

Designing an Expert System to Diagnose and Propose about Therapy of Leukemia

Armin Ghasem Azar¹, Zohreh Mohammad Alizadeh²

Department of Computer Science^{1,2}

Institute for Advanced Studies in Basic Sciences^{1,2}

Zanjan, Iran^{1,2}

a.ghasemazar@iasbs.ac.ir¹, z.alizadeh@iasbs.ac.ir²

Abstract: Expert systems are designed for non-expert individuals with the aim of providing skills of qualified personnel. These programs simulate the pattern of thinking and the manner of how human operates and causes the operation of expert systems to be close to operations of human or an expert. Variety of expert systems has been yet offered in the field of medical science and in this respect it is one of the leading sciences. Leukemia is very common and serious cancer starts in blood tissue such as the bone marrow. It causes large numbers of abnormal blood cells to be produced and enter the blood. Speed is always effective in diagnosis and treatment of Leukemia and recovery of patients, but sometimes there is no access to specialists for patients and because of this reason designing a system with specialist knowledge, that offers the diagnosis and appropriate treatment to patients, provides the timely treatment of patients. In this paper an expert system has been presented for diagnosis of Leukemia using VP-Expert shell.

Keywords: *Expert System of Leukemia;
Diagnosis; Therapy.*

1. Introduction

With the expanding application of information technology, decision making systems or generally decisions based on computer have been of very importance. In this regard expert systems as one of the parts attributed to artificial intelligence have the main role. All kinds of decisions in expert systems are taken by the help of computers. Expert systems are knowledge-based systems and knowledge is their most important part. In these systems knowledge is transferred from experts in any sciences to the computer. Expert systems have been used extensively in various sciences. So far various expert systems have been designed and presented in areas such as industry, space travel, financial decision making and etc. Using expert system has found its way to medical world [1]. DENDRAL was presented in 1965 to describe and explain the molecular structure [2], MYCIN was submitted in 1976 to diagnose heart disease

[3], and other expert systems to detect acid and electrolyte materials, train in management of anesthesia, diagnose diseases of internal medicine are of this category [6]. The purpose of this article is to present an expert system to diagnose and propose practices in therapy of Leukemia. The issue will be discussed in more and then the stages of system construction and its components will be expressed and finally the stages of designed system function will be described with an applied example. A medical expert system is a computer program that offers effective aids in making decision about diagnosis of diseases and motions on treatment method. Diagnosis of disease and predicting complications is done after the program, receives patient's information. This information is usually transmitted through the patient to the physician. Medical expert systems have features that distinguish them from other medical applications. One aspect of this difference is that

these systems, mimic the arguments of an expert physician, step by step, in order to achieve accurate results. In most cases, the specialist using this software is aware of these sequential arguments. Leukemia is one the most important cancers that human society has been involved with. There is not usually a certain sign for Leukemia and when symptoms appear, they are very ambiguous and complex and are too similar to symptoms of flu. An expert system can be designed that can diagnose Leukemia with a view of the above symptoms, and suggest specific treatments. Using expert software systems has some advantages such that:

- Individuals have fleeting and transient expertise. For example, a person may change his job, become sick, etc, but the computer has permanent expertise.
- Person does not have stable expertise. Expert individual may have holidays, recreations programs, etc, that all these impact adversely on normal function of individuals, but computers are stable and

in the same condition, offer the same outputs.

- Also, expert systems have the ability to upgrade. Some other advantages that expert systems can create include:
 - High Performance.
 - Full and Fast Performance Time.
 - Good Reliability.
 - Being Understood.
 - Flexibility.
 - Risk Reductions.
 - Durability and Survival.
 - Existence of Multiple Specialties.

The aim of the project leads to presentation of this article, taking advantages of a software system in order to achieve all the benefits of an expert system to diagnose the disease and propose about how to treat Leukemia [6, 8].

2. Survey Method

2.1. Stages of system construction

Prototype is one of the most common design methods that is used by builders of expert

systems. In this method, the systems that are not yet ready to be formally delivered are provided to users to obtain the necessary feedback and necessary modifications are done on the system. This method involves three stages: Analysis, Design and Implementation, which are repeated together in a lump [13]. Prototype method is also used in this article. Therefore, the purposes and objectives of expert systems are firstly defined and then gradually related research and

identification of hard-wares and soft-wares and related experiences will be done. Then the environment of expert system is described and then conceptual analysis and design of system is done and in fact a kind of feasibility is performed. In the next stage, the components of expert system is determined and the soft-wares that can support these components of system are surveyed and determined. Finally, the system is built and components are put together.

