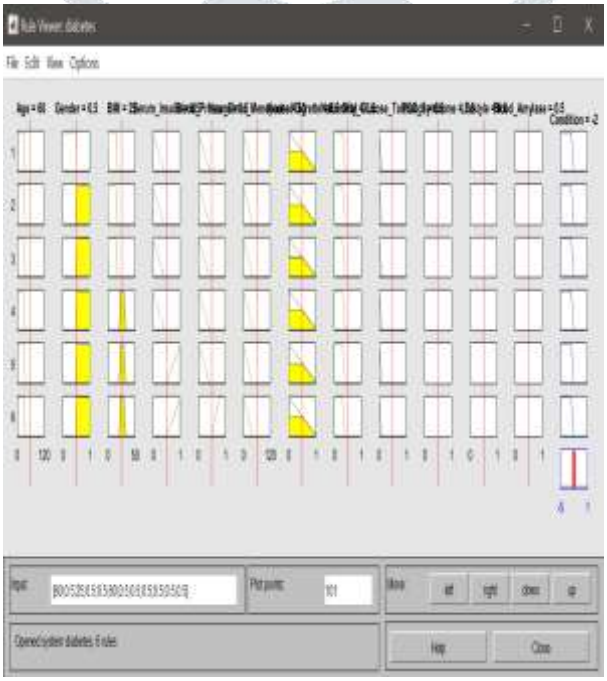

Fig.5. Rule Viewer for FIS

IV. RESULTS

Table.1 comparison of results

No. of records in Training Dataset	No. of Classes Generated	Average Records in each class	Testing Records	Correctly Predicted Records	Base Paper Precision	Proposed work Precision
150	2	75	10	7	0.7	0.797
200	3	67	15	12	0.8	0.877
250	4	63	25	21	0.84	0.896
300	5	60	40	34	0.85	0.888
350	6	59	60	52	0.87	0.897
400	5	80	80	74	0.93	0.987
500	7	72	90	86	0.96	0.964
600	7	86	120	112	0.95	0.993
650	10	65	140	134	0.96	0.995
750	12	63	160	155	0.97	0.983
800	12	67	178	172	0.97	0.985
850	14	61	190	185	0.97	0.996
900	16	56	200	197	0.98	0.989

V. CONCLUSION

This proposed work of mine is an expert system which has been successfully applied in fuzzy domain to diagnose Diabetes. The diagnosis is a two-step way where first part deals with selecting input variables and their intensity as per the case and in second part Fuzzy Inference System outputs the chances of a person being Diabetic. The expert system identifies the degree of disease with the help of carefully designed membership function and rules. The proposed diagnosis system contributes to the field of medical sciences for the diagnosis purpose. Fuzzy evaluation presents with aggregated results based on the input variable strength concentrations used for the Mamdani FIS evaluator. This efficient algorithm helps in precise and early detection of the Diabetes.

VI. FUTURE SCOPE

The future utilisation of this work can be a sub classification on the basis of regional factors affecting various other disease. Best feature of implementing it in a fuzzy domain is to get crisp and precise results. Human brain is capable of evaluating many factors but in case of more factors with different concentration levels, it becomes a tedious task. Fuzzy Inference System can help to work even under adverse condition as we know that machines like computer are not at all susceptible to such conditions or factor. The accuracy and preciseness cannot very. Further a more detailed version can be prepared which can read the values of laboratory results of blood, bone marrow, etc for more precise output.

REFERENCE

[1] Andonovski, Goran, et al. "Evolving fuzzy model based performance identification for production control." Evolving and Adaptive Intelligent Systems (EAIS), 2016 IEEE Conference on. IEEE, 2016.

[2] Ben-Haroush, A., Y. Yogev, and M. Hod. "Epidemiology of gestational diabetes mellitus and its association with Type 2 diabetes." Diabetic Medicine 21, no. 2 (2004): 103-113.

[3] Bui, Dieu Tien, et al. "Hybrid artificial intelligence approach based on neural fuzzy inference model and metaheuristic optimization for flood susceptibility modeling in a high-frequency tropical cyclone area using GIS." Journal of Hydrology 540 (2016): 317-330.

[4] Cakit, E., & Karwowski, W. (2015). Assessing the relationship between economic factors and adverse events in an active war theater using fuzzy inference system approach. International Journal of Machine Learning and Computing, 5(3), 252.

[5] Chandgude, Nilam, and Suvarna Pawar. "Diagnosis of diabetes using Fuzzy inference System." Computing Communication Control and automation (ICCUBEA), 2016 International Conference on. IEEE, 2016.

[6] Chaudhari, Swati, Manoj Patil, and Jalgaon Bambhori. "Study and review of fuzzy inference systems for decision making and control." American International Journal of Research in Science, Technology, Engineering &, Mathematics 5.1 (2014): 88-92.

[7] Chen, Po-Chen, and Mladen Kezunovic. "Fuzzy Logic Approach to Predictive Risk Analysis in Distribution Outage Management." IEEE Transactions on Smart Grid 7.6 (2016): 2827-2836.

[8] Das, A. K., Anh, N., Suresh, S., & Srikanth, N. (2016). An interval type-2 fuzzy inference system and its meta-cognitive learning algorithm. Evolving Systems, 7(2), 95-105.

[9] Elmazi, Donald, et al. "F3N: An Intelligent Fuzzy-Based Cluster Head Selection System for WSNs and Its Performance Evaluation." Mobile Computing and Wireless Networks: Concepts, Methodologies, Tools, and Applications. IGI Global, 2016. 1033-1048.

[10] Fitzgerald, James T., Robert M. Anderson, and Wayne K. Davis. "Gender differences in diabetes attitudes and adherence." The diabetes educator 21.6 (1995): 523-529.

[11] Gress, Todd W., F. Javier Nieto, Eyal Shahar, Marion R. Wofford, and Frederick L. Brancati. "Hypertension and antihypertensive therapy as risk factors for type 2 diabetes mellitus." New England Journal of Medicine 342, no. 13 (2000): 905-912.

[12] Gupta, Gunjan, Manish K. Srivastava, and S. Kumar. "Decision on the Selection of Tourist Hotels for an Hotelier Using the Concept of Fuzzy Inference System." (2016).

[13] Hashemi, Atiyeh, Abdol Hamid Pilevar, and Reza Rafeh. "Mass detection in lung CT images using region growing segmentation and decision making based on fuzzy inference system and artificial neural network." International Journal of Image, Graphics and Signal Processing 5.6 (2013): 16.

[14] James B. Meigs, Peter W. F. Wilson, Caroline S. Fox, Ramachandran S. Vasan, David M. Nathan, Lisa M. Sullivan, Ralph B. D'Agostino; Body Mass Index, Metabolic Syndrome, and Risk of Type 2 Diabetes or Cardiovascular Disease, The Journal of Clinical Endocrinology & Metabolism, Volume 91, Issue 8, 1 August 2006, Pages 2906–2912.

[15] Ley, Christopher J., Belinda Lees, and John C. Stevenson. "Sex-and menopause-associated changes in body-fat distribution." The American journal of clinical nutrition 55.5 (1992): 950-954.

[16] Liang, Sheng-Fu, Chih-En Kuo, Fu-Zen Shaw, Ying-Huang Chen, Chia-Hu Hsu, and Jyun-Yu Chen. "Combination of expert knowledge and a genetic fuzzy inference system for automatic sleep staging." IEEE Transactions on Biomedical Engineering 63, no. 10 (2016): 2108-2118.