Diagnosis of Skin Diseases using Online Expert System

Dr. Muhammad Zubair Asghar, Gomal University, Dera Ismail Khan
Muhammad Junaid Asghar, Gomal University, Dera Ismail Khan

Available at: https://works.bepress.com/drzubair/9/
Diagnosis of Skin Diseases using Online Expert System

Muhammad Zubair Asghar¹, Muhammad Junaid Asghar², Sheikh Muhammad Saqib¹, Bashir Ahmad¹, Shakeel Ahmad¹ and Hussain Ahmad¹.
¹Institute of Computing and Information Technology Gomal University, D.I.Khan, Pakistan
²Faculty of Pharmacy, Gomal University, D.I.Khan, Pakistan

Abstract—This paper describes Expert System (ES) for diagnosis and management of skin diseases. More than 13 types of skin diseases can be diagnosed and treated by our system. It is rule based web-supported expert system, assisting skin specialists, medical students doing specialization in dermatology, researchers as well as skin patients having computer know-how. System was developed with Java Technology. The expert rules were developed on the symptoms of each type of skin disease, and they were presented using tree-graph and inferred using forward-chaining with depth-first search method. User interaction with system is enhanced with efficient user interfaces. The web based expert system described in this paper can detect and give early diagnosis of thirteen plus skin diseases. This ES can be extended to diagnose all types of skin-diseases.

Keywords: Expert System, Skin Disease, Diagnose, Artificial Intelligence, Knowledge, Database.

1. INTRODUCTION
This is web-based expert system called WES (Web based Expert System) for Diagnoses of skin diseases infecting Pakistani population specially in flood effected areas. It contains an extended knowledge base as well as more up-to-date inference mechanism.

The present work describes following improvements over the other similar expert systems in the field.

All previous skin ES are non-internet and non-GUI based systems. The present work is development of web based system having easy to use GUI for the user interaction.

Some of the earlier expert systems have grown up only at the prototype stage. There was obvious potential for more practical nature skin based ES in ophthalmology and WES has been developed to achieve that.

iii) Previous systems were able to deal with fewer skin diseases; resultant Backward chaining of rules was used. No. of skin diseases that our system can diagnose (13) are more than earlier systems, so we did use forward chaining with depth first search method.

The most important characteristic of this system is that it doesn’t need to have the answers to every input question in order to reach a conclusion. The system will not ask the same question twice. For example, there are multiple skin diseases that contain one/more common symptoms, so the responses given earlier will automatically be applied to new diagnoses.

An expert system is an Artificial Intelligence based computer program, which acts like a human expert in particular area of knowledge. It has three main components i.e. a knowledge base (KB), an inference engine (IE) and control strategy (CS) [2]. Knowledge structured in the form of IF-THEN rules is stored in KB. This knowledge is processed by inference engine under supervision of control strategy for achieving expert advice. A Web Based Expert System(WES) is a collection of computer software and hardware components that have been properly selected, designed, developed, combined and configured in order to deliver a service that emulates in an effective and reliable manner the reasoning process of domain experts over the Web[3].

2. OBJECTIVES OF CURRENT RESEARCH
The need for web based decision support and expert systems has been felt world wide as they are capable to provide comprehensive and up-to-date information and consultation in interactive and user friendly manner. Web based system has been developed to fulfill the following objectives:

-To develop an ES that may provide free consultation about skin diseases.
-To assist skin specialists for diagnosing various diseases associated with skin .
-All health care professionals including, skin specialists, medical students, pharmacists can keep their knowledge up-to-date regarding “skin diseases diagnoses and treatment”, as its knowledge base external database is updated on regular basis.
3. METHODOLOGY

Phases/steps carried out in developing WES do include: 1.Problem definition/Scope identification. 2. Knowledge acquisition. 3. Knowledge representation. 4. Coding. 5. Testing and implementation.

