Review: Expert System for Diagnosis of Memory Low Diseases

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Abstract: The proposed system will initially discuss different approaches in designing of Medical Diagnosis Expert Systems with focus on all the information about the memory loss. The different symptoms and causes of memory loss at different age groups and the precautions for any kind of memory loss. It is an attempt to focus on some of very important diseases related to memory loss like Alzheimer's disease, Parkinson's disease, Huntington's disease, and multi-infarct which are among the most common types of memory loss diseases. The study, conducted on postmortem human brain cells and in mice, revealed that the hippocampus in the brain - a region that plays an important part in memory, lacks a protein called RbAp48 in those who experience age-related memory loss. The finding suggests that a deficiency of this protein is a cause of memory loss, but more importantly, the researchers say this form of memory loss is reversible. This proposed Expert System will help the patients to get the required advice about the different disorders attack to them due to their nervous system disorders. The expert rules were developed on the symptoms of each type of neurological disease, and they were presented using decision tree and inferred using backward-chaining method. The knowledge base consists of information about the memory loss and all the diseases related to it which is collected from books and doctors (domain experts) about neurology and its disorders.

Keywords: Alzheimer's disease, Parkinson's disease, Huntington's disease, dementia, MYCIN, Rule-based Expert System.

I. INTRODUCTION

Neurology is the branch of medicine that deals with the nervous system and disorders affecting it. Specifically, it deals with the diagnosis and treatment of all categories of disease involving the central, peripheral, and autonomic nervous systems, including their coverings, blood vessels, and all effector tissue, such as muscle. The whole process of treatment depends on correct diagnosis of a condition. Diagnosing a disease or lesion requires years of experience in medicine, especially when a patient is showing symptoms of rare conditions that physician may have never encountered before or has limited knowledge about it. Expert Systems are computer programs that are derived from a branch of computer science research called Artificial Intelligence (AI) by Durkin [Durkin, 1994]. Rule-based feature extraction has been widely used for many applications. With the processing and storage abilities of computers, it is very useful to develop an expert system, which can help physicians with their diagnosis. Expert systems can help physicians by informing them about unrecognized information needs of a diagnosis, standardizing diagnostic and treatment procedures and even as a training tool with detailed information about symptoms, conditions and diagnosis. Medical diagnosis expert systems have been an interesting topic for many researchers since introduction of MYCIN in 1970 decade.

The memory loss is not an inevitable part of the aging process it's important to distinguish between what's normal when it comes to memory loss and when you should be concerned. The first step to staying mentally sharp as you age is to understand the difference between normal forgetfulness that may be due to stress or other factors and serious memory problems.

Forgetfulness is a common complaint among older adults. You start to talk about a movie you saw recently when you realize you can't remember the title. You're giving directions to your house when you suddenly blank on a familiar street name. You find yourself standing in the middle of the kitchen wondering what you went in there for.

As we grow older, we experience physiological changes that can cause glitches in brain functions we've always taken for granted. It takes longer to learn and recall information. We're not as quick as we used to be. In fact, we often mistake this slowing of our mental processes for true memory loss. But in most cases, if we give ourselves time, the information will come to mind. Memory loss is not an inevitable part of aging process. The brain is capable of producing new brain cells at any age, so significant memory loss is not an inevitable result of aging. But just as it is with muscle strength, you have to use it or lose it. Your lifestyle, health habits, and daily activities have a huge impact on the health of your brain. Whatever your age, there are many ways you can improve your cognitive skills, prevent memory loss, and protect your grey matter.

Alzheimer's disease: Alzheimer's disease is a neurological disorder in which the death of brain cells causes memory loss and cognitive decline. A neurodegenerative type of dementia, the disease starts mild and gets progressively worse.

Parkinson's disease: Parkinson's disease is the second most common neurodegenerative disorder and the most common movement disorder. It is characterized by progressive loss of muscle control, which leads to trembling of the limbs and head while at rest, stiffness, slowness, and impaired balance. As symptoms worsen, it may become difficult to walk, talk, and complete simple tasks. Parkinson's disease (PD) also known as idiopathic or primary parkinsonism, hypokinetic rigid syndrome/HRS, or paralysis agitans is a degenerative disorder of the central nervous system.

