

## KNOWLEDGE BASE SYSTEM IN MEDICINE WITH SPECIAL REFERENCE TO CONSULTING PHYSICIAN

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### Abstract

*Knowledge is the fact or condition of knowing something with familiarity gained through experience or association. A Knowledge base system is also known as expert system. It is a computer program that contains some of the subject-specific knowledge, and contains the knowledge and analytical skills of one or more human experts. This paper deals with the development of knowledge base system in medicine which is able to give an appropriate diagnosis for all the diseases with fever as one symptom. A Knowledge-based system assists in the diagnosis of diseases to doctor in some critical cases. It also improves quality of decision making and speed-up of human professional work.*

*Keywords: Knowledge base system, rules of diagnosis, problem description, types of fever, inference engine, knowledge base.*

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## I. INTRODUCTION

This paper deals with the development of knowledge base system for the diagnosis of disease with fever as one symptom. The rules are generated with the help of symptoms and physical signs. The paper is organized as follows: The domain, Traditional Process of diagnosis, factors considered for the diagnosis of disease, Statement of the Problem, and design for knowledge base system, Model Building, and conclusion

## II. THE DOMAIN

The main aim of this paper is to present diagnosis of disease by studying the age, gender, physical signs and symptoms of patient. Knowledge base system is a computer program that uses encoding of human knowledge which helps to solve problem in specified domain and normally required human expertise. In this paper expert knowledge is acquired in the form of if - then rules to make predication of disease.

## III. TRADITIONAL PROCESS OF DIAGNOSIS

A patient typically presents a set of complaints known as the symptoms to the physician, who then obtains further information about the patient's symptoms, previous state of health, living conditions, and so forth. The physician then makes a review of systems or systems inquiry, which is a set of ordered questions about each major body system in order: general such as weight loss, endocrine, cardio-respiratory, etc. Next come the actual physical examination and often laboratory tests, the findings are recorded, leading to a list of possible diagnosis.

Medical tests commonly performed are measuring checking the listening to the heart with a stethoscope, pulse rate, blood pressure, urine tests, blood tests, x-ray etc.

A physician's job is to know the human body and its functions in terms of normality. There are four branches of medicine, each essential for understanding homeostasis. These are 1) anatomy-the structure of the human body, 2) physiology-how the body works, 3) pathology-what can go wrong with the anatomy and physiology and 4) psychology-thought and behavior. Once the doctor knows what is normal and can measure the patient's current condition against those normal, she can then determine the patient's particular departure from homeostasis and the degree of departure. This is called the diagnosis. Once a diagnosis has been reached, the doctor is able to propose a management plan, which will include treatment as well as plans for follow-up. From this point on, in addition to treating the patient's condition, the doctor educates

the patient about the causes, progression, outcomes, and possible treatments of his ailments, as well as providing advice for maintaining health.

#### IV. FACTORS CONSIDERED FOR THE DIAGNOSIS OF DISEASE:

For the diagnosis of disease, it is necessary to consider age of patient, gender of patient, physical signs and symptoms observed. Medical science is huge branch of science. But the present paper has been confined to knowledge base system in medicine with special reference to consulting physician. Here the paper contains all the disease with fever as main symptom along with other symptom.

Fever Type	Diseases
Fever	Meningitis, Aseptic, Lyme Disease, Rocky Mountain Spotted Fever, Amebiasis, Malaria
Fever with Chill	Atrial Myxoma, Toxic Shock Syndrome, Tonsillitis, Mononucleosis, Diphtheria, Lymphoma
Fever with Swollen Lump	Mumps, Salivary Gland Infection, Dental Abscess, Thyroiditis ,

So consulting physician must first decide which type of fever patient having. Then again disease wise there are number of other symptoms. So consulting physician must carefully ask the symptoms.

#### V. STATEMENT OF THE PROBLEM

To diagnosis patients, knowledge of symptoms that are provided by patient, history of patient, signs and symptoms that are observed by the doctor are important. To treat a patient having different symptoms is really a challenge to the doctor. Hence different types of clinical data which contains symptoms and disease of that symptom is main part of knowledge based system.

