Three-Dimensional Healthcare Model for Effective Decision Making

Narendra Kumar Sharma, Shahnaz Fatima, Swati Saxena

Abstract: Healthcare is the right of every human being but shortage of medical professional, healthcare institutions and use of modern information technology, it is not possible to provide high-quality healthcare services to facilitate them. In the developing country like India greater part of peoples are living in rural areas and face principal disaster due to insufficiency of ideal healthcare institutions as well as medical professionals. The rural clinical health centre might also have medicines to grant first aid, but may not have the expertise. People of India in rural areas have to journey long distances to access suitable healthcare which can be the difference between life and death in the case of emergency. It shows that the immense gap between doctor and patient or people and health care system. We attempt to fulfill that gap and proposed a healthcare model to improve healthcare quality and take effective decisions. The proposed healthcare model will capable to take effective decisions for health related issues specially for people of rural India.

Keywords: Rural Healthcare, Data Mining, Healthcare Model, Decision Making.

I. INTRODUCTION

The accessibility and use of high-quality healthcare is the right of every people but lack of quality infrastructure, specialized doctor, good medical functionaries and trained medical staff, we cannot provide high-quality healthcare services to facilities them. When we look about rural people then situation is very significant and precarious. Therefore we need some kind of interface to fulfill the gap between the people and healthcare system to improve healthcare quality. There are various computational methods and techniques are available to use in healthcare domain to overcome these type of situations. Data mining is one of the most important techniques to felicitate from those circumstances. It has the strong ability to create and store, keep and go records electronically throughout the world in a count number of succeeding [1]. It approves each healthcare contributor to posses its very own database of patients and doctors for digital medical record. The thought of data mining is now dealt with from astonishing points on view covering its implications in many fields which include the healthcare division [1]. To accomplish the goal of health and wealth, data mining has strong ability to store, integrate and share healthcare data for assisting treatment, investigation and decision making.

The attempt is to concern with a healthcare to take effective decision for health related issues specially for the people of rural India. We proposed a healthcare model for effective decision making in health related issues to improve healthcare quality and to save lives of rural people of India. The proposed model is based on three dimensional approaches which includes the public healthcare database, rural knowledge base and decision making process. The healthcare database store health related data which include patients basic information and their health related issues. Rural knowledge base make rules for health related issues for further decision making. Decision making process provide assistance to take effective decisions about health related issues.
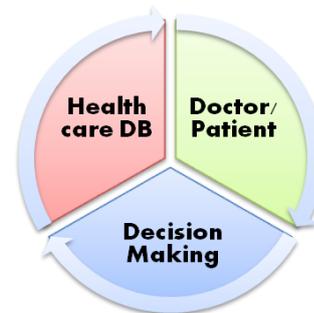
[Fig. 1: Three Dimensional Healthcare Approach]

II. DATA MINING IN HEALTHCARE DECISION MAKING

Data and information retrieval from medical repository or knowledge base acting a progressively exceptionally imperative arrange to help specialists, doctors and domains experts to get to way better medical related information and understanding in arrange to back successful decision making in healthcare. Data mining and medicinal knowledge bases have the capability to move forward data recovery execution and sustain to decision makers for pertinence evaluation and treatment [6]. Data Mining and knowledge base that helps to bring some captivating patterns which means taking out manual tasks and simple information extraction straightforwardly from electronic records and electronic information system that will verify stimulating records, save lives and decrease the expense

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of medicinal services and administrations just as empowering early recognition of irresistible sicknesses based on cutting edge information gathering. Data mining techniques provide the strong capability to find or extract the related and hidden pattern, meaningful data or knowledgeable information from data repository or warehouses. Data mining has the variegated approaches and techniques, which are used for various functions in understanding knowledge discovery [5, 6]. Classification, clustering, statistical techniques, regression, machine learning, association rule, prediction, visualization, etc., are the base for the data mining techniques and methods. The potential of Data mining techniques used in healthcare and medicine as follows [4]:

[Table 1: Data Mining Algorithms & Techniques used in Healthcare Domain]