Huntington's disease: Huntington's disease (HD) is a neurodegenerative genetic disorder that affects muscle coordination and leads to cognitive decline and psychiatric problems. It typically becomes noticeable in mid-adult life. HD is the most common genetic cause of abnormal involuntary writhing movements called chorea, which is why the disease used to be called Huntington's chorea.

II. Literature Review and Related Work

Medical diagnosis expert systems have been an interesting topic for many researchers since introduction of MYCIN in 1970 decade. The Fuzzy Expert System can also be used for disease diagnosis [Mir Anamul Hasan, and et all, 2010]. The Expert system have been used in psychiatric treatment [Goethe and Bronzino,1995], prostate cancer diagnosis [Batuello and Gamito,2001], lung disease diagnosis [Abe, K Ashizawa, and et all,2004], oncology [Anagnostou, et al.,2003] and even selecting surgical candidates [Remzi, Waldert and Djavan,2005], Maxillofacial diagnosis[Afshin Ameri and Hessam Moshtaghi], Diebetes diagnosis[Chang-Shing Lee and et al.,2011] [SMITHA V ,Mrs. Rohini. V, 2010] and there is some research on Neurological diseases [Ahmad A. Al-Hajji, et al., 2012]. This proposed system will have a short overview of each approach and discuss their weak and strong points. However their mandatory questions which are crucial for diagnosis, put limitations on their usage[R Begg, et all, 2006].

Bayesian Belief Networks have the ability to consider probabilities of certain symptoms of a disease and present their judgment by probabilistic calculations. These systems should be designed very carefully because they may underestimate importance of common features or overestimate importance of uncommon features [R Begg, et al., 2006]. Fuzzy Logic Expert Systems are based on fuzzy set theory. As the fuzzy set theory was developed to deal with uncertainty, it could be an appropriate choice for developing a medical expert system [L S Goggin, et al., 2007]. Their main disadvantage over adaptive algorithms is the fact that they require the complete input of patient information to function effectively [R Begg, et al., 2006]. Artificial Neural Networks which resemble a raw representation of human brain have shown great potential in diagnosing medical conditions [Anagnostou, et al., 2003]. These kinds of expert systems present good results for problems which cannot be formalized very well [Afshin Ameri and Hessam Moshtaghi]. The major problem in developing a medical decision support

neural network is its dependency on large number of training cases which are required to gain a good diagnostic ability [L S Goggin, et al., 2007]. This large number of training cases may not always be available.

Many of the researchers come to the conclusion that age is not only the reason for memory loss. Many of the people with the same age group either can have or cannot have memory loss diseases. Ten large studies have shown that the risk of Alzheimer's disease is sharply reduced when inflammation is controlled.

III. PROPOSED WORK AND OBJECTIVES

In this proposed work, Limitation of age group is the main reason for redesigning system. This proposed system will cover diseases for all age group as like for children, teenagers, middle age and above 50 age groups.

The constructed system exploited computer as an intelligent and deductive instrument. The developed system assists the diagnosis process by reminding the required theories and storing the cases of the patients. This proposed expert system is intended to be used as a consultation system by neurologists and researchers in order to reach a decision and for differential diagnosis of different types of neurological disorders cases. The main technical features of this system compared to other neurology diagnosis expert systems. The system will be evaluated using some training data.

Following were the main objectives of the proposed expert system:

-To develop an interactive rule- based expert system to help the neurology diagnosis process.

-To produce relevant data and information for consultations, and with the results obtained at this stage, produce possible diagnoses and suggest treatments.

-To review Artificial Intelligence literature in an expert systems and estimate the expert system model that fits in the domain of neurology.

-To assist Neurologists for various diseases associated with symptoms, i.e. to be a home assistant for doctors.

-To create a medical record for a patient's health history.

-To provide useful information that will help the doctor make some critical decision concerning a patient's health.

With the best level efforts, above one or more tasks may be tried to be implemented.