India's population is very high. The ratio of expert physicians in proportion with population is very small. Expert physicians are not available in rural and remote places. To overcome this problem the best solution is capture the knowledge from the experts and prepare the rule based expert system which is a new diagnosis technique to solve the problem. It is observed that almost 70 % patient that approach to consulting physician are having very basic disease. In this case the rule based expert system helps to minimize the delay in the treatment of

the patient .This system is helpful for the medical students, junior doctors and doctors who are practicing at remote places.

## VI. DESIGN FOR KNOWLEDGE BASE SYSTEM

To design the knowledge based system following components are to be considered.

A) User Interface: User interface is very important part of KBS system. User Interface must be Friendly, self Intelligent, easy to handle.

B) Databases: Any system is intelligent if and only if database contain perfect information of problem. One important feature of knowledge based system is the way they (usually) separate domain specific knowledge from more general purpose reasoning and representation techniques. For Knowledge based system in medicine the database contains huge number of signs and symptoms along with disease, personal information and history of patient.

Sample database structure of KBS in medicine for consulting physician contain following information

- 1) Patient's personal information like case paper number, name, gender, age, blood group
- 2) Patient's diagnosis information like case paper number, symptoms, diagnosis
- 3) Knowledge base information includes disease information along with it's all symptoms divided into three tables 1) symptom1, symptom2, symptom3.

- 1) Symptom1 table contains symptom number and main symptom

Symptom Number	Description
1	Fever
2	Fever with Chill
3	Fever with swollen lump

- 2) Symptom2 table contains sub major symptom number and group of symptoms. Some example are as follows.

Rule number	Symptom1
S1.1	constipation or diarrhea , abdominal pain , tenderness, fatigue , joint pain , sore throat , weakness
S1.2	recent sore throat , chest pain , shortness of breath , joint pain , jerking movements

S2.1	red, sore throat , painful swallowing , difficulty swallowing , painful lumps in the neck
S2.2	severe sore throat , difficulty in swallowing , difficulty in speaking , painful lumps in the neck , difficulty in breathing
S3.1	headache , neck stiffness , sensitive to light , tenderness over sinuses , pain above eyes or over cheeks , nasal discharge
S3.2	tenderness over sinuses , pain above eyes or over cheeks , nasal discharge , headache

3) Symptom3 table contain symptoms of particular disease along with disease name.

Symptom no	Symptoms	Diseases
S1.1.1	Cough ,nausea, vomiting, fever usually higher in the evening, exhausted , a roseis spots rash may develop on the chest, abdomen and the back, complications can lead to gastrointestinal bleeding	Typhoid Fever
S2.1.1	tender , headache , pain may radiate to the ear , young children may refuse to eat or occasionally develop vomiting , the tonsils appear red , swollen , may have small white patches on them	Tonsillitis
S3.1.1	middle ear infections typically produce earache , a feeling of fullness in the ear , dizziness , irritability	Meningitis

C) Inference Engine: The purpose of the inference engine is to seek information and relationships from the knowledge base and to provide answers, predictions, and suggestions in the way a human expert would. The inference engine must find the right facts, interpretations, and rules and assemble them correctly. Two types of inference methods are commonly used Backward chaining is the process of starting with conclusions and working backward to the supporting facts. Forward chaining starts with the facts and works forward to the conclusions.

Expert-system shell provides customizable inference engine In medical science every disease has huge number of symptoms. So inference engine must use heuristic search method for

perfect diagnosis. Forward chaining inference method is used to for this system. Here to develop knowledge base system in medicine for consulting physician

D) Knowledge Base system It contains much of the problem solving knowledge. Rules are of the form IF condition THEN action. Condition portion of the rule is usually a fact - If some particular fact is in the database then perform this action. Action portion of the rule can include actions that affect the outside world (print a disease name on the terminal). Rules can be specific. Rules can be heuristics (e.g. If fever AND constipation or diarrhea AND abdominal pain and tenderness AND fatigue AND joint pain AND sore throat AND weakness AND cough AND nausea AND vomiting AND fever usually higher in the evening AND exhausted AND a roseis spots rash may develop on the chest, abdomen and the back AND complications can lead to gastrointestinal bleeding Then Diagnosis is Typhoid Fever ). That means depending upon the symptoms ,KBS will provide the perfect diagnosis.

