Intelligence Answering about Tuberculosis Using Forward Chaining Approach

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Abstract

An expert system is a computer based system that user knowledge, facts and reasoning techniques to solve problems that normally require the abilities of human experts. Experts systems for the diagnosis of the health problem are set out the fatigue of the role of the caretaker. In order to build the knowledge based of the expert system, it has been necessary to design a model of the problem: once this model is defined the knowledge based is composed by a set of rules constructed in logic. This paper is intended to develop the Rule-based system for diagnosis of Tuberculosis. The knowledge base of an expert system is often rule base, the system has a list of rule which determine what should be done in different situations. The rules are called production rules. Forward chaining is the general concept of data-driven reasoning that is, reasoning in within an agent to derive conclusions from incoming percepts, often without a specific query in mind.

The purpose of this paper is to support the way that ensures the most effects of complications. This proposal builds a rule-based expert system for diagnosis of Tuberculosis to give the knowledge of Tuberculosis concepts. It is an effective way and easily to diagnose the Tuberculosis with related treatment.

1. Introduction

Tuberculosis (TB) is caused by infection with My Co-bacterium tuberculosis (MTB) which is part of a complex of organisms including Mbovis (reservoir - Cattle) and Mafricanum (reservoir human). It is difficult to give an exact definition of term "Tuberculosis" for organisms which are harmless to the body in certain conditions may become dangerous in other conditions. For instance the Military of Pulmonary are not only disease in small does, but are threatening for the maintenance of a healthy condition of the body. In large quantities however they act as acute cavitations capable of distorting life. Broadly speaking, Tuberculosis may be caused as any organisms in what every way produced ill-health, disease or death. It may be of consolidation pulmonary, lymph node, enlargement, Monoarthritis, Hypnosis, Cavitations and Pericarchial effusion etc.

Expert system can be designed for specific hardware and software configurations, or they can be software systems that are designed to run on a general purpose computer. The knowledge, the expert system uses is made up of either rules or experience information about the behavior of the elements of a particular subject domain.

Expert system is important role to calculate the various factors as a human being. To make the decision more quickly for expert systems is too constructed by the knowledge base using the knowledge based expert system the user can solve the problem in an organization. Knowledge base expert systems are integrated with AI and it is very easy and quickly by solving the problem in a short time [1]. By using the expert system people are simulated the human manner in various holds with supporting input or aids. In rule based expert system the user make a simple form according to the user's created system. The system represents the knowledge as a series of production rules used for diagnosis of Tuberculosis. Our proposed system expects to support physician in decision making for medical diagnosis of Tuberculosis and to improve the accuracy and to support some knowledge to the user who have no knowledge about the disease. The rest of this paper is structured as follows; Rule based expert system is presented in section 2, Diagnosis of Tuberculosis (TB) with Inference Forward Changing aspects are presented in section 3 and detail, design and implementation are expressed in section 4 and section 5. Finally, the section 6 is conclusion.

2. Artificial intelligent knowledge based Utilization

A knowledge base is special kind of database for knowledge met. It provides the means for the computerized collection, organization and retrieval of knowledge. Knowledge bases are categorized into two major types: Machine readable knowledge bases stored knowledge in a computer-read able form, usually for the propose of having automated deductive reasoning applied to then. They contain a set of data, often in the form of rules that describe the knowledge in a logically consistent manner, logical operator, material simplification and negation may be used to build it up from the atomic knowledge. Human-readable knowledge bases are designed to allow people to retrieve and use the knowledge they contain primarily for training purposes. The most important aspect of knowledge base is the quality of information it contains. The best knowledge base has carefully written articles that are kept up to data excellent information on retrieval system. (Such as search engine) and carefully bases have an AI component. These type bases can suggest solutions to problems, sometimes based on feedback provided by the user, and are capable of learning from experience.

3. Type of expert system

Expert systems are various kinds of knowledge-based system. According to this classification, an expert system is one whose behavior is so sophisticated that would call a person who performed in a similar manner an expert.

In the commercial would, however, system are emerging that can perform effectively and efficiently tasks for whose education user really do not need an expert. Such systems are referred to as knowledge-based systems.

The distinction between the two types may not be so sharp when it comes to reality. Many systems involve both documented knowledge and undocumented expertise. Basically it is a matter of how much expertise is included in the systems that classifies them in one category or the other knowledge systems can be constructed more quickly and cheaply than expert system. There are many expert systems. This system has been used rule-base expert system.

3.1. Rule base expert system

Expert systems are various kinds of knowledge-based systems. According to this classification, an expert system is one whose behavior is so sophisticated that we would call a person who performed in a similar manner an expert.

