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# NEPHROLOGY EXPERT ADVISORY SYSTEM USING ANT COLONY OPTIMIZATION ALGORITHM

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**Abstract-** Expert System is a computer program that exhibits, within a specific domain, a degree of skill in problem solving that is comparable to that of a human expert. The knowledge base consists of information about a particular problem area, calm from domain experts (doctors). This paper proposed mainly two modules one is Information System and the other is Expert Advisory system. The Information System contains the static information about different diseases and drugs in the field of Nephrology. Our information system helps the patients to know about the problems related to kidneys. The Nephrology Advisory system helps the Patients to obtain the necessary and appropriate counsel depending on their queries. Better Ant Colony Optimization Algorithm (ACO) is used for better results.
**Key words-** *Expert System - ACO.*

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## Introduction

Nephrology is a branch of internal medicine and pediatrics dealing with the study of the purpose and diseases of the kidney. Our Nephrology Expert System mainly deals with common disease, common symptoms and commonly used drugs in the field of Nephrology. This Expert Advisory System contains Nephrology Knowledge Base and provides JAVA based dynamic pages. These web pages contain simulated expert advice on the subject, to the end users when they interact with the expert system online and present advice to problems asked by the system. The domain of our system is, we can developed a system which can give the entire information about the diseases, symptoms, drugs, preventions, self-help and definitions etc… in the area of Nephrology.

The rest of this paper is organized as follows. Section II presents a brief overview of system module. Section III discusses the architecture of Nephrology Expert System. Section IV introduces the characteristic of ACO algorithm for discovering classification rules proposed in this work. Section V reports computational results evaluating the performance of the proposed algorithm.

## System Module

Nephrology Expert System is the problem domain. The functionality behind the system is answering to the questions asked by the user and Experts using a data base connectivity between user and the expert system. The proposed system is divided into three modules:

### Requirements module

**Inputs-** The system needs the information about the symptoms from the user to produce the output.

**Outputs-** The outputs of the system will be:

1. Small Description about the disease
2. Preventions
3. Expert advice and External services available

**Store-** The information collected through experts is stored as a database (Knowledge Base) that serves as a repository for quick processing and future retrieval.

a. About Nephrology
b. Common Diseases

c. Common Symptoms and Stages
d. Preventions
e. Treatment
f. Services Available

The System Stores the information related to expert design in knowledge base in the following ways.

**Rules-** A set of rules, which constitute the program, stored in a rule memory of production memory and On an inference engine required to execute the rules.

**Dataset-** The monitoring data is in the Access database. It can be used as any other data stored in a database. This greatly increases the opportunity with which you can conduct post-analysis of the monitoring data [8].

**Static Module**

The static part the user is confirmed about his disease and wants to know information regarding the preventions and treatment to taken as well as services (expert advice) available. In[8] this part, the user can get all the static information about different Common Diseases, Common Symptoms, Preventions to be taken, and some Frequently Asked Questions (FAQ's) about different diseases in Nephrology field.

**Dynamic Module**

In Dynamic Part, the user is having an interaction with the expert system online, the user has to answer the questions asked by the Expert System in Self –Help option in the menu. Depends on the response by the user the expert system decides the disease and displays the disease and control of disease [8].

**Nephrology System Architecture**

In this model, the patient will provide the information about symptoms through Questionnaire, then the expert system process these symptoms with the help Knowledge based expert model using Machine learning algorithms and finds the probable disease, then the system will present the precautions for concerning to the diagnosed disease. Ant Colony Optimization algorithm and RETE algorithm is used for classification and finding the disease.

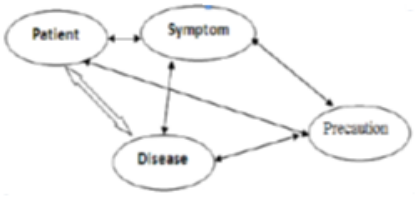


**Fig. 1-** Nephrology System Architecture

**Improved ACO Algorithm**

Ant Colony Optimization algorithm used for the discovery of classification rules. In ACO algorithm each ant incrementally constructs/ modifies a solution for the target problem. Target problem is the discovery of classification rules. Each classification rule has the form:

*IF* < *term1* AND *term2* AND... > *THEN* <*class*>.

