

Designing Expert System to Diagnose and Suggest about Esophagus Cancer Treatment Method

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Abstract. Expert system have been designed to identify what an expert man does and these works are done by a computer .expert systems are computer programs simulating the thinking manner of an specialist about a unique context. In fact ,these softwares identify realistic patterns a specialist makes decision based on it and then they make decision based on patterns as humans.So far , a variety of expert systems have been introduced in the field of medicine science and it's a pioneer science. Performance speed is always very effective in diagnosing and curing esophagus cancer and improving the conditions of patient,but some times there is no accessibility to the specialist physicians for the patients .hence,designing a system having the knowledge of a specialist physician giving diagnose and suitable curing method to the patients may provide treatment conditions for the patients on time.In this article ,an expert system is presented for diagnosing esophagus cancer using the shell of VP-Expert in which the knowledge required for diagnosing and suggesting the treatment has been saved in database regularly.

Keywords: esophagus cancer expert system,diagnosing disease,treatment method.

1. Introduction

Progressing information technology usage ,decision systems or generally decisions made through computer became very important .In this field ,expert systems have a basic role as one of the parts titled as artificial intelligence .Expert systems refer to a special set of computer softwares try to help the human technicians and experts and/or their substitution in a limit professional fields[2].These systems usually save information as “Facts” and “Rules” in a database namely knowledge base systematically and then required results are derived from these data using inferential specific methods. The concept of expert systems rely on this assumption that experts’ knowledge is recorded on computer memory and is available for the ones who need using that knowledge .Expert systems cause the practice of the works or facilitate their practice in various fields like medicine ,accounting ,process control ,human resources , financial services and etc [1]. One of the initial expert systems in the field of medicine is “Dendral” built by Edward Feigerbaum Joshun Lederberg- researchers of artificial intelligence – in Stanford university in 1965.The function of this computer program was to analyze chemicals. The test element could be a complex composition of carbon , hydrogen and nitrogen. Dendral was able to simulate molecular structure of an element by studying the arrangements and information of that element[3].MYCIN is another well- known expert system designed in Stanford in 1972. It was a program whit a capacity of diagnosis blood infections by studying the information of patient's physical conditions as well as the test results. MYCIN could sometimes guess the results of the test early [4] . Another expert system in this field was “centaur” whose function was to study respiratory tests and to diagnose pulmonary diseases[1].The aim of this article is to present an expert system to diagnose and

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suggest the method of esophagus cancer treatment. In the following ,this issue will be explained and after presenting the matters about esophagus cancer , the process of building this system and it's components stated . Medical expert systems are computer programs for solving the problems in the field of medicine using the rules applied by specialist physicians [16].the initial difference between expert systems and the past applied programs is that expert systems use reasoning based on inference and deduction .In common applied programs ,we have a constant algorithm and the method of problem – solving but in intuitive methods complicated problems may be solved through test and error and a desired answer could be obtained. Human's head has been divided in parts so that each part does its specific function separately. A disorder or disturbance in the function of one part have no effect on the other parts [21]. In expert systems this case is also observed. An expert system makes computer to think and imitate the method of the human learning. There fore ,it tries to attract new information to apply to the next phases . Medical expert systems hold features distinguishable from the other medical softwares . One aspect of this difference is that these systems imitate the reasonings of an expert physician. In many cases , the specialist person using this software is aware of these sequence reasonings. It's obvious that expert systems need lots of medical rules and facts about diseases and illness conditions in order to present an accurate result[11].esophagus is a void tube carries food and liquids from throat to stomach. When the human ingests the food, muscular wall of esophagus contracts to more the food down to the stomatch. The glands in esophagus secrete a mucous moisturizing and slipping the location of the food passing and facilitate ingestion. Esophagus locates precisely in back of the trachea and it's average length is 25cm in adults. Esophagus cancer is one of the most fatal cancers [22,17]. As this cancer may hardly be diagnosed at initial stages , at diagnosis time , there is almost no hope for living . esophagus cancer is almost without any sign at initial stages and is seldom identified randomly. The incident of the symptoms indicates the progressed stage may not almost be cured. There fore , an expert system needs to be designed to diagnose the disease of esophagus cancer when observing the symptoms and to suggest typical treatment methods. Applying an expert systems contains the following advantages: expert systems are permanent and stable . In other words, people don't die and are not perishable .Expert systems may be composed of total experiences and knowledge of several expert persons. Expert system can clarify the directions and stages of reasoning led to conclusion . Expert persons can't often do this function during decision times due to different reasons (fatigue , lack of desire and etc). This capacity will increase your confidence about a correct and accurate decision. Expert system may also be used in environments where there are difficulty and threats for the human. Expert systems are fast and responsible as soon as possible. At emergency and necessary times , a person may not be able to make a correct decision because of mental stress or other factors but expert systems are free of these defects[9].One of the most important advantages of expert systems is a simplicity and easy transfer to a variety of geographical places.Other advantages that expert systems can cause are as the following:

Increasing accessibility, comfortable knowledge transmission, decreasing, expenditure, understandable, flexibility [13].The aim of performing this project led to present this article is to apply a software system to achieve all of the advantages of an expert system for diagnosing disease and suggesting the method of esophagus cancer treatment.

