UNIVERSITY OF GONDAR

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE
DEPARTMENT OF INFORMATION TECHNOLOGY(MSC)

Course Title: Artificial Intelligence

Project Title: Childhood Diseases Diagnosis Expert System using Prolog

BY: -

NAME	ID
Alehegn Adane	7655/07

Submitted to Mohamed Sirajudeen (PhD)

Gondar, Ethiopia

Jan, 2016

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ABSTRACT

An expert system (ES) known as knowledge based system, is a computer program that uses knowledge and inference procedures to solve problems that are ordinarily solved through human expertise. The main components of an ES are: a) knowledge base, b) inference engine, c) user interface. The aim of this project is to develop expert systems that can diagnosis and treat childhood diseases. The diagnosis is made taking into account the symptoms that can be seen or felt. The childhood diseases have many common symptoms and some of them are very much alike. This creates many difficulties for the doctor to reach at a right decision or diagnosis. The proposed system can remove these difficulties and it is having knowledge of many childhood diseases. A limitation of this medical expert system is that only symptoms entered by the programmer in the knowledge base are available. It does not think and learn by itself. Therefore the knowledge base needs to be updated any time with new symptoms and new diseases. The proposed expert system is implemented using SWI-Prolog.

1. Introduction

Increasing computer-based methods improve the quality of medical services. Artificial Intelligence (AI) is the area of computer science focusing on creating machines that can engage on behaviors that humans consider intelligent. One of the most important areas of Artificial Intelligence (AI) is an Expert system. Artificial Intelligence is defined as intelligence exhibited by an artificial entity. AI programs that achieve expert-level competence in solving problems in task areas by bringing to bear a body of knowledge about specific tasks are called knowledge based or expert systems. A lot of Expert systems are built in medical domain. Their purpose is the diagnosis and treatment of certain diseases. A Medical Expert System is made out of a group of programs and a medical knowledge base with which one can have a dialogue with a computer. The information obtained from the computer is similar to the information given by an expert doctor in that certain area. The proposed system for dealing with the problem of childhood diseases diagnosis and treatment is an expert system. Expert System (ES) is widely used in many areas and it has many applications. Most important fields area of expert system is the medicine and it use in detection, diagnosing symptoms and treatment diseases. The user can interact with a computer to solve a certain problem by expert system. This is because the expert system can store heuristic knowledge. The development of expert system is implemented in visual prolog programming environment. These programming tools facilitate human knowledge or expertise for medical therapy. The reason for Visual prolog program is the flexibility the expandability and low lost. This helps medical expert (doctor) diagnosis of a patient rightly.

2. Problem statement

In most developing countries and remote areas the insufficient of medical specialist has increase the mortality of Childs suffered from various diseases. The insufficient of medical specialists for Childs will never be overcome within a short period of time. But higher education institutions should give high attention to the problem by producing quality and high number of doctors in the country. But in addition to producing quality doctors, there should be expert systems that can diagnosis different diseases as doctors do. This expert system will not replace doctors rather it assist general practitioner and specialist in diagnosing and predicting childhood disease condition from certain rules or "experience. Patients can take different decisions based on the system order. Computer technology, expert system could be used to reduce the number of mortality and reduce the waiting time to see the child specialist. This system will reduce cost, effort and time of doctors and patients.

3. Objective

3.1 General objective

The general objective of this project is to develop expert systems that can diagnosis childhood diseases.

3.2 Specific objective

- ✓ To read different related expert system
- ✓ To design user interface that can diagnosis childhood diseases
- ✓ To collect childhood diseases symptoms from domain knowledge
- ✓ To design interface that accepts domain facts and rules

4. Scope

The scope of this project will cover treatment and diagnosis of childhood disease and there are different activities which will be performed. The following activities will be included;

- ✓ Collecting childhood diseases symptoms
- ✓ Design user interface using prolog
- ✓ Setting predicate variables properly

5. Project description

An expert system is a set of programs that manipulate knowledge to solve problems in a specialized domain that requires human expertise. The main components of expert system are knowledge base and inference engine. Knowledge base contains the domain knowledge needed to solve the problems in the form of rules. The rules are a popular paradigm for representing knowledge. Inference engine is the code at the core of the system which derives conclusions from knowledge base through inference or reasoning. The major features of expert system are user interface, data representation, inference, explanations, coping with uncertainty and advantages of expert system are fast response, increased reliability, reduced cost, reducing errors, multiple expertise, intelligent database, reduced danger. There are also some disadvantages of expert system. Disadvantages are absence of common sense, no response in exceptional cases, and no change with changing environment.