S. No.	Algorithm/ Techniques	Learning Type	Behavior	Task Performed	Evaluation Criteria	Performance depends on
1.	Classification	Supervised	Predictive	Identifying Class	Accuracy	Correctness of Training Data
2.	Clustering	Unsupervised	Descriptive	Grouping Data	Accuracy	Efficiency
3.	Regression	Supervised	Predictive	Map a data item	Evaluation	Type of function (linear, logistic etc)
4.	Association Rule	Unsupervised	Descriptive	Identifying correlated attributes	Efficiency	Support and confidence value
5.	Prediction	Supervised	Predictive	Predicting future dataset	Accuracy	Past and current data
6.	Summarization	Unsupervised	Descriptive	Maps data into subset	Accuracy	Derived data from data
7.	Time Series Analysis	Supervised	Predictive	visualize time series	Forecasting	Value of an attribute
8.	Sequence Discovery	Unsupervised	Descriptive	Sequential pattern in data	Efficiency	Based on time

III. PROPOSED DESIGN OF THREE-DIMENSIONAL HEALTHCARE MODEL (3D-HCM)

The foremost intend is to concern with a healthcare model to take effective decision for health related issues specially for the people of rural India. The model has technological combination of data mining and knowledge base for data storage, analysis, health care solutions and decision making. The proposed design of Three-Dimensional Healthcare Model for Effective Decision Making (3D-HCM, Figure 2) consists of three modules. They are database module, knowledge base module and decision making module. The database module consists with three stages including data understanding, data preparation and data transformation. The database module will be used to store patients and doctors information. The knowledge base also consists with model building, evaluation and deployment. The knowledge base contains the generalized set of rules obtained from model building phase which will be use in decision making. The decision making module will be used by individuals and medical experts. The decision making process uses the existing public healthcare data and knowledge base retrieved from rural knowledge base for decision making in public healthcare [6].
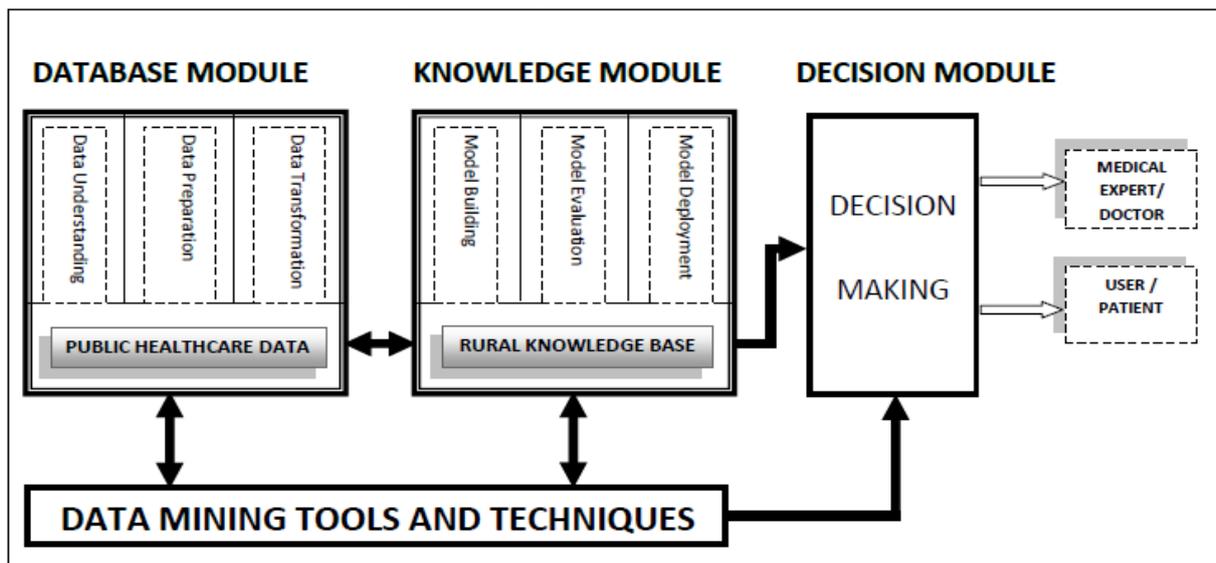

Fig. 2: Proposed Design of Three-Dimensional Healthcare Model (3D-HCM)]

IV. DATABASE MODULE (PUBLIC HEALTHCARE DATA)

The database module consists with three stages includes data understanding, data preparation and data transformation. The data understanding, understand the primary raw data then data will be finalize to prepared for loading into database with the help of data transformation tool. The database module consists with patients database and patients disease database. Patient database have to be used for storage of patients basic info like his/her name, age, gender, address, contact number and other particular details. Patient disease database keep all the information about affected person and their sickness [2]. The information stored in patients disease database includes type of disease, treatments, illness history and other details about laboratory test, investigation and administrating therapy. The patient data will be alienated from other database to improve the patient records storage, so that other department can use the report and data when the patients are referred to them. This method prevents unauthorized use and access of patient data from other department or agencies. It helps to improve the data confidentiality and integrity for further treatment and decision making.