2. Cancer

Cancer is a diseases affects on the cells as the basic units of the life. To better understand any kind of cancer ,it's helpful to get information about normal condition of the cells and the reactions that occur into them to cause cancer[14] . Human body is composed of many cells. In natural state, cells grow and divide . Cells are produced more when the body needs them so that this process keeps them normal and healthy . Nevertheless , cells continue to divide even at times when there is no need for them . Additional cells mass may form tumor which are benign or malignant . Benign tumors: they aren't cancer.us , often removable and not recur after removing in many cases. Benign cells aren't spread over other parts of the body and not considered a threat for life. Malignant tumors:They are cancerous and the cells of a malignant tumor are abnormal with no control and rule . These cancerous cells attack to the surrounding tissues and destroy them. Cancerous homogenous cells can be separated from a malignant tumor and enter the blood circulation or

lymphatic systems. This phase is called metastasis that caused the spread of cancer from initial tumor to secondary tumors over other parts of the body[18].

3. Esophaguse Cancer

In fact, esophagus is a connective pipe between pharynx and stomach so that esophagus cancer causes involving these parts. Cancers have a malignant nature . Esophagus cancer is one of the cancers mostly depends upon environmental and genetic factors and nutritional styles of a community people . Esophagus cancer is a disease taken place in a part of digestion system connecting pharynx to stomach . This part called esophagus is as a pipe. Esophagus cancer is divided in two important types based on the kind of malignant cell:Squamous cell carcinoma (scc) and Adeno cell carcinoma(ACC).[18]

SCC occurs by squamous cells present in esophagus and generated on top and middle parts of esophagus. Adeno cell carcinoma often occurs in gland tissue of the buttom part. Treatment of both cancers are almost similar . If cancer spreads out of the esophagus ,it will almost enter the lymphatic gland initially and then it might spread into the liver , lungs brain and bones . Esophagus cancer is rare in the persons under 40 years old and the incident rate will be more within the next decades of life. The reason of squamous cell carcinom is unknown but environmental , nutritional and topical factors have also been introduced .Alcoholism and smoking are initial danger factors. In Iran , in the south zones of Caspian sea this disease is seen more than that the other zones that is probably related to the hot tea. The other danger factors may be: radiation , Plamer winson syndrome ,Ashalazy ,Lay shortages and celiac disease. Adeno cell carcinom of esophagus might be the disease of white men. The proportion of whites vulnerability to the blacks is 4:1 and male to female is 7:1. The only identified danger factor is esophagus bart. In bart esophagus ,intestine mocous substitutes with the normal mocous of esophagus that it causes as the result of choronic acid and bile storages return[17]. The most important symptoms of esophagus cancer are as the following : general signs in most of the patients are progressing dysphagia (problem in ingestion) as decreased weight during a short time. Dysphagia is initially related to the solid nutritions and then it progresses little by little and includes half- solid foods even liquid .Feeling a bulk and protuberance in throat and painful swallow, a pain dissipated to the chest or back, regurgitation (coming up the food digested without force and pressure), undigested food with a malodorous smell and hiccup may be with vomit and inflammation of lung layers, bloody mucous ,sore throat , back , back of the chest and below the two shoulders are the signs of this disease .Progressing the disease , esophagus becomes gradually more narrow .One of the early signs of disease is a pain in the chest .It's possible that a person swallowing hot liquids suffers from stomachachc. The late symptoms of disease include epiphora (as the result of no saliva swallow) and respiratory signs are also prevalent .Sound coarseness and cough are generated when cancer penetrates to surrounding parts.[13,15]

Disease stages

After diagnosing the disease of esophagus cancer the physician should determine the disease stage to make a decision for .

Stage 1: cancer is found only in surface cells.

Stage 2: Cancer has involved deep layers of esophagus or progressed to lymphatic glands around esophagus but not to the other areas of the body.

Stage3: Cancer has penetrated deeper to esophagus layers or dissipated in lymphatic glands near esophagus area.

Stage 4: Cancer has been spread out over other parts of the body such as liver, lungs, brain and bones[14,15].

4. Expert System Fabrication Processes

One of the most conventional methods of designing used by the producers of expert systems is "prototype" method .In this method , systems which aren't ready to be delivered formally yet ,are given to the users to get the necessary feedback and necessary modifications be done on system. This method includes three stages ; analysis, design and, implementation so that they are reiterated simultaneously and together

[19].The method used in this article is also “prototype”.For this purpose,firstly the purpose and goals of an expert system is defined and then relevant research reviewed and software ,hardware and relevant experiences considered.After wards an expert system environment is defined and conceptional analysis and design of the system regarded.In other words, a type of probability measuring is done. At the next stage the components of an expert system is determined and software that may support the elements of system studied and specified .Finally the system is constructed and the components and elements assembled[2,17].