6. Medical Expert System and it limitations

The main aim of any medical expert system is the diagnosis and treatment of diseases. A medical expert system is built up of programs and medical knowledge base. The information obtained from medical expert system is similar to the information given by doctor or expert in that particular area. my medical expert system has main childhood diseases in its knowledge base. The user or patient is asked to answer with YES or NO, If a particular symptom appears or not. In the end, based on user's or patient's answers, the name of the disease is displayed on the screen. A limitation of this medical expert system is that only symptoms entered by the programmer in the knowledge base are available. It does not think and learn by itself. Therefore the knowledge base needs to be updated any time with new symptoms and new diseases.

7. Expert system and its architecture

An expert system (ES) known as knowledge based system, is a computer program that uses knowledge and inference procedures to solve problems that are ordinarily solved through human expertise. The main components of an ES are: a) knowledge base, b) inference engine, c) user interface. There are many applications of expert systems such as diagnosis, design, planning, financial decision making etc. Most applications of expert systems in medicine involve predicting, diagnosing and treating a particular disease. Now expert systems has many other roles in clinical care such as disease prevention, therapy, rehabilitation of the patient after therapy etc. n medicine, expert systems are used to train the medical students on various medical tasks. In certain situations, where either the case is quite complex or there is no medical experts readily available for patients medical expert systems are useful. From the very beginning the main obstacle of using expert systems in medicine has been the accuracy of such systems. The development of an expert system requires medical data of specialized doctor. This data is collected in two phases. Firstly, the creation of personal interview between doctor and patient record the medical background of heart disease. Secondly, medical data is turned into rules (IFTHEN). Rules for diagnosis contain in IF part the symptoms and in THEN part the disease. Rules for treatment contain in IF part the disease and in THEN part the treatment. The inference engine (forward reasoning) is the mechanism through which rules are selected to be fired. It is based on a pattern matching algorithm whose main purpose is to associate the facts (input data) with applicable rules form the rule base. Finally, the heart diseases are produced by the inference engine.