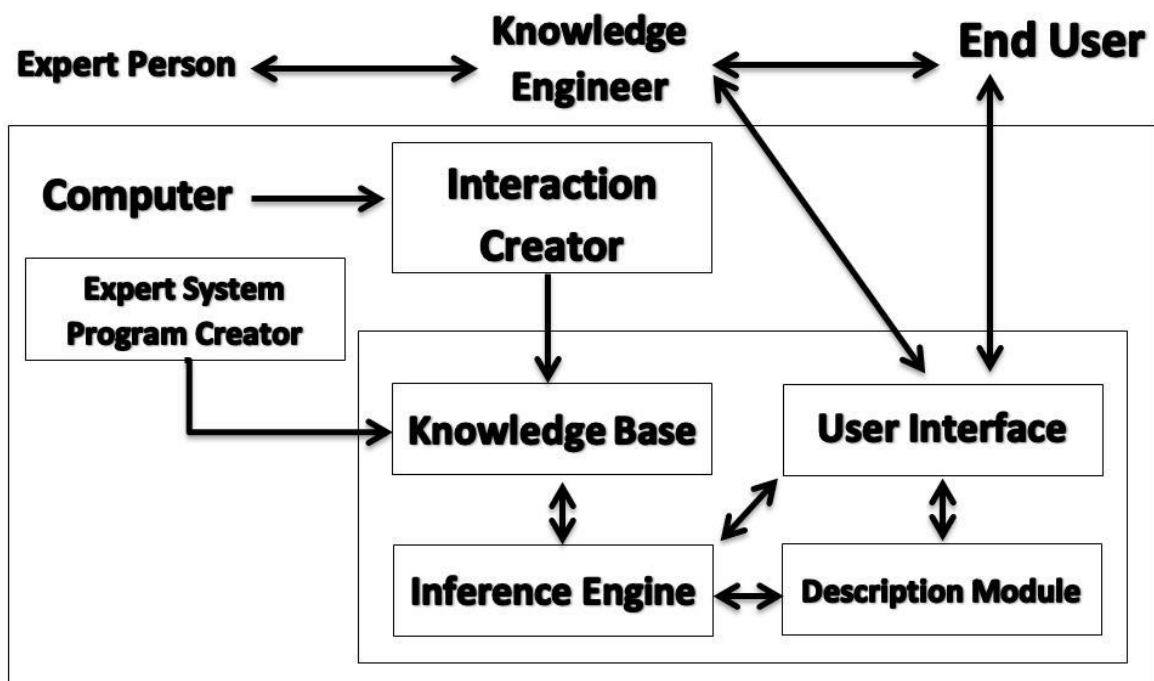


Figure 1: The Relationship between Various Components in Expert Systems [6]

2.2. Components of Expert System

Expert system for diagnosing and proposing about Leukemia as any expert system is composed of three main components:

- Knowledge base management subsystem.
- Interface management subsystem.
- Inference engine subsystem.

The schematic view of components of an expert system is shown in Figure 1. In following all three components of designed system will be described [6, 7, 13]. The VP - EXPERT expert shell has been used in order to design the mentioned expert system. This software has been presented in 1993 by World Tech Systems Company in America as a tool for developing rule-based expert systems. The software features can include [7, 14]:

- Ability to create a knowledge base file with a simple table.
- Chaining capability to link together multiple knowledge bases.
- Automatically generation of some questions that achieving to the result is not possible without knowing their answers.
- Existence of relatively diverse mathematical functions.
- Existence of instructions that wants expert system to explain its activities through a consultative work.

