RESEARCH ARTICLE   OPEN ACCESS

Clinical Decision Support System for Diabetes Disease Diagnosis

Piyush Mishra* D.B.V. Singh ** Nagendra Singh Rana ***, Shailendra Sengar****

*Research Scholar of ITM, Gwalior-474001, India
**Associate Professor, Dept. of EI, ITM, Gwalior-474001, India
***Assistant Professor, Dept. of EI, ITM, Gwalior-474001, India
**** Student, Dept. Of EI, ITM, Gwalior

ABSTRACT:
To improve decision making with uncertain symptom linguistic information / data and to reduce the time consumption in diagnosing the disease, various type of simulated diagnosis systems have been developed. Many of such diagnosis systems a designed to possess the clinical data and symptoms associated with a specific disease as knowledge base. While diagnosing the three main terms are most concerned such as Speed, cost and accuracy of diagnosis. The main purpose of DSS systems is to make rule and plan to manage basic symptom knowledge to face challenges in practice using data processing techniques and mathematical modelling tools. Modern most of the existing systems have been developed as an expert system that contains all the diagnosis tact as rules. The concept of a fuzzy set has shown better knowledge representation to improve the decision making process. So an we made attempt in this paper to design and develop such diagnosis system, using fuzzy logic Rule base The system developed is evaluated using a simple set of symptoms that is added to clinical data in determining diabetes
Keywords: Decision Support System, Clinical Decision support System, different methodise, Decision support system for diabetes

I. Introduction

Traditionally to diagnose diseases, a physician is usually based on the clinical history and physical examination of the patient, examining of medical images, as well as the results of laboratory tests. But, today computer science has changed our world and computers become a big part of our life. By the help of computer it is easy for us to analyze and diagnose the medical problems and diseases**.** Various attempt are made by researchers to make such system which can help medical problems. These systems are now widely used in clinics and hospitals . They are considered to be very useful for patient as well as for medical experts in making the decisions. Different methodologies are used for the development of those systems. The way of gathering the input data and to present output information's is different in different methodologies. Any computer program that helps experts in making clinical decision comes under the domain of clinical decision support system.

II. Related Works

Currently for medical planning, diagnosis and treatment, knowledge-based systems and intelligent computing systems are used. Mostly these system approaches involve models of either fuzzy logic, or artificial, or a genetic algorithm neural networks or

Sum of all these techniques with an appropriate reasoning mechanism Szlovits and Pauker say that medical decision making involves categorical reasoning and probabilistic reasoning that helps the system to realize expert-like behaviour. According to Pandey and Mishra these knowledge-based systems use reasoning techniques like Rule-Based Reasoning (RBR), Case-Based Reasoning (CBR) and Model-Based Reasoning (MBR) to provide significant performance in the area of diagnosis. Earlier, Go l o b a r d e s et al. [6] stated that CBR is one of the most popular prediction techniques in medical diagnosis as it is easy to apply and provide good explanation of the output. medical diagnosis became popular. Some of the remarkable applications included "A Fuzzy Expert System for Heart Disease Diagnosis" by A d e l i and N e s h a t. The system provided better results in about 94 % compared to that of an expert. Similarly, Baydaa S. Bhnam [4] also appreciates the effectiveness of fuzzy logic in the designed expert system that helped in decision making for diagnosing liver and pancreas diseases. Expert system. The method adopted a fuzzy based methodology for the diagnosis.Priti Sinivas, Sajja and Shah developed a prototype of knowledge-oriented decision support system for advisory, diagnosis and awareness in abdomen pain, Chung and Chen presented a

International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622
International Conference On Emerging Trends in Mechanical and Electrical Engineering
(ICETMEE- 13th-14th March 2014)

knowledge-based decision system using a rule base for healthcare

III. What Are Cdsss

This part briefly shortly describe some typical definitions of CDSSs and a general model of CDSSs which most researchers adopt in the literature of CDSSs