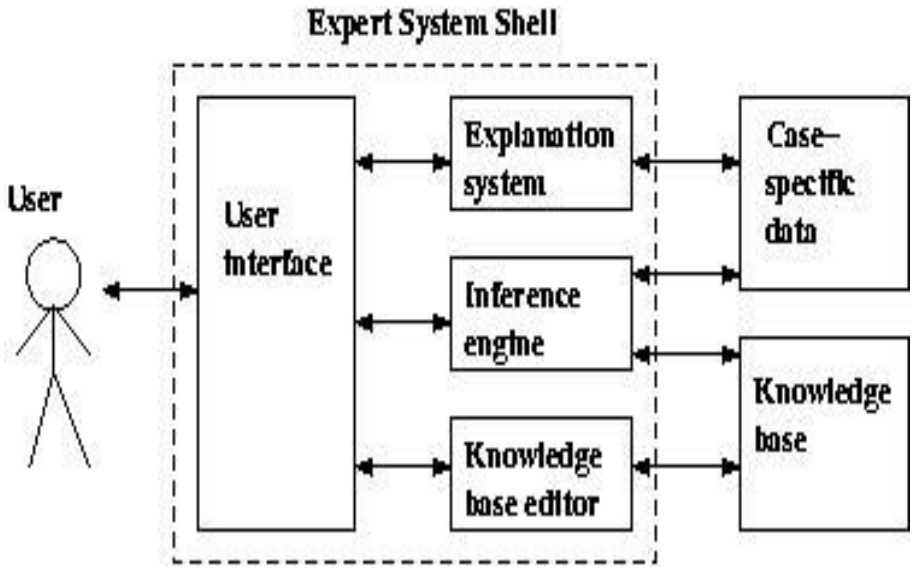

Figure 1: ES Expert System

Figure shows the most important modules that make up a rule-based expert system. The user interacts with the system through a *user interface* which may use menus, natural language or any other style of interaction. The core components of expert systems are the knowledge base and the reasoning engine. Then an *inference engine* is used to reason with both the *expert knowledge*)extracted from our friendly expert) and data specific to the particular problem being solved. The expert knowledge will typically be in the form of a set of IF-THEN rules. The *case specific data* includes both data provided by the user and partial conclusions (along with certainty measures) based on this data. Almost all expert systems also have an *explanation subsystem* ,which allows the program to explain its reasoning to the user. Some systems also have a knowledge base editor which helps the expert or knowledge engineer to easily update and check the knowledge base . One important feature of expert systems is the way they (usually) separate domain specific knowledge from more general purpose reasoning and representation techniques. The general purpose bit (in the dotted box in the figure) is referred to as an *expert system shell* .As we see in the figure, the shell will provide the inference engine (and knowledge representation scheme), a user interface, an explanation system and sometimes a knowledge base editor. Using shells to write expert systems generally greatly reduces the cost and time of development.

8. Childhood Diseases

The main childhood diseases are asthma, type 1 diabetes, cystic fibrosis and Duchene muscular dystrophy. Asthma can first appear as a cold or respiratory infection. What is actually happening is an inflammation of the lungs and airways which lead to the symptoms like wheezing, breathlessness, chest tightness, nighttimes or early morning coughing. Type 1 diabetes occurs when a child's pancreas no longer produces insulin, the body must be helped to make and regulate insulin. The symptoms of type 1 diabetes are increased thirst and frequent urination, extreme hunger, weight loss, fatigue, irritability or unusual behavior, blurred vision and yeast infection. Cystic fibrosis is a life threatening illness affecting the lungs via thickening mucus. The pancreas is also affected causing problems with the body's digestive system. The symptoms of cystic fibrosis are salty tasting skin, persistent coughing with and without phlegm, frequent lung infections, wheezing or shortness of breath and poor growth or weight gain. Duchene Muscular Dystrophy is the most common form of muscular dystrophy affecting children, exclusively boys. It causes muscle break down leading to weakness and, eventually, an inability to walk. The main symptoms of Duchene muscular dystrophy are delay in walking, frequent falls, and large calf muscles, difficulty in getting up from a lying or sitting position, weakness in lower leg muscles and wadding gait.

9. PROPOSED SYSTEM

A Rule based expert system has the following components- 1) The Knowledge Base contains information about childhood diseases which are represented as a set of if-then production rules. The knowledge base is analogue to the long term human memory. The total ordering of production rules is done in the knowledge base. Consider the following example: Asthma is a childhood disease whose symptoms are wheezing, breathlessness, chest tightness, nighttimes or early morning coughing. So it will be stored in knowledge base in the form of a rule which is as follow:-

Disease (Child, asthma):-

Symptom (Child, wheezing),

Symptom (Child, breathlessness),

Symptom (Child, chest_tightness),

Symptom (Child, night_or_early_times_coughing).

2) The Fact Base contains facts which are used to match against the antecedent part of rules stored in the knowledge base. The fact base is analogue to the short term human memory. 3) The main task of Inference Engine is to carry out the reasoning by linking the rules with facts and deducing new facts. 4) The User Interface is used to communicate between user and expert system. It is the method by which the expert system interacts with the user. 5) The Explanation Module enables the user to ask the expert system how a particular conclusion is reached and why a specific fact is needed. 6) The Developer Interface is used to modify the knowledge

10. Project implementation

10.1 User Interface

The User Interface is used to communicate between user and expert system. It is the method by which the expert system interacts with the user. The interaction is performed through an interactive dialog, an example of which is given below;

Q: Does the child have headache? (y/n) y.

Q: Does the child have sneezing?(y/n)|: y.

Q: Does the child have sore_throat?(y/n)|: y.

Q: Does the child have chills?(y/n)|: y.

Q: Does the child have runny_nose?(y/n)|: y.

