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Fuzzy Based High Blood Pressure Diagnosis

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Abstract
A methodology for the automated development of fuzzy expert systems is presented. The idea is to start with a crisp model described by crisp rules and then transform them into a set of fuzzy rules, thus creating a fuzzy model .Nowadays the use of computer technology in the fields of medicine area diagnosis, treatment of illnesses and patient pursuit has highly increased. Despite the fact that thesefields, in which the computers are used, have very high complexity and uncertainty and the use of intelligent systems such as fuzzy logic, artificial neural network and genetic algorithm have been developed . This research based thesis focused on the use of Computer Science and Engineering (CSE) to design a web-based fuzzy expert system for the management of hypertension(High Blood Pressure) using the fuzzy logic approach. In this thesis, systolic blood pressure, diastolic blood pressure, age, and body mass index (BMI) were taken as input parameters to the fuzzy expert system and "hypertension risk" was the output parameter. The resultant hypertension risk was based on fuzzy rules that were developed for the expert system. The input trapezoidal membership functions are normal, high, and very high for blood pressure. The output triangular membership functions are mild, moderate and severe. The expert system was designed based on clinical observations, medical diagnosis, and the experts' knowledge. The expert system provides a web-based interface that was designed using ASP as a scripting language with Microsoft Access as a database under Windows operating system platform, and using ASP.NET to archive the system design. . We selected the records of 500 patients with hypertension provided by Dr. Kaushal Kishore (MBBS,MS)-M.G.M. Hospital, Jamshedpur. and computed the results that were in the range of predefined limit by the domain experts.

Keywords
Fuzzy logic. High Blood Pressure diagnosis, expert system, diagnosis website, intelligent system, High Blood Pressure.

I. Introduction

The demand for intelligent and knowledge-based systems has increased as modern medical practices become more knowledge-intensive. The developed and the developing world currently face a series of health crises including hypertension management that threaten the lives of millions of people. There is a constant drive to improve the management of hypertension by the Health Care Delivery Sector.

The diagnosis of hypertension involves several levels of uncertainty and imprecision. The taskof hypertension diagnosis and management iscomplex because of the numerous variablesinvolved i.e. imprecision and uncertainties . Patients cannot describe exactly how they feel; doctors and nurses cannot tell exactly what they observe; and laboratories results are dotted with some errors caused either by the carelessness of technicians or malfunctioning of the instruments. Medical researchers cannot precisely characterize how diseases alter the normal functioning of the body (Szolvits, 1988). Hypertension can become so complex and unpredictable that physicians sometimes must make decisions based on intuition. All of thesecomplexities in medical practice make traditional quantitative approaches of analysis inappropriate. Fuzzy logic plays an important role in medicine. Fuzzy logic is a method that renders precise what is imprecise in the world of medicine using natural language. Fuzzy logic systems are excellent in handling ambiguous and imprecise information prevalent in medical diagnosis. Fuzzy set and fuzzy logic founded by (Zadeh, 1965) makes it possible to define inexact medical entities as fuzzy set.

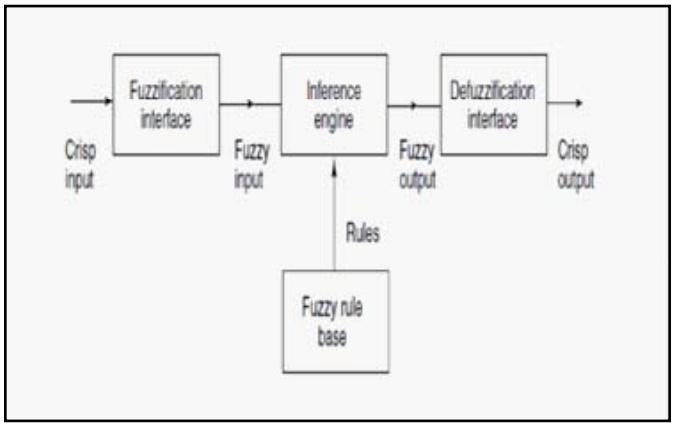
Hypertension (High Blood Presssure) is one of the known cardiac diseases believed to be the cause of the "sudden death"syndrome prevalent in Nigeria today (Ogah, 2006). Complications of hypertension could lead to stroke or heart failure (Hobbs and Boyles. 2004). Such complications may be caused by improper diagnosis and or improper management of the disease, due to inaccessibility of experienced medical personnel at all times. This necessitated the dire need for a tool that is readily available to render up-to-date medical information to the patient.

II. Definition Of Problem

Although measurement of Blood Pressure is easier, cheaper and available for people of any state or place. In India people does not consider is seriously. By measuring Blood pressure only its occurrence can be checked but the probability of being high blood pressure cannot be checked.it is a real world problem. This proposed system is a Diagnosis system capable to give the possibility of being High blood pressure patient. SBP (Systolic blood pressure) , DBP(Diastolic blood pressure),Age and BMI(Body mass index) are major factors which affects the blood pressure.

After the brief study of fuzzy expert system and blood pressure rules are generated through which Risk of high blood pressure can be calculated.

III. ASIC Architecture Of Fuzzy Expert System



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Implementation

Development of expert system

For developing an expert system at first the crisp sets are converted into fuzzy sets .Elements of crisp sets are real World object. Linguistic variables are declared. According to nature of elements membership function are given. Its result will generate rules for solving the problem. The rules are if. Then rule. Further the fuzzy output is defuzzified and gives the result to user.