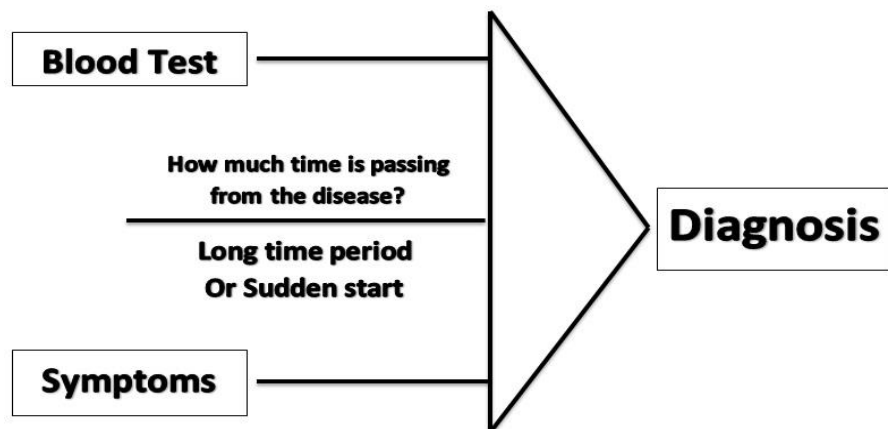


Figure 2: Mockler diagram related to diagnosis of Leukemia [6]

2.3. Knowledge Base Subsystem

The block and Mockler diagrams are used in order to achieve the knowledge base of mentioned system. Block diagrams are graphs in which the main tasks of the system is determined and is very suitable for expressing the relationship between agents and targets. The block diagram related to the diagnosis of Leukemia in the first level has been composed of three parts of blood test, symptoms of disease and time of disease on set. Block diagrams do not help in writing the rules, because they do not have necessary details for this work. In this regards, a diagram is necessary that specifies the relationship between factors effective on the aim by specifying the questions, rules and recommendations. The first level of Mockler diagram for diagnosis of Leukemia is shown in Figure 2. As is shown, the questions about duration of disease have been shown on the straight line and options related to the questions can be also seen under the same line. After the questions and options that user should answer to every question, are determined by drawing

Mockler diagram, the results and various situations can be determined that the user may impose in response to any question. For this purpose, 3 tables, decision in order to identify patient, deduce the type of blood test mode and deduce the type of symptoms are used.

2.4. Inference Engine Subsystem

In rules-based systems, inference engine, works in a manner that selects a base for the test and checks whether or not the conditions of this rule are correct? These conditions may be assessed through examination of the user or may be derived from the facts that were obtained during interviews. When conditions about a rule are right, then the results of that rule will be correct. Once this rule is activated, and the result is added to the knowledge base.

2.5. The User Interface Subsystem

The user interface for an expert system, normally should be of high exchangeable power, so that the structure of information exchange is

accomplished in the form of talk to an applicant and an expert human [8]. VP-Expert shell has a user interface that some questions are asked from the user based on rules of system knowledge base and based on the answer user gives the system, necessary conclusions are done and at the end a good answer is offered to the user. In the next section, the work process of expert systems is described with a practical example.

2.6. Implementation

Consider a man is suddenly contacted vomiting, headache, anemia and splenomegaly and his blood test shows that the PLT is 19,000, WBC to 3,000 units, RBC to 5, HCT to 0.30 and the amount of hemoglobin is 11 units. This person plans to investigate disease status (or lack of) and its kind with designed expert system. A view of the user interface and the answer of designed system is shown in Figure 3. After the diagnosis of disease, system provides ways of disease treatment.

```
-----[ KBS: BLOODC~1 ]-----
welcome to the system of diagnose and propose style of treatment in blood
ancer
what is the number of unit PLT in blood test?
19000

when do you notation that you are sick?
sudden_start ◀          long_time

Do you have any vomiting?
yes                       no

-----[ RULES ]-----
vomiting = yes and
headache = yes and
hepatomegaly = yes and
anemia = yes
THEN
sick_sign = ALL CNF 100
ELSE p = A CNF 100
Finding vomiting

-----[ FACTS ]-----
PLT = 19000 CNF 100
blood_test = sick CNF 100
sick_time = sudden_start CNF 100

↑ ↓ → ← Enter to select  END to complete  /Q to Quit  ? for Unknown
```

Figure 3: The Question of VP-Expert System from User about Vomiting Disease Symptoms

3. Discussion And Conclusion

In this article, providing an expert system to diagnose and recommend treatment method for Leukemia was proceeded. For this purpose, the objectives and targets of expert system were first defined and then the review of relevant researches and identification of hard-wares and soft-wares and related experiences was preceded and the environment of expert system was described. Then the conceptual design and system analysis and in fact a kind of feasibility was conducted. In the next step, the components of expert systems were determined and the VP-Expert shell was determined as a software that can support those components. It is noteworthy that it should be tried to provide systems that can simulate the behavior of expert people, but it is not always possible. One defect of the designed system is that the clinical evaluation is not possible and system acts only based on user responses and cannot survey the verification of responses received from the user.

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