An Ant Colony Optimization algorithm (ACO) is essentially a system based on agents which simulate the natural behavior of ants, including mechanisms of cooperation and adaptation. In [4] the use of this kind of system as a new metaheuristic was proposed in order to solve combinatorial optimization problems. This new metaheuristic has been shown to be both robust and versatile – in the sense that it has been successfully applied to a range of different combinatorial optimization problems [9].

ACO algorithms are based on the following ideas:

- Each path followed by an ant is associated with a candidate solution for a given problem.
- When an ant follows a path, the amount of pheromone deposited on that path is proportional to the quality
- of the corresponding candidate solution for the target problem.
- When an ant has to choose between two or more paths, the path (s) with a larger amount of pheromone have a greater probability of being chosen by the ant.
- As a result, the ants eventually converge to a short path, hopefully the optimum or a near-optimum solution for the target problem, as explained before for the case of natural ants. In essence, the design of an ACO algorithm involves the specification of [2].
- An appropriate representation of the problem, which allows the ants to incrementally construct/modify
- solutions through the use of a probabilistic transition rule, based on the amount of pheromone in the trail
- and on a local, problem-dependent heuristic.
- A method to enforce the construction of valid solutions, that is, solutions that are legal in the real-world
- situation corresponding to the problem definition.
- A problem-dependent heuristic function (h) that measures the quality of items that can be added to the current partial solution.
- A rule for pheromone updating, which specifies how to modify the pheromone trail (t).
- A probabilistic transition rule based on the value of the heuristic function (h) and on the contents of the pheromone trail (t ) that is used to iteratively construct a solution. Artificial ants have several characteristics similar to real ants, namely:
- Artificial ants have a probabilistic preference for paths with a larger amount of pheromone.
- Shorter paths tend to have larger rates of growth in their amount of pheromone.
- The ants use an indirect communication system based on the amount of pheromone deposited on each path.