Rule-based Reasoning

The idea of rule-based systems is to represent domain expert's knowledge in a form called rules. In a typical rule-based expert system, a rule consists of several premises and a conclusion. If all the premises are true, then the conclusion is considered true. The components of a rule-based expert system include the knowledge base, inference engine, knowledge acquisition component, and explanation system as illustrated in figure below.
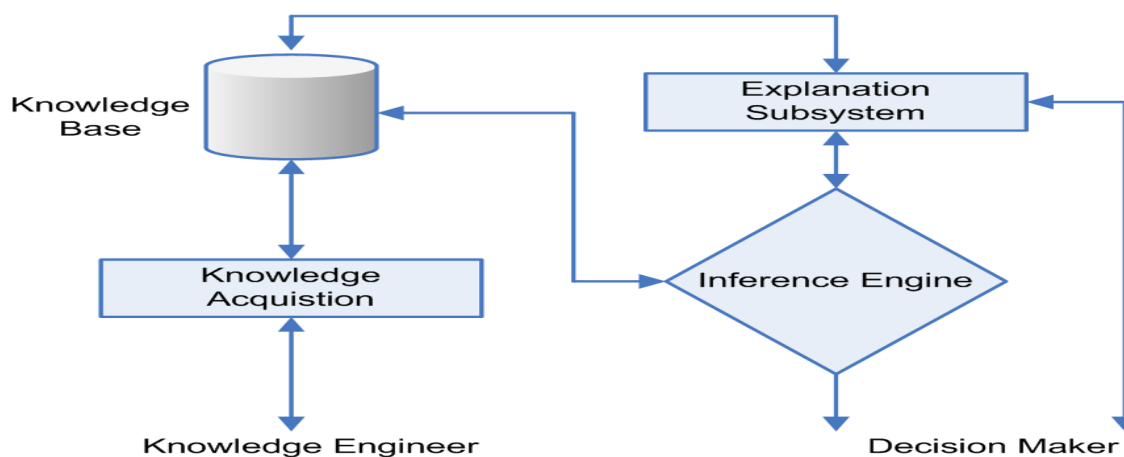

Fig1: Architecture of a Rule Based Expert System

In the figure1 above, knowledge base is a declarative representation of the expertise, often in IF THEN rules. Inference engine is the code at the core of the system, which derives recommendations from the knowledge base and problem-specific data in working storage. The knowledge acquisition component acquires new rules that can be added to the knowledge base by using the knowledge acquisition sub-system. The explanation sub-system is to explain its advice or recommendations, and even to justify why a certain action was recommended.

The main components of Expert System are as follows:

1) **Knowledge base:** The permanent knowledge of an expert system is stored in a knowledge base. It contains the information that the expert system uses to make decisions. This information presents expertise gained from top experts in the field. This knowledge comes in the form of facts and rules. Facts are minimal elements of the knowledge which must be identified before anything else. For example, fibroadenoma is a breast disease is a fact. Rules consist of if….then statements, where a given set of conditions will lead to a specified set of results.

2) **Inference Engine:** The inference engine is a computer program that controls the execution, and uses rules to respond to a query and determine whether a suitable match can be found in the fact list, through backward or forward chaining. It determines which rules will be applied to a given question and in what order by using information in the knowledge base.

   - Backward- and/or forward-chaining reasoning models are typically implemented in rule-based expert systems: Backward chaining is an approach that starts with a goal, e.g., Which HBD is it and works through a potential thesis until it reaches the fact that supports the thesis.

   - Forward-chaining inference engines are goal-oriented in the sense that they try to prove a goal or rule conclusion by confirming the truth of all the premises. These premises may themselves be conclusions of other rules. This method begins with a set of known facts or attributes values, and applies these values to rules that use them in their premise.

3) **Knowledge Acquisition**: Most expert systems continue to evolve over time. New rules can be added to the knowledge base by using the knowledge acquisition sub-system. Knowledge acquisition represents a bottleneck in the development of an expert system; it is a process of acquiring, organizing and studying knowledge for the diseases. The data and knowledge of system are collected from different sources. The first primary source is acquired from specialized databases, books and a few electronic websites. The second source is from a physician interviews, doctors (domain experts) about neurology and its disorders. This knowledge can be divided by important facts. After that, the knowledge engineer organizes the questions and answers on the form of a questionnaire that appropriate for inference and queries building.

IV. APPLICATION

The development and testing of computerized systems to assist in the diagnostic process is a time honored research activity in medical information science.

The Proposed system will enable a patient to find out the diseases, when no other help is possible.

Diagnosis expert system can help a great deal in identifying those diseases and describing methods of treatment to be carried out taking into account the user capability in order to deal and interact with expert system easily and clearly.

The proposed system will not only simplifies task of the doctors but also helps the patients by providing initial medicines for small diseases in emergency.

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