

Applications of Expert System in Medical Field

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Abstract — An Expert System is a system that generates responses on the basis of expert knowledge base. Its application area covers fields like an organization's strategic impression, based on decision making to, in medical field where, decisions are going to made for diagnosing a disease, to providing assistance for the treatment of diagnosed disease. Here in this paper we are going to review the applications of an Expert System in different areas of medical field like radiology, allopathic medicine, and homeopathy.

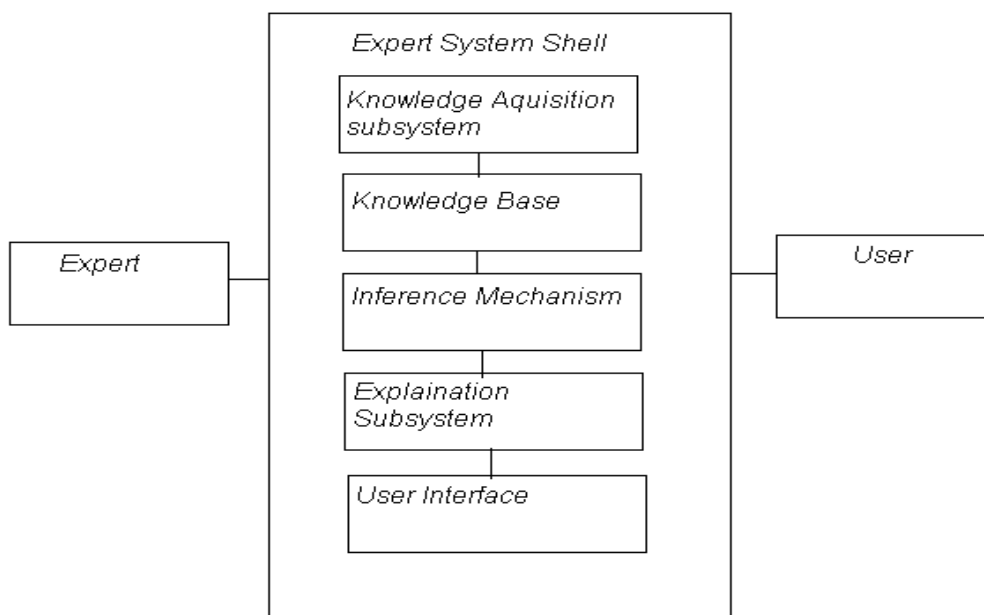
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INTRODUCTION

Expert system is an artificial intelligence program that has expert knowledge about a particular domain and knows how to use its knowledge to respond properly, domain refers to the area within which the task is being performed.

I. THE BASIC COMPONENTS OF ES

- 1.1 **Knowledge base:** It is not the conventional database, but it is more suitable for storing data that can easily inferred by humans, like heuristic knowledge, in form of symbols.
- 1.2 **Reasoning engine:** The Reasoning mechanism is all about manipulating symbolic information stored in Knowledge Base and responsible for solving the problem. The inference mechanism can range from simple *modus ponens* backward chaining of IF-THEN rules to case-based reasoning.
- 1.3 **Knowledge acquisition subsystem:** It is subsystem that is responsible for acquiring knowledge from experts from respective domain.
- 1.4 **Explanation subsystem:** It is a subsystem that explains the workflow functionalities of system.
- 1.5 **User interface:** It is the way through which user is going to communicate with the system, provides the inputs to system.



1.6 The Role of Human in Expert System:

- 1.6.1 Domain expert** – currently experts solving the problems the system is intended to solve
- 1.6.2 Knowledge engineer** - encodes the expert's knowledge in a declarative form that can be used by the expert system
- 1.6.3 User** - will be consulting with the system to get advice which would have been provided by the expert Systems built with custom developed shells for particular applications.
- 1.6.4 System engineer** - the individual who builds the user interface, designs the declarative format of the knowledge base, and implements the inference engine.