**Results and Discussions**

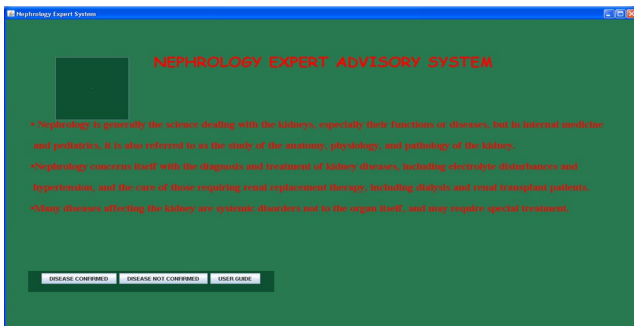


**Fig. 2-** Nephrology Expert System

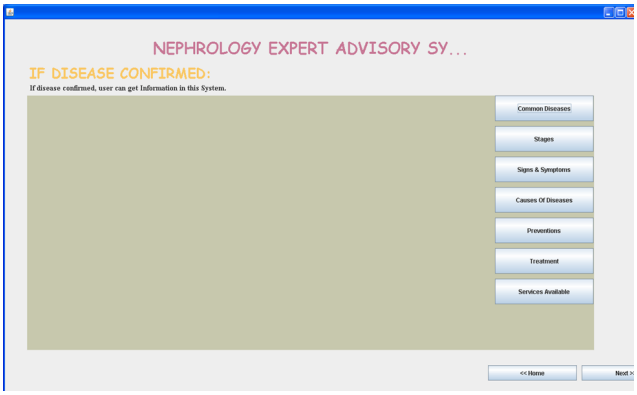


**Fig. 3-** Static Module

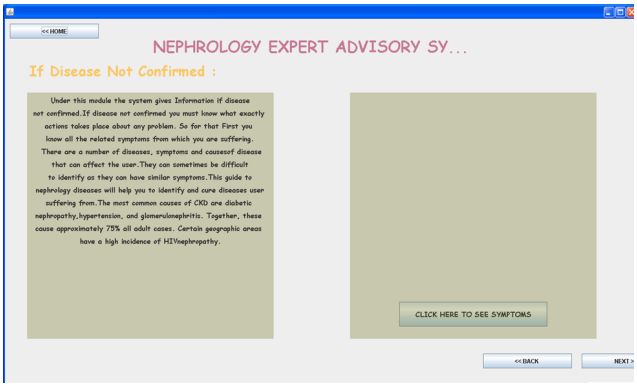


**Fig.** Dynamic Module

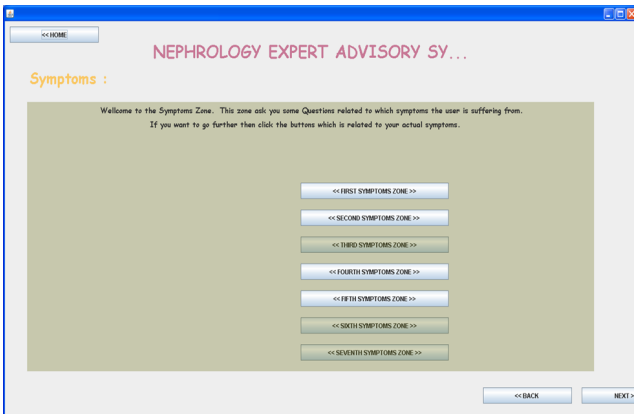


**Fig. 4-** Nephrology Expert System

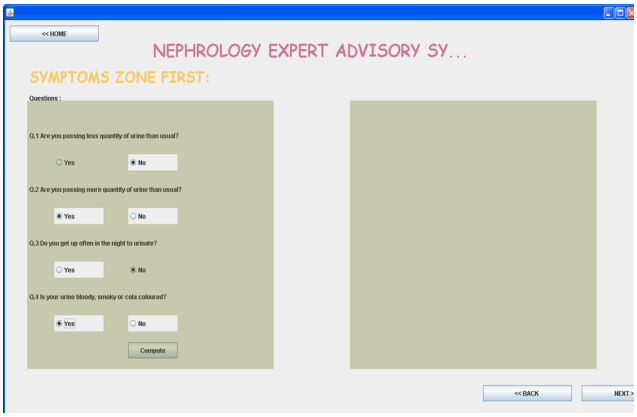


**Fig. 5-** Expert System of Nephrology

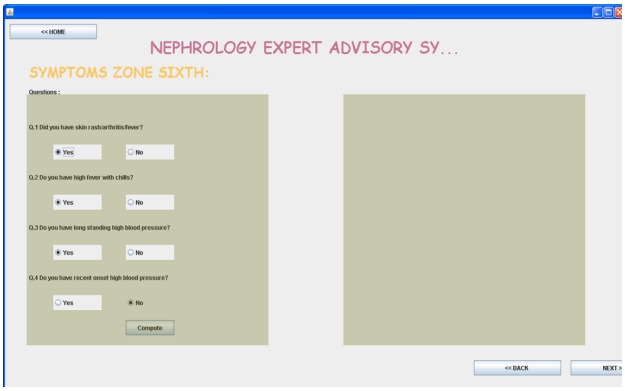


**Fig. 6-** Expert System of Nephrology

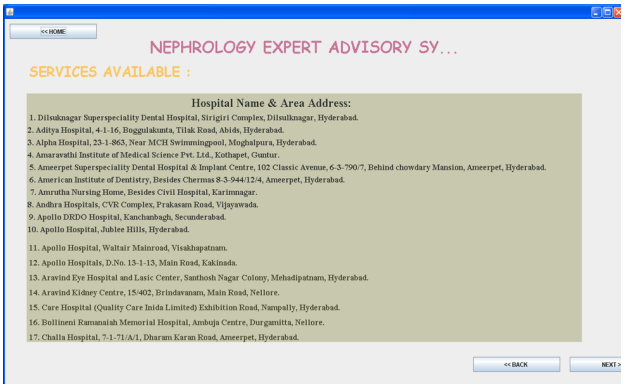


**Fig. 7-** Expert System of Nephrology

## Conclusion

The work in this paper has revealed and emphasized the effectiveness and importance of expert system as a decision support tool for the patients and diagnosis services. The data analysis reveals that some disorders, which have not been identified and treated by doctors, can also be managed by expert systems. It is also very clear that there is difference in the advice quality and consistency given by the expert system almost near to the human experts.

## Future Work

In Future there is a proposal that implementing this expert system in all rural & regional languages for better understanding of the users.

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