3.1 Definition of CDSSs & methodological branches

In the literature, many researchers have given their definitions of CDSSs. Some typical definitions are given below. Musen defined a CDSS as any piece of software that takes information about a clinical situation as inputs and that produces inferences as outputs that can assist practitioners in their decision making and that would be judged as "intelligent" by the program's users. Also many more researchers gave their various definition. In more recent studies, researchers have been trying to classify CDSSs in the literature so as to provide a holistic picture of CDSSs. Fig 2 denotes different methodise used in cdss
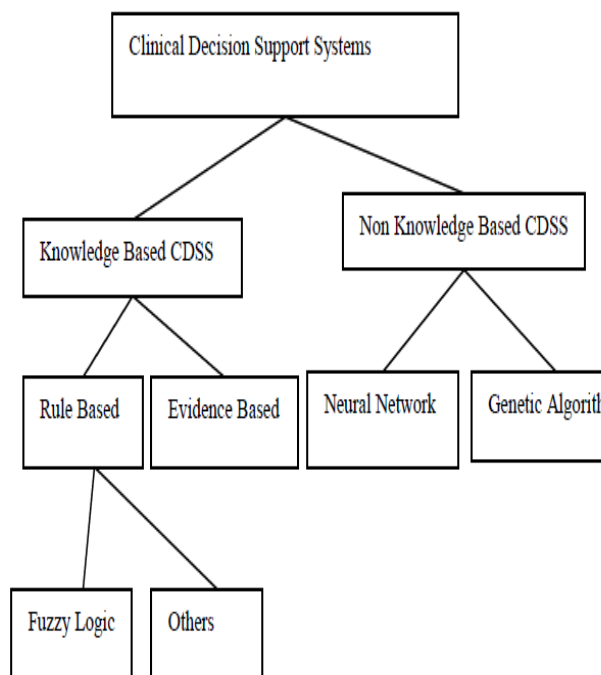

Fig .1. Representing different methodological branches of the Clinical Decision Support System

IV. Decision Support System For Diabetes

In this work we designed the decision support system for diagnosis of diabetes disease using fuzzy logic approach. In Fig-1 shows the block diagram of decision support system of diabetes disease diagnosis. As shown in figure symptoms are the input parameters for the system than the fuzzy logic method is applied to find out the disease on the basis of symptoms and the output of the system is divided into four parts.
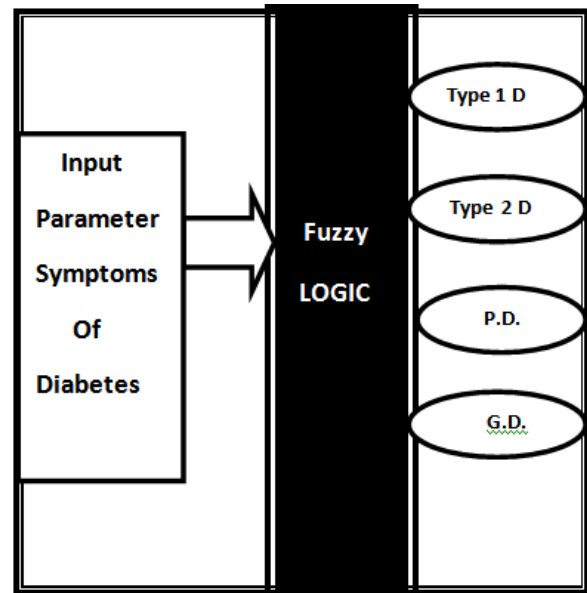

Fig.2.Block Diagram of decision support type System for Diabetes (D-Diabetes, PD-Prediabetes, GD-Gestational Diabetes)

4.1 Developed framework

A centralized knowledge base consisting of facts of diabetes in terms of symptoms is done. Four unsame modules process the data related to the disease diagnosis, such as patient data, pathological data, doctor's input and inference engine are designed to have interaction with this knowledge base.

4.2 Description of the system

As mentioned in the last section, the disease diagnosis system consist of:

- clinical signs, symptoms, laboratory test
- Doctor's data/ recommendation
- Knowledge Base
- Inference engine

A detailed illustration of the modules defined in the architecture, is given in Fig.3. A general model of CDSSs. which has been Discussed in the literature is shown as Figure -3.This figure shows four block as first one is clinical signs and symptoms and one for Inference mechanism and third block is for knowledge base and forth one is for diagnostic Recommendations
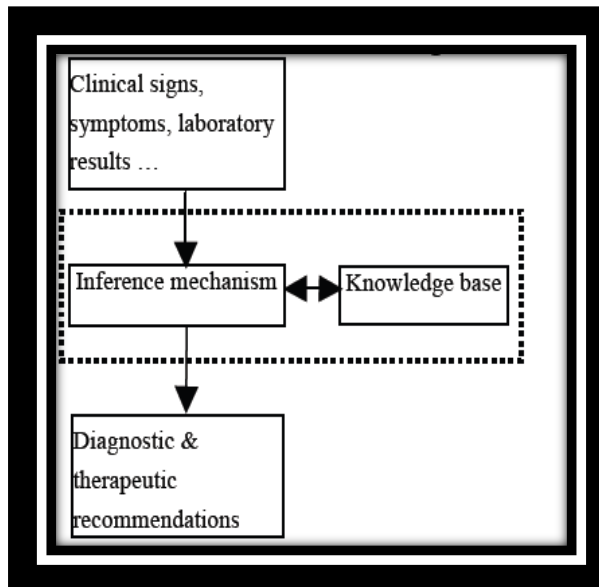
International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622
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Fig.3. Model of CDSS

As seen from Figure 3 there are inputs composed of clinical signs, symptoms, laboratory tests and so on to the system and outputs including diagnostic and therapeutic recommendations from the system. The system has two basic architectural components: a knowledge base and an inference (reasoning) mechanism. The knowledge base is a structured Collection of expert medical knowledge used by the CDSS. The inference mechanism is a set of computer algorithms used to process clinical signs, symptoms and laboratory test results in relation to the knowledge base. So this involves in various task

- What is the problem domain?
- What can be the solution?
- Amount of data available.
- Researcher choice and purpose.