3.1 Problem Definition/Scope Identification.
An expert system needs precise domain. The domain must be well organized and well understood. In diagnosis domain, as number of disorders (diseases) increase linearly, the number of possible diagnoses increase exponentially (i.e. there are more combinations of diagnoses to consider). This type of growth in the total no. of solutions is called combinatorial explosion[10]. Clearly, Skin Disorders diagnoses are an appropriate domain for expert system development. This WES has a narrow domain of skin diseases[5]. Following list shows some sample skin diseases which can be diagnosed by our system.

I. Facial Rashes
II. Whiteheads
III. Enlarged Pores
IV. Dark Circles
V. Erythrokerma
VI. Tinea Barbae
VII. Bullous pemphigoid
VIII. Acne -> Acne vulgaris, Acne Sears, Acne Treatment, Back Acne, Baby Acne, Acne Myths, Adult Acne, Acne Control, Tea Tree oil for Acne
IX. Mastocytosis
X. Comedo
XI. Onychomycosis
XII. Skin Abscess
XIII. Acanthosis nigricans

3.2 Knowledge Acquisition
Knowledge Acquisition includes three activities: choosing what knowledge is needed; obtaining and interpreting the knowledge; and modeling the knowledge. Some commonly used approaches are direct interviews, observations Ishikawa diagrams, case studies [7]. Direct interviews and observations were used for KA. The KA for this system consisted of several interviews with skin specialists, making observations and getting historical data from various skin clinics, depts. and wards in DHQ teaching hospitals of Pakistan , free skin caring camps and skin labs of medical college. Knowledge acquisition process will last for three months.

3.3 Knowledge Representation
There are numerous approaches for knowledge representation depending on nature of problem domain. As this is a rule based system, so IF-THEN style rules are used because they are easy to understand and enhance. The rule has two components: IF<situation THEN<suggestion> The IF-part (antecedent/left hand side) suggests describes a situation under which the rule is applicable. The THEN part (consequent/right hand side) suggests an action to be performed under the situation ( for action rules) or a plausible inference to make under the situation( for inference rules)[7].

3.4 Testing and implementation
System will be tested to ensure that it provides good quality decisions. Reasoning technique is tested for correctness i.e. whether it attains the desired accuracy rate. During testing omitted rules, incorrect rules, overlooked special cases are checked. Association of rules and missing relationships are also checked. Thorough testing verifies that all paths in the knowledge base are covered. ES was tested by two skin Specialists. The prototyping approach will be used to implement WES. A small domain of the knowledge acquired will be implemented in JESS and presented to the skin specialist. They will test the prototype using different scenarios. Their recommendations, additions, deletions or changes from the conclusions given by WES. Once the skin specialists agreed with the recommendations given by the ES, new prototype with more knowledge will be developed and presented again to experts for testing. The procedure will continue until all the acquired knowledge was included in WES knowledge base. WES is planned to be launched on the web using Apache server. Working Model of our expert system is given as under in Figure 1.
4. RESULTS AND DISCUSSION

During Phase-I i.e. Symptom Analysis, series of questions appear on computer screen. After this during Phase-II, system asks follow-up questions. At end system generates “diagnostic report” about the patient under examination, suggesting a possible disease and its proper management and treatment. Patients with computer background can get benefits from this system without assistance of skin specialist. Table-1 shows a sample session with our expert system. This ES can give answers to questions like “EXPLAIN” and “WHY” at each and every step during interaction with system. After detailed dialogue system comes with following suggestion. You have chances of suffering from a skin disease “Acanthosis nigricans[4]” Certainty factor (CF)= 90%.

Table-1: Sample session with Expert System

| ES: Is skin condition characterized by dark thickened? | Patient: Yes. |
| ES: Is there any sign, especially in the folds of skin in the axilla (armpit)? | Patient: Yes. |
| ES: Groin and back of the neck effected.? | Patient: Yes. |
| WES: Do you feel irritation, or headache? | Patient: Yes |
| WES: Is there any light sensitivity? | Patient: No |

In future this system will be extended to diagnose all skin diseases. WES will be made ready for next stage, where national/regional languages like Urdu can be used for interaction with it on the web.

REFERENCE