That Child disease could be common_cold

Herewith the user interfaces;

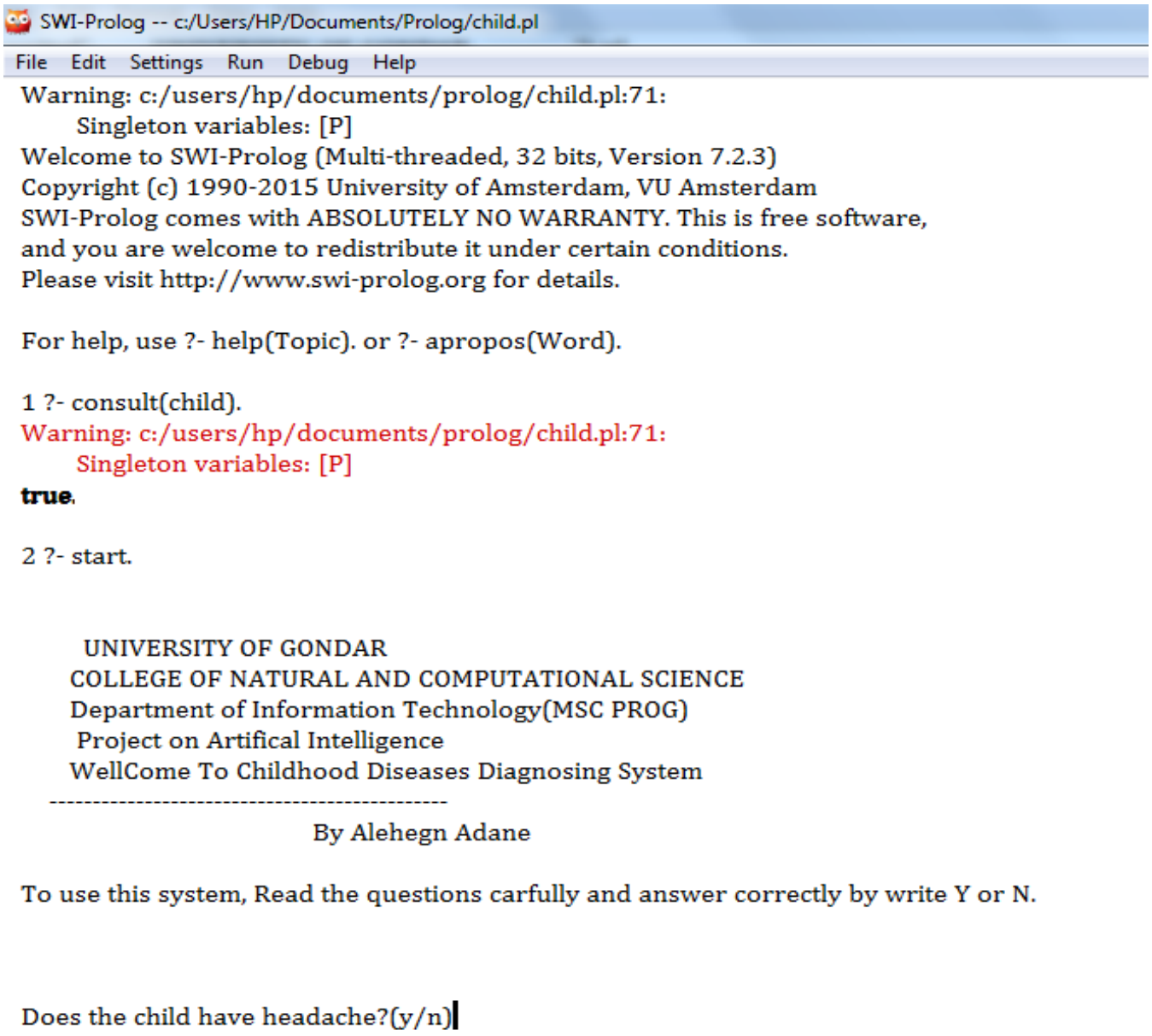

Figure 2: Welcome screen

```
  UNIVERSITY OF GONDAR
 COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE
 Department of Information Technology(MSC PROG)
  Project on Artifical Intelligence
 WellCome To Childhood Diseases Diagnosing System
-----------------------------------------------
                          By Alehegn Adane

To use this system, Read the questions carfully and answer correctly by write Y or N.


Does the child have headache?(y/n)y.

Does the child have sneezing?(y/n)|: y.

Does the child have sore_throat?(y/n)|: y.

Does the child have chills?(y/n)|: y.

Does the child have runny_nose?(y/n)|: y.

That Child disease could be common_cold

Try again ? (y/n)|:
```

Figure 3: sample diagnosis page

Try again ? (y/n)|: y.

Does the child have headache?(y/n)|: n.

Does the child have wheezing?(y/n)|: y.

