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# Adaptive Neuro Fuzzy Expert System for Disease Diagnosis

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**ABSTRACT**

This paper emphasizes on the power of neuro fuzzy system to propose a model for those people who cannot afford to consult the expert doctors owing to their high fees and unavailability in rural areas. This work has a promising future in the field of the Neural Network and Fuzzy Logic in designing of a complete model comprising of the analysis of a number of common diseases in India. Once globalized, this study will help to reduce the global burden of typical diseases.

***Keywords:*** e-Health Monitoring, medical advice, neuro-fuzzy, fuzzy concepts, SMS advisory system, cancer, knowledge based methodology.

## I. INTRODUCTION

Neural networks are very rich in decision making as well as in diagnostic power. Neural networks are useful in many tasks of our everyday life. Diagnosis of a problem is always a big issue in reference to find the solution. Similarly if a disease is diagnosed properly and perfectly, we can say that solution will become very easy. In case of human life, it is a big issue to discover the actual level or stage of any disease. The expertness, experience and the perception of the practitioner are the most effective factors to present the decision of the diagnosis. To follow a correct path of diagnosis is very typical and not easy without any mistake as the complexity increases [1].

To handle the uncertainties and vagueness, fuzzy logic presents powerful reasoning methods. The Fuzzy Expert Systems define inaccurate knowledge and furnishes linguistic concept with fantabulous approximation to medical texts [2][3].

The problem of health monitoring has been taken as it one of the daring conundrum in agrestic areas where populace many times do not get germane direction and are not financially sound to visit doctors in city [4].

In India almost 60% population lives in churl areas where the handiness of medical practitioner is either less or they are least expertise in diagnosis [5]. This leads to a huge number of deaths in rural due to lack of pertinent medical diagnosis followed by congruent treatment [5].

This work presents a model for diagnosing the stage of a disease by taking the different parameters affecting the person and by utilizing the decision and diagnostic power of neural networks. A practice has been made for formulating the parameters mathematically and such type of neuro fuzzy expert system based model has been proposed by which doctors as well as any general patient or guardian or least experienced doctors of rural can also be beneficial.

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The rest of the paper is organized as follows. Required constraints for the proposed model have been explained in section II. Proposed model has been presented section III. Discussion about the model is explained in section IV. Concluding remarks are given in section V.

## II. DECISIONS FOR A NEURO FUZZY MODEL

Human reasoning and decision making is fuzzy, involving a high degree of vagueness in evidence and concept utilization and requires a high level of uncertainty management in medical diagnosis [6].

Some of constraints are recommended according to the analysis for neuro fuzzy system to achieve the defined target as –

1. A perfect discussion with authorized doctors must be taken before initialization of the system [1].
2. Attention must be for a human.
3. Simplicity of the system must be there.
4. Human beneficial system must be there.
5. Minimized inputs must be taken and perfect matched output must be provided to the user.
6. An understandable system also must be for computer expert as well as non experts.

Design of adaptive neuro-fuzzy systems for the detection of cancer, tuberculosis, or of other disease, electrocardiographic changes in patients and more are the applications reported using neuro-fuzzy approach [7].

## III. PROPOSED MODEL

There are the multiple areas of technology by using which a neuro fuzzy system can serve public very easily among of which a proposed model for a SMS advisory system has been presented here.

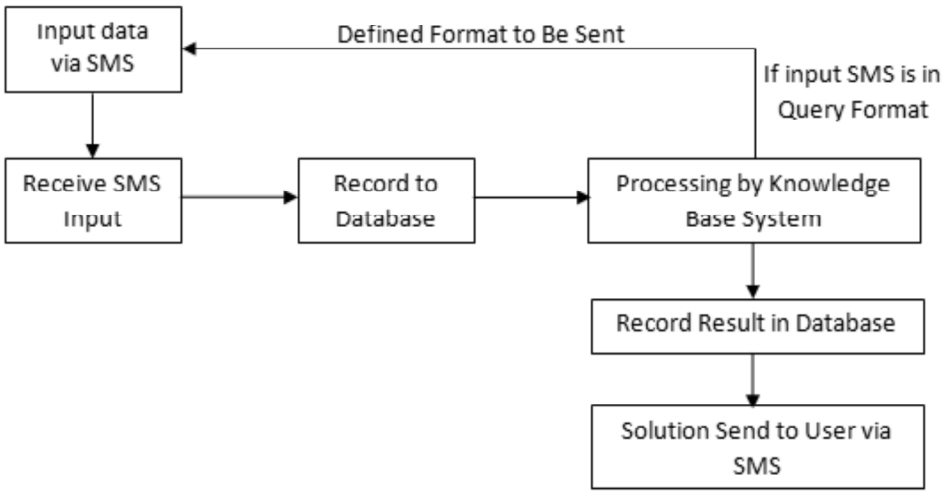


**Figure 1: Basic block diagram of SMS Advisory System**

As shown in the figure 1, total process will be completed in following steps-

**STEP 1:** A patient or user will send the SMS related to any problem to predefined mobile number or number provided by any SMS gateway.

Let take an example for Cancer. For example-

"Give solution of cancer",

"I am suffering with cancer, give the solution",

"I have the problem of cancer",

"Please provide cancer related solution",

.. so many.

Any statement which includes the keyword of disease as Cancer.

**STEP 2:** SMS will be taken by the defined gateway or by defined server.

**STEP 3:** With the proper details as mobile number and received SMS will be stored in database for defining as queue to be processed.

**STEP 4:** A defined knowledge based system will analyze the received SMS. It will work in if-else manner.

a) If the SMS will not be found in predefined format, a reply message will be sent to the same number. For example [8]-"Plz specify problem as: <name>, <age>, <lesionSize>, <nodesEffected>, <bodypartEffected:Y/N> Example: Shashank_Bhardwaj,33,1,4,Y"

b) If the SMS will be received in defined format as defined in replied back in part (a) than after being processed in neuro fuzzy rules based knowledge system, a result (for example, given below) will be stored in database.

Example of generated message by Knowledge based system-

"Dear Shashank_Bhardwaj, Your Cancer Stage is 4."

**STEP 5:** New queued message will be sent via SMS to the related mobile number.

## IV. DISCUSSION

On behalf of given and explained proposed model, it can be easily realized that integration of fuzzy logic and neural networks to facilitate e-health monitoring in remote rural areas to provide medical advice and assistance, is possible. Any system either SMS advisory or e-mail advisory or web interface [9] can be easily implemented. This work can also be encouraging in differential diagnosis, fuzzy relations, image analysis, text analysis, multi-valued logic, therapy etc [1]. SMS advisory part of the model is only the way how to get the input by the user and how to inform to user but this can also be brought into operation by using the concept of any web interface or by email or by any possible way.

## V. CONCLUSION

Many of the problems can be easily solved by using the power of adaptive methods of neuro-fuzzy systems. The computer based diagnostic tools and knowledgebase helps for fast and perfect diagnosis of diseases. We have shown how the neuro fuzzy base expert system can be built for providing the solution to any patient or doctor. In rural and tribal areas [9][10], where the economy crises and illiteracy forces people to take wrong decisions and advice regarding healthcare, this research work can prove very useful. Concept of suggested model is very easy to implement as well as to use. If a patient or a general user can get the consultancy only by forwarding a single SMS, it will be very well phenomena to examine the disease more effectively. Implementation of the model will also help a person to get out of the dark and dilemmas.

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