#### VII. MODEL BUILDING:

The implementation stage takes as its primary input. Model includes menus, dialogs, and data management forms, data reporting formats, and specialized procedures and functions. Appropriate test cases will be developed for each set of functionally related model, and an online help system will be developed to guide users in their interactions with the model.

When user select patient information option from menu following screen will appear on screen. To add new patient information press new button.

The screenshot shows a web application window titled "KRANTI-KBS IN MEDICINE". The main content area is titled "Patient Information" and contains the following form elements:

- Case Paper No:** Text input field containing "8".
- Date:** Dropdown menu showing "11/10/2008".
- Name:** Text input field containing "RAHUL PATIL".
- Age:** Text input field containing "53".
- Gender:** Radio button selection with "Male" selected and "Female" as an option.
- SYMPTOM 1:** A section with three radio buttons: "Fever with rash" (selected), "Fever with swollen lymph glands", and "Fever with Chill".
- Navigation Buttons:** A vertical stack of buttons labeled "New", "Save", "Report", and "Home".

Here user must enter Name of patient age and gender. Next is symptoms selection. By using normalization symptoms are divided into three groups. Kranti knowledge based system covers all the diseases in which fever is one symptom. So first stage user can select type of fever i.e whether the patient is suffering from 1) only fever 2) fever with chill or 3) fever with swollen lump.



Symptom selection

KRANTI-KBS IN MEDICINE

**Patient Information**

Case Paper No  Date

Name  Age  Gender  Male  Female

**SYMPTOM 1**

Fever with rash    Fever with swollen lymph glands    Fever with Chill

**SYMPTOM 2**

constipation or diarrhea ,pink skin rash on chest and abdomen ,abdominal pain and tenderness ,fatigue ,joint pain ,fever ,sore throat ,weakness

recent sore throat ,fever ,chest pain ,shortness of breath ,joint pain ,red rash ,jerking movements

tick bite, usually occurs in summer,fever ,pink or hemorrhagic rash on wrists and ankles ,headache ,muscle aches

occurs in late winter and early spring ,outbreaks in crowded living conditions ,skin rash ,fever ,stiff neck ,confusion ,fatigue ,headache I

rash with pustules (white appearing caps) ,widespread rash ,fever and chills ,increased incidence with dialysis shunts ,iv drug users ,indwelling catheters or pacemakers

occurs most commonly in hospitalized patients ,severely ill or burn patients ,red rash which has ,emorrhage in it ,fever and chills

increased incidence with use of antibiotics, immune suppression and leukemia ,many small pink lesions on trunk ,arms and legs ,painful swallowing ,red ,painful eye ,fever and chills ,painful urination

history of indwelling catheters ,history of artificial heart valves ,history of intravenous drug use ,small red rash ,sometimes hemorrhagic ,rash on fingers ,palms ,toes and soles ,rash on white area of the eye ,fever and chills ,chest pain ,shortness of breath

most common in young females, those using tampons ,joint pain ,diffuse rash followed by scaling of skin in hands and feet ,fever and chills ,muscle pain

**SYMPTOM 3**

cough and nausea and vomiting and fever usually higher in the evening and exhausted and a rose colored skin rash may develop on the chest ,abdomen and the back and complications can lead to gastrointestinal bleeding

recent sore throat ,fever ,chest pain ,shortness of breath ,joint pain ,red rash ,jerking movements

and Shaking chills with fever develop, these may last anywhere between 15 minutes and 1 hour and rupture of red blood cells that are infected with parasite and sweating occurs after the fever and this cycle of symptoms repeats itself every 48-72 hours and Anemia can develop due to destruction of the red blood cells and shortness of breath and generalized weakness and pallor, rapid heart rate and exercise intolerance

New

Save

Report

Home

After selecting the symptom1, depending upon symptom selected in symptom1 system can display list of symptom2. Symptom2 contains group of symptoms. Select one group. Again depending upon group selected in symptom2, system will display symptom3. Again select one group. Now system will display disease name.