V. KNOWLEDGE BASE MODULE (RURAL KNOWLEDGE BASE)

The knowledge base module consists with model building, evaluation and deployment phase. The knowledge base contains the generalized set of rules obtained from model building phase which will be further use in decision making [3]. In this stage, knowledge is captured from various sources of guidelines followed by public healthcare data. Further knowledge will be extracted from healthcare database by using data mining techniques. The data mining models can be predictive or descriptive type, depending upon the data mining tasks. The knowledge base serves as repository of different models and set of rules & regulations for knowledge to healthcare and decision making. The knowledge base module makes use of the data mining technique to predict patient illness or prerequisites based on previous similar instances or cases [2]. Data from the patient and patient disease database will be further use for examination, analysis and decision making. The knowledge base and the effects of its saved cases will grant direction for the discovery of new relationships in the form of newly brought about decision rules.

VI. DECISION MODULE (DECISION MAKING)

The decision making module uses the available public healthcare data, knowledge extracted from healthcare data by using data mining techniques and model to be used. Decisions will be taken by the medical experts and individuals depending upon the levels of healthcare systems [3]. The proposed healthcare model '3D-HCM' is an impartial process which maintains the record of every patients and their related medical history by approach of desegregation them into a single framework. Accessing data or record is privilege given to hospital, government organization or authentic agencies only for data analysis, examination and decision making. Such type of system reduces the paper work and increase the

accessibility of data anytime [1, 5]. The proposed healthcare model provides an interface between user, patient and medical expert or doctors, where data is store in database module and decision making process uses the existing public healthcare data and knowledge base retrieved from rural knowledge base for decision making in public healthcare. The decision making module will be categorized into following segments:

A. User Module

The user module is accountable for authenticate the users like personal user, hospital staff or any other valid user. Two parameters are involved to authenticate the user to enter valid user name and right password only [1]. If user is valid, then he or she will be allowed to access record put away in database.

B. Medical Expert/Doctors Module

The medical expert or doctor module is accountable to validate the doctors and shows their basic information of his/her qualification, specialization, schedule and belonging hospitals [1, 7]. Only registered doctor will check the patient details through his/her patient ID and ensure the previous treatment details and illness history. Doctor can make use of electronic prescription contains the diagnosis detail, lab reports, medicine list and current health condition.

C. Patient Module

The patient module is accountable to validate the registered patient through his/her patient ID and password. Patient can find appropriate doctor enlist with doctor code, take appointment and get the medical services from hospital [7]. Patient is additionally prepared to utilize their patient ID to buy medicine and taking medicinal services provided by clinics or hospitals. If the hospital and supervision authority permitted, then they can access the electronic health record, medication record, medicinal history, lab reports etc.

VII. CONCLUSION

The proposed healthcare model '3D-HCM' has the capability to amend the present healthcare system to a novel facet. It aptitudes the prospect to convey medical expert and decision maker in one place and change the conventional thinking about treatment and decision making. The '3D-HCM' supports the decision making process uses the existing public healthcare data and knowledge base retrieved from rural knowledge base for decision making in public healthcare. The proposed healthcare model '3D-HCM' works as bridge between people and healthcare system and fulfill the gap between healthcare system and decision makers. The aim is to concern with this healthcare model to take effective decision for health related issues to improve healthcare quality and to save lives of rural people of India.

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AUTHORS PROFILE

Narendra Kumar Sharma: Research Scholar from Amity Institute of Information Technology, Amity University Uttar Pradesh. He obtained his MCA degree from UP Technical University, Lucknow. He presented various research papers in National and International conferences and published many research papers in National and International Journals. His areas of interest are Data Mining, Data Science, Artificial Intelligence and Soft Computing.

Dr. Shahnaz Fatima: Dr. Shahnaz Fatima is MCA and Ph.D. She has completed her PhD from Integral University. Her research area is Human computer interaction. Currently she is working as an Asst. Professor in Amity University. Dr. Shahnaz Fatima has published many of the valuable research papers in various national and international conferences and journals. She is the member of International Association of Computer Science and Information Technology (IACSIT).

Dr. Swati Saxena: She is working as an Assistant Professor in the Department of Computer Applications, Maharana Pratap Engineering College, Kanpur and having 15 years of teaching experience in Computer Science and Applications. She received her PhD degree from Banasthali University, Rajasthan. She has authored a number of research papers and books. Her areas of interest are algorithms, soft computing, data science and related fields.