4.3 Common symptoms of Diabetes and questions
The questionnaire includes listed below:
- Excess thirst
- Excess hunger
- Frequent urination
- Fruity breath odour
- Bedwetting
- Weight loss
- Being overweight
- Poor wound healing
- Weight fluctuation
- Frequent infections
- Blurred vision
- Irritability
- Increased fatigue
- Itchy skin

- Family history of pre diabetes
- Depression and stress
- Tingling sensations in fingers and feet
- Family history of diabetes during
- pregnancy
- Diabetes during previous pregnancy
- last pregnancy that resulted in a child
with birth weight of 9 pounds or

V.   Research Methodology
Methodology which is used to develop decision support system for Diabetes disease diagnosis can be explained as. Figure shows the process chart of the methodology of decision support system for diabetes disease diagnosis. Initially we gathered the information about diabetes disease with the help of doctors, books, internet, with the consultation pervious victims of disease. After collecting all the information related to disease we refined all the collected information we classify the symptoms of disease (diabetes). A thorough diagnostic evaluation may include a complete history of the following:
- When did the symptoms start?
- How long have the symptoms lasted?
- How severe are the symptoms?
- Have the symptoms before, and if
- So, were they treated and what treatment was received?

As we get the symptoms as input , fuzzification is done. And after the fuzzification of symptoms the rules are designed using If-Then rules. These if-then rules statements are used to formulate the conditional statements that consist fuzzy logic. A single fuzzy if-then rule consider the form: If x is 'A' then y is 'B'. After designing the rules the interface is done by using forward chaining method. This method involves checking the condition part of a rule to determine whether it is t false or true. If condition is true, then the action part of the rule is also true. This action continue until a result is found or we reach on a a dead end . Forward chaining is commonly consider to as data-driven reasoning. After interfacing rules the defuzzification of the output is done and system displays the result of analysis.
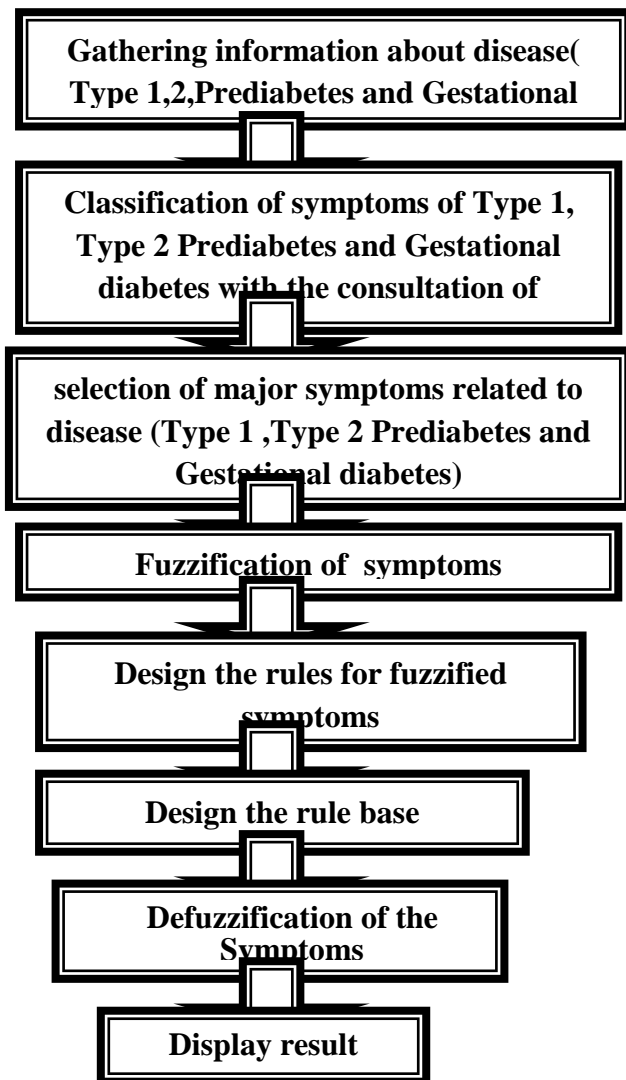
International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622
International Conference On Emerging Trends in Mechanical and Electrical Engineering
(ICETMEE- 13th-14th March 2014)