Knowledge systems can be constructed more quickly and cheaply than expert systems. Many commercial expert systems are rule based because the technology of rule-based systems is relatively well developed. In such systems the knowledge is represented as a series of production rules.

3.1.1 Knowledge base

Contain must of the problem solving knowledge. Rules are of the form IF condition THEN action. Condition potion of the rule is usually fact (If some particular fact is in the database then performs action). Action potion of the rule can include actions that affect the outside world test another rule. Add a new fact to the database (if it is raining then road is wet). Rules can specific a priori rules. Rules can be heuristics rules can be changed together. E.g.. " if A then B" " if B then C" since A..> B..> C so " if A then C".

3.1.2. Inference engine

General problem solving knowledge or methods, interpreter analyses and processes the rule. Scheduler determines which rule to look at the next. The search portion of a rule based system it takes of the heuristic information. Otherwise, the time to solve a problem could become prohibitively long. This problem is called the combinatorial explosion. Expert system shell provides customizable inference engine. The rules are initially designed expert by human expert. The knowledge base of an expert system is rule-based the system has a list of rule which determine what should be done in different situations [6].

3.1.3. Structure of rule base expert system

The production model is based on the idea that humans solve problems by applying knowledge (expressed as production rules) to a given problem represented by problem-specific information. The production rules are stored in the long-term memory and the problem-specific information or facts in the short- term memory.

The knowledge base contains the domain knowledge useful for problem solving. In a rule-based expert system, the knowledge is represented as a set of rules. Each rule specifies a relation, recommendation, directive, strategy or heuristic and has the IF (condition) THEN (action) structure. When the condition part of a rule is satisfied, the rule is said to fire and the action part is executed.

The database includes a set of facts used to match against the IF (condition) parts of rule stored in the knowledge base.

The inference engine carries out the reasoning where by the expert system reached a solution. It links the rules given in the knowledge base with the fasts provided in the database.

The explanation facilities enable the user to ask the expert system how a particular conclusion is reached and why a specific fact is needed. An expert system must be able to explain its reasoning and justify its advice, analysis or conclusion. The user interface is the means of communication between a user seeking a solution to the problem and an expert system [7].

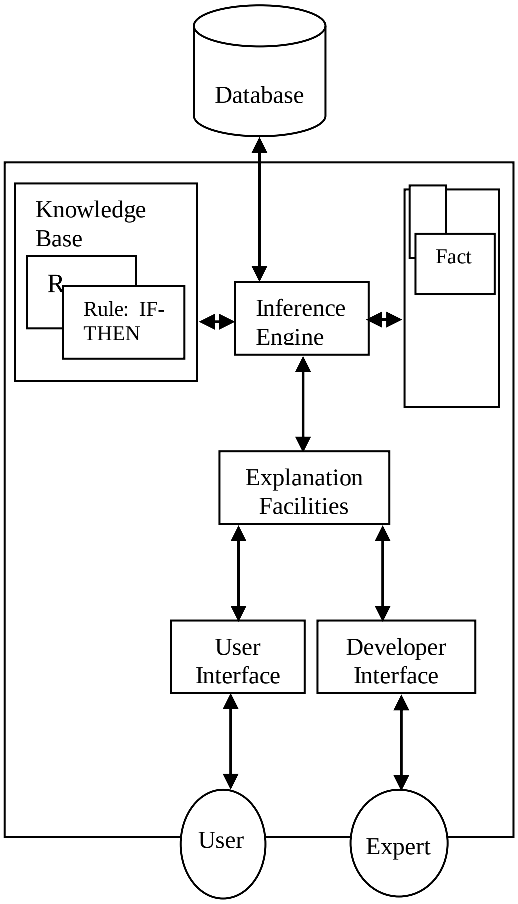

Figure 1. Complete structure of a rule-base expert system

4. Diagnosis of tuberculosis (tb) with inference forward chaining aspects

Tuberculosis is a disease which courses virus. In Myanmar 90% of people are infected with M. tuberculosis. In the kind of tuberculosis, Pulmonary Tuberculosis is common during the public. Among the external parts of the lung, it involves Pleural Effusion, TB meningitis, TB spire, TB glands, skeleton TB, argental canal TB, reproductive organs TB, Brain TB and intestinal canal TB. Not only Tuberculosis but also Extra Pulmonary TB is found in a HIV positive man.

4.1. Classification of TB

In the two kinds of tuberculosis, Pulmonary Tuberculosis and Extra Pulmonary Tuberculosis. Pulmonary Tuberculosis has Smear Positive Pulmonary TB and Negative Pulmonary TB. Negative Pulmonary TB severe and not severe. Severs has

(i) in X-ray, wounds in moronic cavity and

(ii) smear negative pulmonary TB but sever TB.

