

Clinical Decision Support System for Treatment and Management strategies of COPD

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Abstract- In this advanced technology most of the modern hospitals are adopting Clinical Decision Support System (CDSS) model for the diagnosis and management of most of the medical related problems. The system plays a vital role in medical decisions. In the present study, we are developing a CDSS which helps the physician to take better medical decision on the diagnosis of Chronic Obstructive Pulmonary Disease (COPD). The system also helps to take appropriate decision on treatment and management strategies for patients who are suffering from COPD. COPD is an increased inflammatory immune response to the lungs to particles and gases, from cigarette smoke, neutrophils. COPD is considered as a long term dysfunction, disease but its natural history as it occurs at intervals by periods of acute deterioration or exacerbations. Patients with COPD can have a sign of relief and be positive in today's generation because new medical therapies with alternate remedies. Any disease requires well-planned management strategies. In this paper we have designed a CDSS for treatment and management for COPD.

Keywords- COPD, CDSS, Treatment & Management strategies.

I. INTRODUCTION

By 2020 COPD is expected to be the third largest disease in the world [1], so it gained lot of importance in medical profession for its accurate diagnosis and treatment. In this application we have an attempt to design a Clinical Decision Support System which helps the physician to take the vital decision for treatment and management strategies for COPD. The decision on the treatment and management for COPD can be taken by our application based upon the various stages of the COPD. It advises the chronic patients regarding drugs, habits, life style, food, exercises etc. It also covers pulmonary rehabilitation which is most effective management strategy. CDSS has been a vital in the field of Bio-Medical. It has been used in various field for taking appropriate and quick decisions. To design a CDSS we need a domain expert with a good knowledge of the domain and also expert doctors relating same field. In this application as mentioned prior we are designing and developing CDSS for treatment and management strategies for COPD, we are using the GOLD criteria for prescribing the drugs, inhalers and others medication details to the patients. The CDSS has been designed not only to provide the treatment and management strategies but also has been framed with some questions which help the patients to quit smoking which is very important for a COPD patient having smoking habit. Along with it if the patient is aged above 55 this application also helps to conduct Dementia & Depression test which is very common comorbidity in COPD patients.

II. LITERATURE SURVEY

An organized and complete search of medical works record was checked using detailed pursuit procedure through a combination of free-text finding terms and medical topic titles. Searching titles involved words related to COPD, bronchitis, and pulmonary emphysema, and for epidemiology as well as frequency, familiarity, level of mortality, and risk of dying [4].

Composition was checked in two phases by analyst using old inclusion and exclusion criteria, phase1 is comprise reviewing all titles and abstract weather to keep or remove them, and phrase2 covers the full text of articles identified in phrase1 to preserve or eradicate from data extraction.

Report was included, if they designate incidence, prevalence and transience in COPD or course such information for nations of interest. The initial summit, of what is expected to be a extensive successively annual succession, carried together advisers in breakdown remedies to discover several difficulties and tasks aspect by clinicians once dealing respiratory organ sicknesses, particularly respiration syndrome and COPD. The combination of COPD and the mission to lump substitute populations, or phenotypes, the percentage sure shows features foreseeing answer to detailed conduct devices were conjointly declared.

This encompassed discussion of the tackles existing to measure the effect on patient's day-to-day life, the role of carnal movement in COPD equally predict and rehabilitation, the impact of co morbidities.

III. METHODOLOGY

CDSS has been a vital in the field of Bio-Medical. It has been used in various field for taking appropriate and quick decisions. To design a CDSS we need a domain expert with a good knowledge of the domain and also expert doctors relating same field.

In the application as mentioned prior we are designing and developing CDSS for treatment and management strategies for COPD, we are using the GOLD criteria for prescribing the drugs, inhalers and others medication details to the patients.

The GOLD criteria program was discovered in the year 1998 with an aim to give better treatment and management strategies for the patients suffering from COPD. From 1998 till present there were many updates for the GOLD criteria which have been accepted by the physicians globally.

The CDSS has been designed not only to provide the treatment and management strategies but also has been framed with some questions which help the patients to quit smoking which is very important for a COPD patient. All the question to quit smoking are extracted from GOLD criteria.

It also has a follow up menu which takes care about the next visit of the patient and also helps the doctor remember the last prescribed drugs and other details.

Machine learning is an emerging area of artificial intelligence that provides an increasing variety of algorithms capable of learning patterns from clinical data to predict the models classifying and predicting medical problems. The goal of ML in clinical medicine is to derive models that can use patient specific information to predict the outcome of interest and to thereby support clinical decision-making [3].

IV. OBJECTIVES

- Based upon diagnosis of various stages of COPD, our application helps to plan better treatment and management strategies for controlling the disease.
- To design a module for daily activities, exercises, food and life style for managing the problem.
- To help Patients to quit smoking by conducting "Quit Smoking" test.
- Check Drug-Drug interaction if the COPD patient has other comorbidity disease associated with COPD.
- Check whether patient is suffering from Dementia or Depression if patient is diagnosed with COPD & aged above 55.
- Follow-up for the patients suffering from COPD.