These are major factors which affects the blood pressure

But these factors are directly related to it and contain some degree of membership for all .SBP(Systolic blood pressure),DBP(Diastolic blood pressure),Age,BMI(Body mass index).

Linguistic Variable And Membership Function Graph

For all factors these are the linguistic variable and membership function graph. These graphs are trapezoidal and also contain L type and R type.

Graphs are trapezoidal because the membership functions for some range are same

Linguistic Variable

Systolic blood pressure{mild ,moderate ,severe }

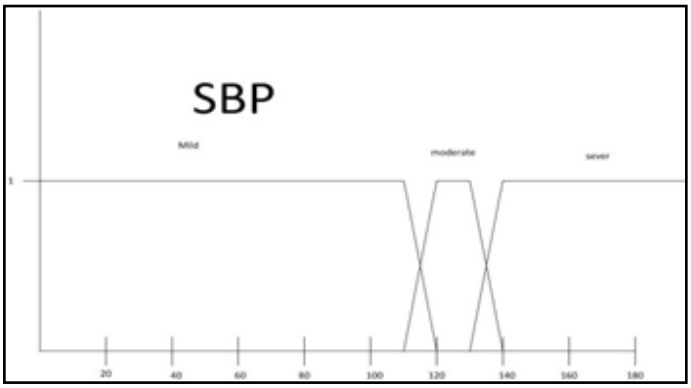
Diastolic blood pressure{mild ,moderate ,severe }

Age{Young, Middle-aged, Old, Very old}

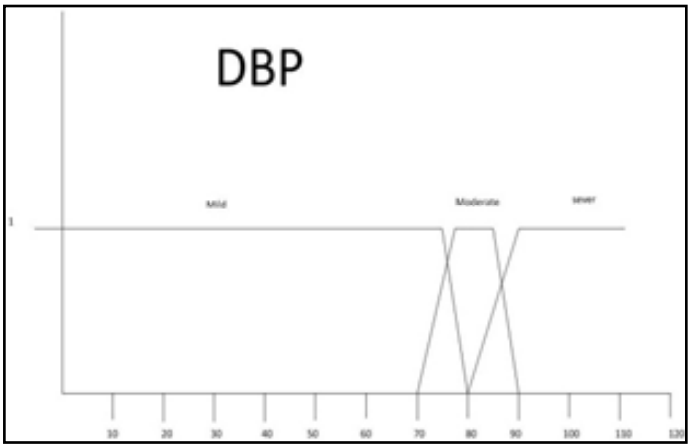
Body mass index{Low, Normal, High, Very high}

Membership Function Graph

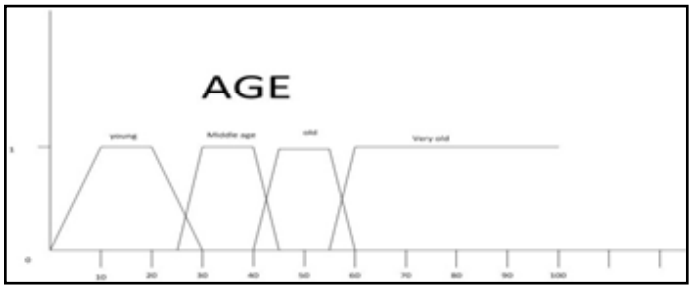
Systolic blood pressure



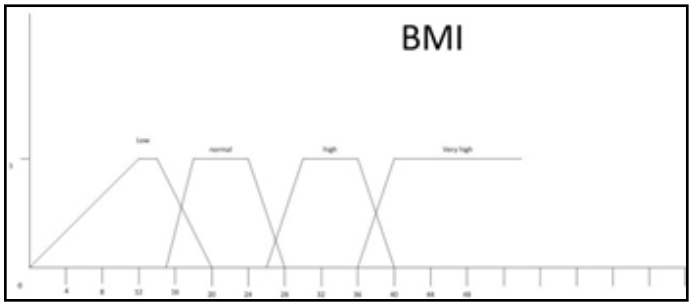
Diastolic blood pressure



Age



Body mass index



INFERENCE

IF….THEN RULE

As a result the High Blood Pressure or HBPR is calculated. For calculating HBPR these are the generated logic

IV. Implementation Rule

For severe

If SBP is severe AND DBP is severe THEN HBPR is severe

If SBP is moderate AND DBP is moderate AND Age is young AND BMI is (HIGH OR Very high)THEN HBPR is severe.

If SBP is severe AND DBP is severe THEN HBPR is severe

If SBP is moderate AND DBP is moderate AND Age is young AND BMI is (HIGH OR Very high)THEN HBPR is severe.

If SBP is (mild OR moderate) AND DBP is severe AND Age is young AND BMI is (HIGH OR Very high)THEN HBPR is severe.

For moderate

If SBP is mild AND DBP is moderate AND Age is (young OR middle-aged) AND BMI is (HIGH OR Very high)THEN HBPR is moderate.

If SBP is moderate AND DBP is mild AND Age is (young OR middle-aged) AND BMI is (HIGH OR Very high)THEN HBPR is moderate.

If SBP is mild AND DBP is severe AND Age is (middle-aged OR old OR very old) AND BMI is (low OR normal)THEN HBPR is moderate.

Else

HBPR is mild

Future Scope

This thesis is prepared by using Mamdani style of inference.It is possible that the same problem can be solved using other inference. Other factors which may include for designing the system.These factors may be Inheritance, Cholesterol.

CONCLUSIONIn today's busy world blood pressure is taken as usual problem and neglected. This site provides the risk of High blood pressure .Anybody can easily use this and prevent from high blood pressure risk

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