4.2. Diagnosis of tuberculosis (TB)

The user can regard as a doubtful TB man can be regard based on these facts. Having a cough for more than 3 weeks. Smearing, Getting / becoming thinner more and more. Other signs of thoracic cavity are Bleeding in smearing, Bleeding with cough, having pain in thoracic cavity etc. Other general signs are Body temperature gets higher and higher, Sweating at night, Fatigue so on. We can also diagnosis of tuberculosis based on related major signs.

4.3. Treatment of tuberculosis (TB)

Table 1. Treatment Schedule

Category of tuberculosis	Initial phase	Continuation phase
1. New cases of smear-positive pulmonary TB Severe extra-pulmonary TB Severe smear-negative pulmonary TB Severe concomitant HIV disease	2 months H3R3Z3E3 or 2 months H3R3Z3E3 2 months HRZE or 2 months HRZE	4 months H3R3 4 months HR 4 months HE
2. Previously treated smear-positive pulmonary TB H3R3E3 Relapse Treatment failure Treatment after default	2 months H3R3Z3E3S3/1 month H3R3Z3E 2 months HRZES/1 month HRZE	5 months 5 months HRE
3. New cases of smear-negative Pulmonary TB less	2montha H3R3Z3E3 2 months HRZE	4 months H3R3 4 months HR 6 months HE

A variety of highly effective short- course regimens are available: choice depends on local health resources and infrastructure. They are based on the principle of an initial intensive phase followed by a continuation phase to destroy any remaining bacteria. The subscript after the letter refers to the number of doses per week; daily has no subscript. H= isoniazid; R= rifampicin; Z=pyrazinamide; E= ethambutol; S=streptomycin. A continuation phase of 6 months HE has a higher failure and relapse rate than a continuation phase of 4 months of HR but can be used for mobile patients and those with a limited access to health services; the HE regimen can also be used concomitantly with antiretroviral treatment of HIV-infected patients. Treatment should be guided by sensitivity testing. Ethambutol may be omitted in the initial phase of category 3 patients if disease is non-caviars, smear –negative pulmonary TB, or if patients are known to have a drug- susceptible organism, or for young children with primary TB.

4.4. Forward chaining approach

The completeness of resolution makes it very important inference method. Real-world knowledge bases often contain only clauses of restricted kind called Horn clauses. A Horn clause is a disjunction of literals of which at most one is positive. The restriction to just one positive literal may seem some what arbitrary and uninteresting, but it is actually very important for three reasons:

1. Every Horn clause cab be written as an implication whose premise is a conjunction of positive literals and whose conclusion is a single positive literal.
2. Inference with Horn clause can be done through the forward chaining algorithms.
3. Deciding entailment with Horn clauses can be done in time that is linear in the size of the knowledge base.

This last fact is a pleasant surprise. It means that logical inference is very cheap for many propositional knowledge bases that are encountered in practice [4].

4.5. Forward chaining algorithm

The forward–chaining algorithm PL-FC-ENTAILS? (KB, q) determines whether a single proposition symbol q- the query is entailed by a knowledge base of Horn clauses. Function PL-FC-ENTAILS? (KB,q) returns true or false