1.7 Four interactive roles form the activities of the expert system for their categorization:

- 1.7.1 Diagnosing:** The basic role of an expert system is to replicate a human expert and replace him or her in a problem-solving activity. In order for this to happen, key information must be transferred from a human expert into the knowledge database and, when appropriate, the inference engine. Two different types of knowledge emerge from the human expert: facts and procedural or [heuristic](#) information.
- 1.7.2 Interpreting:** Procedures capture the if-then logic the expert would use in any given activity.
- 1.7.3 Predicting:** By [inferring](#) difficulties from past observations, the expert system identifies possible problems while offering possible advice and/or solutions. In a predictive role, the expert system forecasts future events and activities based on past information.
- 1.7.4 Instructing:** in an instructive role, the expert system teaches and evaluates the successful transfer of education information back to the user.

II. DIFFERENT APPLICATIONS OF ES IN DIFFERENT MEDICAL FIELDS

2.1 Radiology:

Radiology is field of medical science that uses imaging to diagnose seen within the body. It has variety of techniques like x-ray radiography, ultrasound, Computer Tomography (CT), Positron Emission Tomography (PET) and also Magnetic Resonance Imaging (MRI)[1].

- 2.1.1 BIONET:** BIONET is multilayered feed forward neural network model based diagnosis system for diagnosing arm and neck based common diseases like cervical spondylosis, collagen disorder and rare diseases like caries spine and malignancy. BIONET is made up of two phases training and diagnosing, where under training phase, BIONET is trained from the training samples are the clinical records patients suffering from the neck and arm pain, then BIONET is undergoes for diagnosing phase. After that the validation of inference made by BIONET is done by 3 experts [2].
- 2.1.2 ICON:** ICON is computer based ES developed to help radiologist with precedes of differential diagnosis. ICON has two part: 1)domain independent Essential attending and 2) domain specific part. The data from [physician and radiologist and clinical findings used by production rule interpreter which draws the further inferences, then it is used to process expressive frames, contains information about diagnostic alternatives. These frame determine which content information is passed to prose generator which sequences the contain and assembles a set of prose paragraphs discussed in the case function is ICON: 1) Production Rules 2) Expressive Frames 3) Prose Generation [3].
- 2.1.3 Diagnosing from chest x-ray:** For analyzing diseases like Heart failure, lung collapse, and TB, started with Lung Isolation, as Lung boundary detection algorithm using watershed based segmentation technique. After that Thoracic Measurement Algorithm for heart failure dieses, detected, when cardiothoracic ratio becomes greater than 50%. Then Lung Collapse is detected by checking the ratio of right lung volume over that of left lung, should be less than the high threshold (140%). After that Nodule detection is done for detecting TB, using Nodule detection Algorithm [4].
- 2.1.4 Detection of Retinopathy for diabetic patients:** It is very chronic disease for diabetic patients that leads to them to blindness. So for detecting Retinopathy in diabetic patients in early days of diabetes it can curable. In these Retinopathy many image processing algorithms were used, like Pre-processing, Localization and Segmentation of Optic disk, Segmentation of retinal vasculature, Localization of macula and fovea, Localization and Segmentation of Retinopathy[5].

2.2 Allopathic Medicine:

DExs: A Diagnosis Expert System that can help a great deal in identifying those diseases and describing methods of treatment to be carried out taking in to account the user capability in order to deal and interact with the expert system. In it Knowledge Acquisition is done from expert doctors, book and electronic web sites. It implements forward chaining is the mechanism, for rule selection. An Expert System for diagnosing eye disease based on Naive Bayes. An Expert System for diagnosing eye disease based on Naive Bayes: It applied Case Based Reasoning, Naive Bayes, is used as method for classifying eye diseases by applying Bayes's theorem. It also implements Case Based Reasoning for inferring patient symptoms[6].

2.3 Homeopathy:

An Expert System for Homeopathic Glaucoma Treatment(SEHO): This system assists ophthalmologists in selecting the most appropriate therapy for a patient diagnosed having Glaucoma. It uses backward chaining for the same and GURU as the tool[7].

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