Does the child have breathlessness?(y/n)|: n.

Does the child have fever?(y/n)|: y.

Does the child have cough?(y/n)|: n.

Does the child have rash?(y/n)|: y.

Does the child have body_ache?(y/n)|: y.

Does the child have chills?(y/n)|: y.

That Child disease could be chicken_pox

Try again ? (y/n)|:

Figure 4: sample diagnosis page

11. Conclusion

An expert system (ES) known as knowledge based system, is a computer program that uses knowledge and inference procedures to solve problems that are ordinarily solved through human expertise. The main components of an ES are: a) knowledge base, b) inference engine, c) user interface. The aim of this project is to develop expert systems that can diagnosis and treat childhood diseases. The diagnosis is made taking into account the symptoms that can be seen or felt. The childhood diseases have many common symptoms and some of them are very much alike. This creates many difficulties for the doctor to reach at a right decision or diagnosis. The proposed system can remove these difficulties and it is having knowledge of many childhood diseases. A limitation of this medical expert system is that only symptoms entered by the programmer in the knowledge base are available. It does not think and learn by itself. Therefore the knowledge base needs to be updated any time with new symptoms and new diseases. The proposed expert system is implemented using SWI-Prolog. However, the knowledge base needs to be constantly updated with new symptoms and diseases. Symptoms already available in knowledge base are not 100% correct because different doctors have different opinions and there are anomalies in medicines.

12. Sample code

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%Childhood disease and treatment to keep your child healthy.

%by Alehegn Adane

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%


notice:-

nl, nl,

write('        UNIVERSITY OF GONDAR              '),nl,

write('      COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE        '),nl,

write('      Department of Information Technology(MSC PROG)        '),nl,

write('       Project on Artifical Intelligence        '),nl,

write('      WellCome To Childhood Diseases Diagnosing System        '),nl,

write('    ---------------------------------------------'),nl,

write('                                    By Alehegn Adane'),nl, nl,

write('To use this system, Read the questions carfully and answer correctly by write Y or N.'),nl,

nl.


disease(Child, common_cold):-
```

symptom(Child, headache),

symptom(Child, sneezing),

symptom(Child, sore_throat),

symptom(Child, chills),

symptom(Child, runny_nose).

disease(Child, asthma):-

symptom(Child, wheezing),

symptom(Child, wheezing),

symptom(Child, breathlessness),

symptom(Child, chest_tightness),

symptom(Child, night_or_early_times_coughing).

disease(Child, measels):-

symptom(Child, fever),

symptom(Child, cough),

symptom(Child, conjunctivitis),

symptom(Child, rash).

disease(Child, flu):-

symptom(Child, fever),

symptom(Child, headache),

```
                                        symptom(Child, body_ache),
                                        symptom(Child, chills).

disease(Child, chicken_pox):-
                                        symptom(Child, fever),
                                        symptom(Child, rash),
                                        symptom(Child, body_ache),
                                        symptom(Child, chills).

disease(Child, mumps):-
                                        symptom(Child, fever),
                                        symptom(Child, swollen_glands).

disease(Child, german_measles):-
                                        symptom(Child, fever),
                                        symptom(Child, headache),
                                        symptom(Child, runny_nose),
                                        symptom(Child, rash).
disease(Child, runny_nose):-
                                        symptom(Child, rash),
                                        symptom(Child, flu).
```

```
/*Ask rules*/

symptom(P, Val):-ask('Does the child have',Val).

ask(Obj, Val):-known(Obj, Val, true),!.

ask(Obj, Val):-known(Obj, Val, false),!, fail.

ask(Obj, Val):-nl,write(Obj),write(' '),

        write( Val) , write('?(y/n)'), read(Ans), !,

        ((Ans=y, assert(known(Obj, Val, true)));(assert(known(Obj, Val, false)),fail)).


diagnose:- nl, disease(symptom,Disease) ,!,nl,

        write('That Child disease could be '), write(Disease).

diagnose:- nl, write('Sorry,we may not be able to diagnose the desease!!').

start:-notice, repeat, abolish(known/3),dynamic(known/3), retractall(known/3), diagnose,nl,nl, write('Try again ? (y/n)'),read(Resp),\+ Resp=y,

        nl,write('Bye ! Thanks for using this system'),abolish(known,3) .
```

13. Reference

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