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inputs: KB, the knowledge base, a set of
            propositional Horn clauses.
        q - the query, a proposition symbol
local variables: count , a table, indexed by clause,
            initially the
        number of premises
        inferred , a table, indexed by symbol, each
        entry initially false
        agenda, a list of symbols, initially the
        symbols
        known to be true in KB
while agenda is not empty do
        p⟵ Pop (agenda)
        unless inferred [p] do
         inferred [p]⟵ true
          for each Horn clause c in whose premise
          p appears do
              decrement count [c]
                if count[c] = 0 then do
                   if HEAD [c]=q then
       return true
                PUSHCHEAD[c],(agenda)
       return false
```

Forward chaining is sound: every inference is essentially an application of Modus Pones. Forward chaining is also complete: every entailed atomic sentence will be derived. The easiest way to see this to consider the final state of the inferred table. Furthermore, any atomic sentence q that is entailed by the KB must be true in all its models and in this model in particular. Hence, every entailed sentence q must be inferred by the algorithm.

5. System design

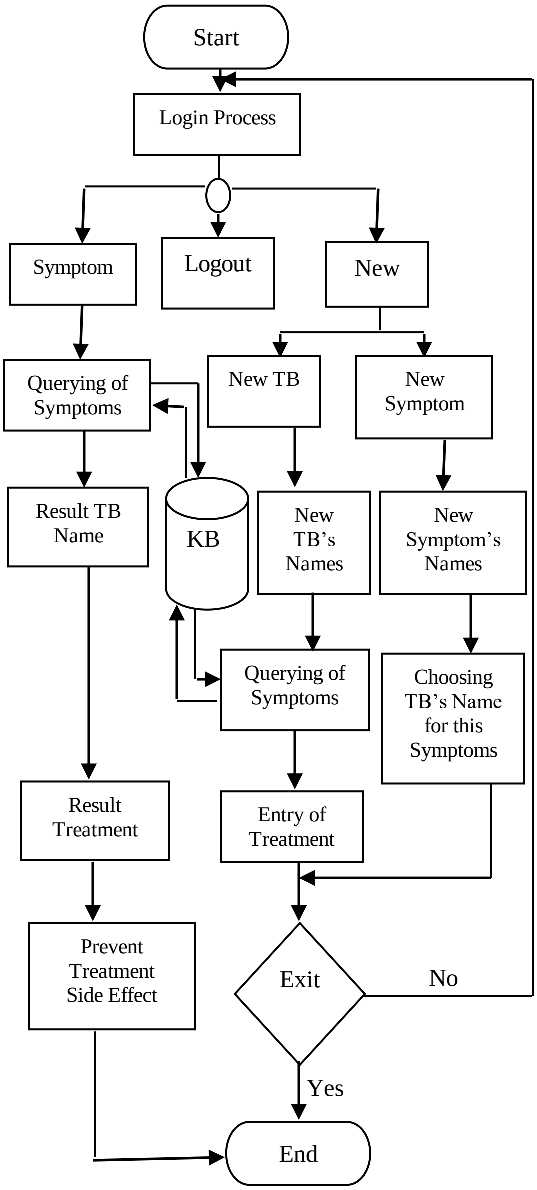

Figure 2. System flow diagram

The system design can be seen the entry of symptom data portion and display the information of diagnosis Tuberculosis. At the entry of symptoms Tuberculosis, the system can perform the following functions. There are two categories to choice before processing, create new user and login (old user). Each of them can be activated by selecting mouse In this dialog box, the user must enter the old/new name and the old/ new password. Those names and passwords are kept in security passed table of the database. After that, figure 2 is the query system form will open.

In this form, there are four categories: Symptom, Add new and Logout. The user can choose each of them. The user must answer each question till the end of the question in query symptom form.

6. System implementation

If user wants to know a Tuberculosis name and its treatment, the user can choose treatment button. When symptoms dialog box appear, the user must select the correct answer.

If the user answers non-specific answer for a question, invalid answer form will appeared. To entry the new symptoms by admin, choose the "New" button from query system form. After entered a new symptom, it is asked the existing Tuberculosis to check that this symptom which is concerned Tuberculosis or not, and then update in the symptom database. Admin can entry new Tuberculosis by using "New" button from query system form. The admin must enter and update the treatments in database.