V. ARCHITECTURE

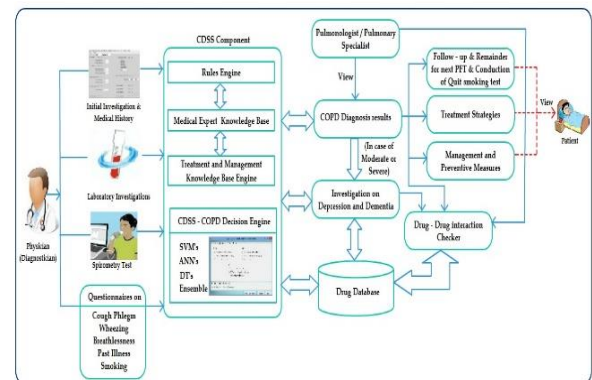


Figure 1. Proposed CDSS for Treatment & Management Strategies

Here we are designing a Clinical Decision Support System for COPD. We first collect the basic information of the patient followed by medical history like smoking history, allergy, TB history, Cardiac problem, Asthma, Wheezing, Breathlessness, Hypertension, and Symptoms of COPD etc. Once the medical history of the patient is collected we conduct Spirometer test, the results of the Spirometer result values (FEV1/FVC) is used for knowing the stage of COPD the patient is suffering. Once the patient is diagnosed with COPD (Mild, Moderate, Severe stage) we have designed Treatment and Management strategies wherein the videos of exercises, yoga's, breathing techniques, Pulmonary Rehabilitation and Medications are available [2].



Figure 2. CDSS Component

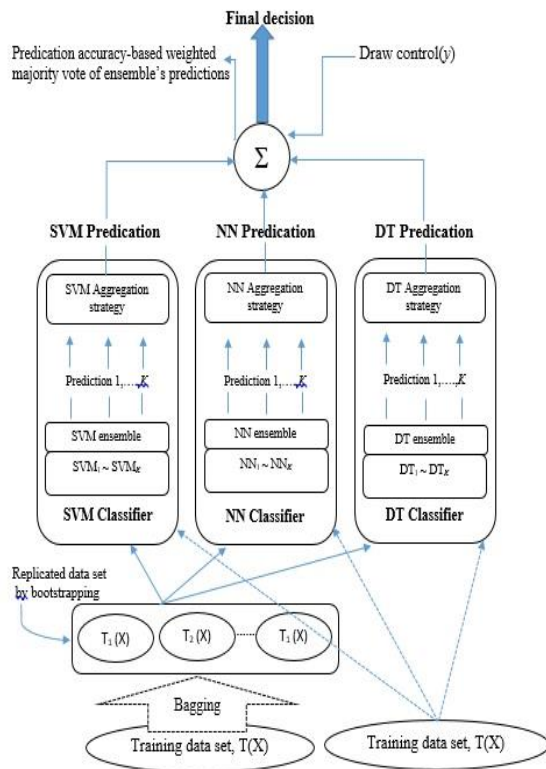


Figure 3. Working of ML module

The proposed CDSS consists of broadly three main objectives:

- ❖ Firstly, designing a Supportive Vector Machine model for the initial evaluation of COPD, this model makes an effort to persuade the standards to distinct COPD patients when assumed a set of patient description and medical reports. This model will help the patients to pursue quick assessment and treatment. Timely finding and precise diagnosis will help the patients improve their quality of life with lowering risk factors and harmful to life.
- ❖ Once it is found that the patient is suffering from COPD, the next stage is to identify the severity of the disease. This is done by the implementation of Artificial Neural Network, by constructing the Multilayer Perceptron Neural Network (MLPNN) with 3 layers can be used to design an efficient Clinical Decision Support System (CDSS) for the diagnosis of various stages of COPD. The MLPNN is trained by back-propagation algorithm which is very efficient method, which is the second objective of our study.
- ❖ Once the stage of the disease is being classified, the next step is to enable improvement of treatment outcomes and to detect the interaction of drugs and the possible side effects associated with it by employing knowledge base system and prediction techniques.

VI. RESULTS

Table 1. Experimental results of various ML algorithms

ML Algorithms	Number of Runs	Classification Accuracy (%)	Sensitivity	Specificity
ANN	10	93.2329	0.941	0.937
DT	10	91.0262	0.901	0.924
SVM	10	94.753	0.936	0.939

The Machine Learning (ML) algorithms applied are Artificial Neural Networks (ANN), Decision Tree (DT) & Support Vector Machine (SVM). ANN has yielded a classification accuracy of 93.23 whereas DT has yielded an accuracy of 91.02 and the SVM was the most optimum ML algorithms among the three algorithms used which has yielded an accuracy of 94.75 for the classification.

VII. CONCLUSION

We have designed a CDSS for treatment and management strategies for COPD which is very helpful for both physicians and patients. The system helps the physicians to take medical decisions on prescribing the drugs, and inhalers to be taken by the patients for controlling the disease. This application also provides a detailed knowledge about the life style habits, food, rehabilitation procedures, follow-up charts and other physical exercises with which the patient can manage and control the pulmonary problem in an effective way. The CDSS also has "Quit Smoking" test which helps the patients quit smoking. The patients diagnosed with COPD and aged above 55, we have to conduct Depression & Dementia test which are part of the proposed CDSS. The Drug-Drug interaction checker is also the part of the proposed CDSS which helps to check the interaction between COPD and its associated comorbidities diseases.

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