5. Basic elements of Expert System

Expert system to diagnose and suggest about esophagus cancer morbidity is composed of the basic elements as any expert system[9,12]:

- Knowledge –base management sub system.
- User interface management sub system.
- Inference engine sub system.

In the following,these elements are clarified in the designed system.

To design mentioned expert system,expert –shell VP-Expert has been applied. This software was distributed in 1993 by word tech systems in America as a tool for developing expert systems.based on the rules . Some of the features of this software are referred here[20]:

- Capability of creating knowledge-base file using a simple table.
- Capability of chaining to link knowledge-bases to each other.
- Automatic generation of some questions so that without knowing their answer , We may not get the result .
- Availability of relatively various math functions.
- Availability of real or truth threshold level.

6. Knowledge –Base Management Subsystem

Knowledge –base or Knowledge storage is a location.where expert system knowledge saved as encoded and understandable for system.To access the knowledge base of mentioned system,block and mokler diagrams have been utilized .Block diagrams are the diagrams in which basic functions of the system are identified and are very suitable for stating the relationship between factors and goal [22].Block diagram related to esophagus cancer morbidity diagnosis is composed of three sections ; esophagus test ,illness symptoms and , esophagus bart condition at the first level.At the next section of diagram,the section of esophagus test has been separated to five subsections : barium intake ,endoscopy ,CT Scan,bone scanning and bronchoscopy[15] .The section of illness symptoms has been separated to the following subsections: dysphagia, losing weight,hiccup,vomit,bloody mucous,sore throat, backache,back of chest and below two shoulders pains ,pain in thorax area , mouth epiphora , sound coarseness,cough and asthma.Block diagrams don't help us in writing the rules[14] .because they have no necessary details for this work.In this regard ,a diagram is needed to specify the relationship between the factors affect on the goals by specifying the questions ,rules and suggests. Mokler or dependency diagram is a type of diagram suitable for this purpose.Mokler diagram is one of the useful methods for describing and expressing the relationships between factors and goal so that it makes clear the goal through input questions and shows the rules and descriptions derived from the first sample [12] .In mokler diagram variables are located on smooth lines and related decisions into the triangle . These decisions will continue from lower levels to higher levels to make a final decision that is illness diagnose .mokler diagram has been prepared using provided block diagrams[3].After designing diagrams of Mokler , questions and option that user should determine in answering any question was specified and the results and various conditions that the user may apply when answering any question identified [8].After specifying type of esophagus cancer disease meaning sec and acc by the system,it suggests types of therapy to the user corresponding to the disease .some of the available rules about mentioned expert system is given below.

Rule assessment_1

If Esophageal_test=healthy and
 Bart_Esophageal = positive
 Sick_sign=acc
 Then assessment=more_scrutiny
 Rule assessment_2

If Esophageal_test=sick and
 Bart_Esophageal = positive
 Sick_sign= acc
 Then assessment= acc
 Rule assessment_3

If Esophageal_test= healthy and
 Bart_Esophageal = negative
 Sick_sign= acc
 Then assessment= more_scrutiny
 Rule assessment_4

If Esophageal_test= sick and
 Bart_Esophageal = negative
 Sick_sign= acc
 Then assessment= more_scrutiny

7. Inferential Motor Subsystem

Inferential motor is a processor corresponding with available information (facts) in the working memory with the knowledge – base and inferences new results and adds it to the working memory [11]. In fact , inference machine is the heart of an expert system . inference machine may act in two manners to reach a judgement : Reasoning method begins from the data and draws a conclusion meaning that it starts from "Ifs" and reaches to suitable “Then s” by considering the related data. In other words ,we get from the basics to the results in the present sequence .The second method of inference is that it starts from results and looks for initial suitable conditions for such specified results .In other words , the start point is “ Then s” and get to “Ifs” from them .The first method of inference is called the method based on the data and the second one called the method based on the goal[5,6].In designed system an Expert VP-Expert shell has been utilized .One of the appropriate features of this shell is the lack of need to motor designing so the result of designing and developing expert system will be easier.[4]

8. User Interface Management Sub System

User interface means a set of equipment and softwares acts as user communicative channel and expert system .In other words, it allows the possibility of presenting information to desired problem and make the system conclusions available for the system[10].VP-Expert shell has an user interface where it asks questions the user based on the rule of system database and based on the respond that user gives to system,necessary inferences are drawn and finally gives a suitable respond to the user[13].

9. Conclusion

Expert system is a computer program designed to model the ability of solving a problem by a human. In this article an expert system has been introduced to diagnose and suggest the method of esophagus cancer disease therapy .Hence ,first the purpose and goals of an expert system were defined and then the relevant research reviewed and software and hardware identified and also the environment of an expert system described.After that,an analysis snd conceptive design of system namely a kind of probability were done.Next ,the elements of an expert system was determined and VP-Expert shell identified as a software

able to support its elements. It should be tried to present systems that can simulate the behaviours of expert persons. One of the disadvantages of designed system is that there is no possibility for a clinical study and system only acts based on the responses of a user and isn't able to study the validity of perceived responses from the user.

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