## Patient Information

Case Paper No  Date

Name  Age  Gender  Male  Female

## SYMPTOM 1

Fever with rash  Fever with swollen lymph glands  Fever with Chill

## SYMPTOM 2

- constipation or diarrhea ,pink skin rash on chest and abdomen ,abdominal pain and tenderness ,fatigue ,joint pain ,fever , sore throat ,weakness
- recent sore throat ,fever ,chest pain ,shortness of breath ,joint pain ,red rash ,jerking movements
- tick bite, usually occurs in summer,fever ,pink or hemorrhagic rash on wrists and ankles ,headache ,muscle aches
- occurs in late winter and early spring ,outbreaks in crowded living conditions ,skin rash ,fever ,stiff neck ,confusion ,fatigue ,headache I
- rash with pustules (white appearing caps) ,widespread rash ,fever and chills ,increased incidence with dialysis shunts, iv drug users, indwelling catheters or pacemakers
- occurs most commonly in hospitalized patients ,severely ill or burn patients ,red rash which has ,emorrhage in it ,fever and chills
- increased incidence with use of antibiotics, immune suppression and leukemia ,many small pink lesions on trunk ,arms and legs ,painful swallowing ,red ,painful eye ,fever and chills ,painful urination
- history of indwelling catheters ,history of artificial heart valves ,history of intravenous drug use ,small red rash ,sometimes hemorrhagic ,rash on fingers, palms, toes and soles ,rash on white area of the eye ,fever and chills ,chest pain ,shortness of breath
- most common in young females, those using tampons ,joint pain ,diffuse rash followed by scaling of skin in hands and feet ,fever and chills ,muscle pain

## SYMPTOM 3

- cough and nausea and vomiting and fever usually higher in the evening and exhausted and a rose colored skin rash may develop on the chest ,abdomen and the back and complications can lead to gastrointestinal bleeding
- recent sore throat ,fever ,chest pain ,shortness of breath ,joint pain ,red rash ,jerking movements
- and Shaking chills with fever develop, these may last anywhere between 15 minutes and 1 hour and rupture of red blood cells that are infected
- with parasite and sweating occurs after the fever and this cycle of symptoms repeats itself every 48-72 hours and Anemia can develop due to destruction of the red blood cells and shortness of breath and generalized weakness and pallor, rapid heart rate and exercise intolerance

New

Save

Report

Home

Diagnosis is Typhoid Fever

## VIII. INTEGRATION AND TEST STAGE

Kranti model is tested in the hospital. This model is implemented into number of hospitals for testing, where the expert doctors are present. The diagnosis made by doctor is exactly same as by model. This model produced proper result.

## IX. CONCLUSIONS

- In KBS knowledge is collected from different consulting physician. So it is more expert.
- Improved quality of decision making.
- A speed-up of human professional work.
- Within hospital, major internal cost saving is possible using KBS.
- Preservation of scarce expertise in the medical science.
- It assists in the diagnosis of diseases to doctor in some critical cases.
- Experts were trust more on of KBS advice than novices.



- Novices relied more heavily on the KBS than experts.
- KBS in medicine is more useful in villages where doctors are not available. One Personal computer and trained operator can make initial diagnosis.
- A large database of knowledge can be added to and kept up-to-date - it can store more knowledge than a person.
- The system cannot 'forget' or get facts wrong.
- It survives forever. There is no loss of knowledge as in case of doctor.
- The computer can access specialist knowledge that a doctor may not have.
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## X. SUGGESTIONS

To create a rule-based system for a given problem, you must have (or create) the following:

- A set of facts to represent the initial working memory. This should be anything relevant to the beginning state of the system.
- A set of rules. This should encompass any and all actions that should be taken within the scope of a problem, but nothing irrelevant. The number of rules in the system can affect its performance, so you don't want any that aren't needed.
- A condition that determines that a solution has been found or that none exists. This is necessary to terminate some rule-based systems that find themselves in infinite loops otherwise.

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