Gathering information about disease(Type 1,2,Prediabetes and Gestational

Classification of symptoms of Type 1, Type 2 Prediabetes and Gestational diabetes with the consultation of

selection of major symptoms related to disease (Type 1 ,Type 2 Prediabetes and Gestational diabetes)

Fuzzification of symptoms

Design the rules for fuzzified symptoms

Design the rule base

Defuzzification of the Symptoms

Display result

Fig.4. Process chart of methodology

5.1 For Type 1 diabetes the basic and major symptoms are as follows

- Excess thirst
- Frequent urination
- Excess hunger
- Weight loss
- Increased fatigue
- Fruity breath odor
- Bed wetting

5.2 For Type 2 diabetes the basic and major symptoms are as follows

- Frequent urination
- Excess hunger
- Over weight
- Weight fluctuation

- Blurred vision
- Increased fatigue
- Irritability
- Frequent infection
- Poor wound healing
- Excess thirst

5.3 For Pre diabetes the basic and major symptoms are as follows.

- Excess thirst
- Frequent urination
- Excess hunger
- Over weight
- Blurred vision
- Irritability
- Frequent infection
- Itchy skin
- Family history
- Depression & stress
- Tingling sensation

5.4 For Gestational the basic and major symptoms are as follows.

- Over weight
- History of family about diabetes during pregnancy
- Previous pregnancy
- Baby over to 9 pounds during last Pregnancy

5.5 DSSD Knowledge-Base

Knowledge is a key factor in the performance of intelligent systems. The knowledge-base of DSSD is composed of structured and concise representation of the knowledge of domain experts of tropical medicine. The structure knowledge is belongs to facts, rules and events of different type of diabetes , which were commonly agreed upon by experts in the field of medicine. The fuzzy rules for this research were developed with the assistance of domain experts (five medical doctors) who are experts in the field of internal medicine. The knowledge-base of DSSMD has fuzzy rule base for diabetes diagnosis. Some of the rules for various type of diabetes diagnosis can be interpreted as follows:
Some Sample rules created for the RBS are listed as:

- **IF** ((Excess thirst = true) and (Frequent urination = true) and (excess hunger = true)) **then** type1 **or** type2 **or** pre diabetes.
- **IF** ((Weight loss = true) and (Fruity breath odor = true) and (Bed wetting = true) **then** type1.
- **IF** ((Itchy skin = true) and (Family history = true) and (Depression & stress = true) and (Tingling sensation = true)) **then** pre diabetes.

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- **IF** ((Blurred vision = true)and (Irritability and Frequent infection = true)) **then** type2 **or** pre diabetes
- **IF** (Increased fatigue = true) **then** type2
- **IF** (Over weight = true) **then** type2 **or** pre diabetes **or** Gestational
- **IF** ((Weight fluctuation = true) and (Poor wound healing = true)) **then** type2
- **IF** ((Family history of diabetes during pregnancy= true) and (Previous pregnancy = true) and (Baby over 9 pounds during previous pregnancy = true)) **then** Gestational

5.6 DSSMD Inference Engine

The process of drawing conclusion from existing data is called inference. Fuzzy inference is the process of mapping from a given input to an output using the theory of fuzzy sets. The core of decision making output is process by the inference engine using the rules Contained in rule base. The fuzzy inference mechanism used in this research is the Mamdani Inference . The fuzzy inference engine utilize the rules in the knowledge-base and derives conclusion base on the rules. DSSMD inference engine uses a forward chaining mechanism to search the knowledge for the symptoms of various type of diabetes. Figure 4 shows the process chart methodology , that we used to design the decision support system for diabetes

VI. Conclusion

In this chapter, the fundamental theory of CDS systems was described together with different methodologies for implementing the clinical decision support system. The selection of a particular methodology also depends upon some external parameters such as the cost of system, efficiency required, and amount of data available and the sensitivity of the system. The primary goal of CDS systems development, as for any branch of biomedical research, is to improve the overall health of the people. CDS systems may give to this by enhancing the quality of healthcare services, and by control the cost-effectiveness of medical examinations and treatment. This decision support system is very useful to the physician as well as the user for diagnosis various type of diabetes disease just by giving the symptoms as input. Diabetes is world wide spread disease and very much similar in symptoms several of people died because of these disease due to not proper information and accurately identification of disease especially in rural areas where medical expert and pathological labs are not easily available this system will be really beneficial. Obviously, the development of CDS systems requires close collaboration of two scientific areas: medicine and computer science. This collaboration aims to codify knowledge and define the logical procedures used by the physician to reach a conclusion. As a result, the engineer must "extract" knowledge from the physician and reproduce it appropriately Due to the limitation of time, there are still few aspects of clinical decision support systems remain unstudied. In future, the knowledge from this paper can be reused as a thesis work or as a research topic itself

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