Review: Use of Expert System in Medical Science

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Abstract— Expert systems are a well-known area of Artificial Intelligence and have a huge impact in various fields of life. An expert system is a computer application that solves complicated problems that would otherwise require extensive human expertise. To do so, it simulates the human reasoning process by applying specific knowledge and interfaces. Expert systems also use human knowledge to solve problems that normally would require human intelligence. Expert system has played a good role in medical science and related areas. The paper presents a review on literature available for the use of expert system in the field of medical science with some of the examples.

Keywords: THEN, MRI

I.   INTRODUCTION

Expert systems (ES) are a branch of applied artificial intelligence (AI), and were developed by the AI community in the mid-1960s. An expert system is a computer program that is designed to hold the accumulated knowledge of one or more domain experts. The basic idea behind ES is simply that expertise, which is the vast body of task-specific knowledge, is transferred from a human to a computer. This knowledge is then stored in the computer and users call upon the computer for specific advice as needed. The computer can make inferences and arrive at a specific conclusion. Then like a human consultant, it gives advices and explains, if necessary, the logic behind the advice [1].

The end user provides input information by selecting one or many options from list or by entering data. Depending on that data, program check knowledge base, simulates data and takes decision [4].

STRUCTURE OF EXPERT SYSTEM [4]

The knowledge which is used by expert system for decision making must be organized in an easily accessible format that distinguishes among data, knowledge and rules. Structure of expert system consists of 3 levels or parts.

A. Knowledge base (Rule base)
[1] Consists of problem solving knowledge
[2] Rules are IF (condition) THEN (action) format

B. Working memory:
It refers to task specific data or that data of interest to the system for the problem under consideration.

C. Inference Engine:
It is a general problem solving control mechanism or method. It analyses and processes the rules, searches next portion of rule base and arrives at some solution or conclusion. These three parts together form expert system. The knowledge base may be a specific diagnostic. Knowledge compiled by a consulting firm and the problem data may be given by user. The knowledge base is the nucleus or heart of expert system. A knowledge base is not data base but it is rule in IF-THEN format created by knowledge engineers, who translate the knowledge of real human experts into rule and strategies. These rules and strategies can change; they depend upon the problem of domain. It constitutes the rules, facts or intuition that human expert might use in problem solving in particular domain. Inference engine organizes problem data and searches knowledge base for applicable rules.

II.   USES OF EXPERT SYSTEMS[6]
1. Experts are not always available. An expert system can be used anywhere, any time.
2. Human experts are not 100% reliable or consistent
3. Experts may not be good at explaining decisions
4. Cost effective
5. ES are often faster than human experts
6. Provide a high potential payoff or significantly reduced downside risk
7. Provide Multiple expertise

8. Provide expertise needed at a number of locations at the same time.

9. Provide expertise that is expensive or rare

10. ES are easy to develop and modify

III.   PROBLEMS WITH EXPERT SYSTEMS[6]

1. Limited domain

2. Systems are not always up to date, and don't learn

3. No "common sense"

4. Experts needed to setup and maintain system

5. Lack of trust

6. Possibility of error

IV.   EXPERT SYSTEM IN MEDICAL SCIENCE[2]

Machine learning systems can be used to develop the knowledge bases used by expert systems. Given a set of clinical cases that act as examples, a machine learning system can produce a systematic description of those clinical features that uniquely characterize the clinical conditions. This knowledge can be expressed in the form of simple rules, or often as a decision tree.

There are many different types of clinical task to which expert systems can be applied.

Diagnostic assistance: When a patient's case is complex, rare or the person making the diagnosis is simply inexperienced, an expert system can help come up with likely diagnoses based on patient data.

Therapy critiquing and planning: Systems can either look for inconsistencies, errors and omissions in an existing treatment plan, or can be used to formulate a treatment based upon a patient's specific condition and accepted treatment guidelines.

Image recognition and interpretation: Many medical images can now be automatically interpreted, from plane X-rays through to more complex images like angiograms, CT and MRI

Scans. This is of value in mass-screenings, for instance, when the system can flag potentially abnormal images for detailed human attention.

V.   THE STRUCTURE OF MEDICAL EXPERT SYSTEMS[3]

A medical expert system has the following components-

1) The Knowledge Base encloses information with reference to diseases which are characterized as a set of if-then production rules. The knowledge base is analogue to the long-standing human memory. The whole sorting of production rules is prepared in the knowledge base. You may understand it with the help of example. Tuberculosis is a lung disease whose symptoms are persistent cough, constant fatigue, weight loss, loss of appetite, fever, coughing up blood, night sweats. So it will be stored in knowledge base in the form of a rule which is as follow:-

Disease (Patient, tuberculosis):-

Symptom (Patient, persistent_cough),

Symptom (Patient, constant_fatigue),

Symptom (Patient, weight_loss),

Symptom (Patient, loss_of_appetite),

Symptom (Patient, fever),

Symptom (Patient, coughing_up_blood),

Symptom (Patient, night_sweats).

Similarly in this way you can store maximum possible rules in the knowledge base.

2) The Fact Base contains facts which are applied to match in opposition to the antecedent part of rules stored in the knowledge base. The fact base is analogue to the instant human memory.

3) The foremost job of Inference Engine is to bring out the reasoning by connecting the rules with facts and deducing new facts.

4) The User Interface is used to correspond among user and expert system.

5) The Explanation Module permits the user to inquire the expert system how a finicky conclusion is reached and why a specific fact is desired.

6) The Developer Interface is used to alter the knowledge base

VI.   CONCLUSIONS

The paper presents a good overview of previous paper for expert system with its advantage and disadvantages. Also the paper provides special emphasis of expert system in the field of medical science.

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