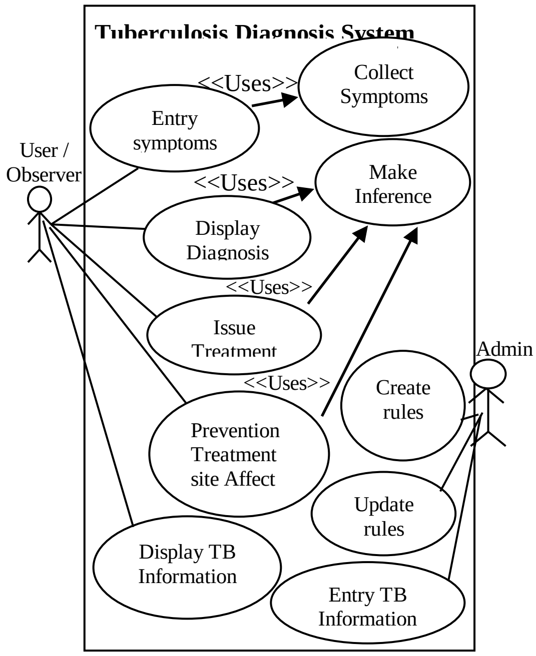

Figure 3. Use case diagram of TB diagnosis system

(1) Actor

(i) User

In this system, the user can operate two ways. Firstly the user can entry the symptoms and query the expected tuberculosis. Next user can ask the symptom giving the tuberculosis name

(ii) Admin

Admin can create and update the rules of system.

(2) Use Case

(i) Entry Symptom

In this system, Entry Symptom of the case can be allowed all of user's symptoms which are made inference and save to a file.

(ii) Display Diagnosis

Display Diagnosis of use case can be allowed the tuberculosis name which satisfies the patient's entry symptoms.

(iii) Issue Treatment

Issue Treatment of use case can allow the antidote treatment to treat patient of being tuberculosis name.

(iv) Prevent Treatment site affect

This use case can allow the require prevention for treatment site affect.

(v) Display Tuberculosis Information

Tuberculosis information of use case can express the information of tuberculosis and its treatment.

It can allow the entry tuberculosis and symptoms to update in the knowledge base.

(vi) Create Rules

Create Rules of use case can create new tuberculosis and their symptoms.

(vii)Update Rule

Update Rule of Use Case can allow the entry tuberculosis and symptoms to update in the database.

(xi)Entry Tuberculosis Information

Entry tuberculosis information of Use Case can allow entering the treatments of new entry tuberculosis and displaying the information.

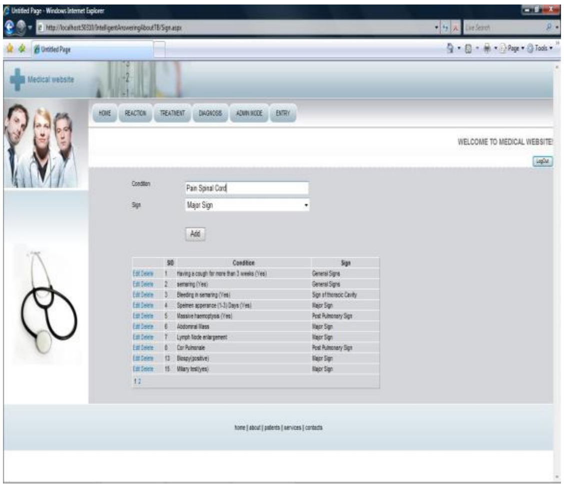

Figure 4. TB signs

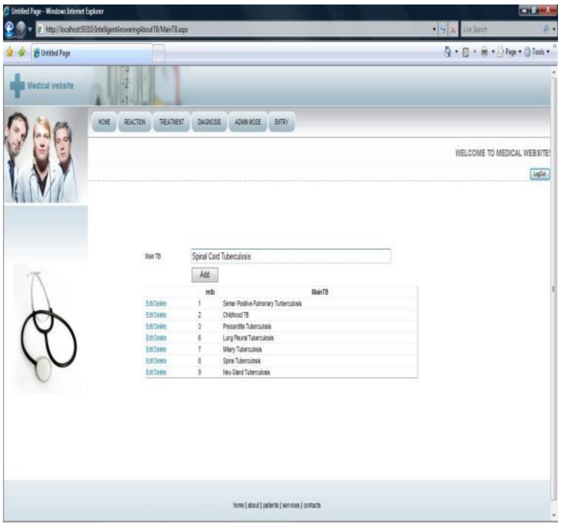

Figure 5. Tuberculosis Rule Builder Form

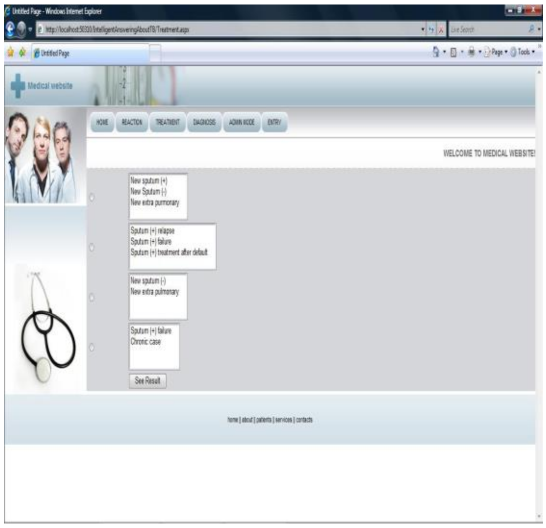

Figure 6. TB Side Effect

7. Conclusion

In this paper, a computerized system is presented in which consists of questions, systems of tuberculosis persons, diagnosis and treatment are presented. By using it, the correct decision and good treatment of Tuberculosis cases have been got.

The graphical screen format is also created in viewing symptoms of tuberculosis person, information of the irritant tuberculosis. Therefore, user can easily choose the symptoms, diagnosis and treatment to activate the expert process. The system makes quickly and easily by using expert knowledge. The final decision can be achieved in a short period. The user who has the symptoms of Tuberculosis are admitted to get the information of various tuberculosis and treatment of various tuberculosis cases.

8. References

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