Journal of Advances and Scholarly Researches in Allied Education
Vol. 20, Issue No. 2, April-2023, ISSN 2230-7540

A Study the overview of Healthcare in India using Machine Learning Techniques

Kunal Gupta[1]*, Dr. Faizanur Rahman[2]

[1] Research Scholar, Kalinga University

[2] Research Guide, Deparment of Computer Science, Kalinga University.

Abstract- In India the term "Healthcare" is usually associated with hospitals, but comprise of multiple aspects like pharmaceuticals, Hospitals, diagnostic Centres, ancillary centers, Health insurance, Telemedicine Healthcare software, medical tourism and medical equipment India's Healthcare Sector presents a not-so-healthy paradox as it is supposed to be. Indian Healthcare sector has not attempted fully to make it competitive. The healthcare sector in India is booming thanks to rising governmental and private investment as well as increased access and usage. The aim of this study to overview of machine learning based models to improve the healthcare sector. In the present scenario, it is essential to leverage machine learning techniques to provide affordable and easily accessible healthcare facilities in India.

Keywords - Healthcare, Machine Learning, Data Mining, Disease Diagnosis

----------X----------

INTRODUCTION

Health care, also known as medical care or medical service, is a system that aims to improve health-related services in order to meet the clinical needs of individuals. Patients, doctors, clinicians, academics, and the healthcare industry as a whole are all working to keep and restore health records. The exponential growth of available data in every industry, including healthcare, has necessitated the development of new data mining tools in recent years. But as the healthcare industry becomes increasingly digitised, medical organisations produce a flood of healthcare data [K. Priyanka, 2014]. Everything having to do with a person's health that is recorded digitally is considered healthcare data [R. Raja 2020]. Including, but not limited to, a patient's medical history, doctors' notes, prescription records, clinical reports, etc. All of this information is extensive, complex, and varied. The increasing complexity of healthcare data makes evidence-based decision making difficult in the current era. In order to maximise the results of any working domain, machine learning, data mining, and statistical approaches are essential areas of study [Rohan Bhardwaj 2017]. When compared to the quantity of data that exists, the rate at which humans can analyse that data is quite low. Given the scarcity of healthcare data analysis specialists, this is of paramount importance in the healthcare industry. Medical practitioners need access to computerised (semi-automatic) Medical Disease Diagnosis Systems (MDDSs) so that they can make more educated and effective treatment decisions for their patients. This will lead to better care, earlier disease diagnosis, and lower healthcare expenses. The primary emphasis of this research is on using machine learning (supervised) techniques to solve classification/prediction issues in healthcare data. Diagnostic speed, precision, and dependability can all be improved by combining data mining techniques with a variety of learning algorithms applied to the healthcare sector.

OVERVIEW OF HEALTHCARE INDUSTRY

Modern health centres comprise not only doctors, patients and medical staff but also various processes, including the patient's treatment. In recent years modern system and techniques have introduced in health-care institutions to facilitate their operations (Electronic Decision Support for Australia's Health Sector, 2002). Huge amounts of medical records are stored in databases and data warehouses. Such databases and applications differ from one another. The basic ones store only primary information about patients such as name, age, address, blood group, case id, admit date, X-ray copy, drug prescription, blood count result, etc. The more advanced ones let the medical staff record patients' visits and store detailed information concerning their health condition (Aftarczuk, 2007). The healthcare industry, also known as the medical industry or the health economy, is an amalgamation & integration of economic sectors that offer products & services for the treatment of patients in the curative, preventive, rehabilitative, & palliative care categories. It entails the creation and commercialization of products & services that support preserving and regaining health. Modern healthcare is organised into several subsectors and

relies on interdisciplinary teams of qualified professionals & paraprofessionals in order to meet the health needs of people and populations (wikipedia, 2016). The healthcare industry is one of the world's most populous and rapidly expanding markets. Wikipedia (2016) reports that in most industrialised countries, health care spending accounts for above 10% of GDP.

HEALTHCARE INDUSTRY OF INDIA

Healthcare has rapidly expanded to become one of India's most lucrative and labor-intensive sectors. The healthcare sector in India is booming thanks to rising governmental and private investment as well as increased access and usage. The healthcare system in India is split between the public and private sectors. The government's public healthcare system focuses on primary healthcare centres (PHCs) in rural areas and a small number of secondary and tertiary care facilities in big cities. Private organisations mostly operate secondary, tertiary, and quaternary care facilities in major, intermediate, and minor urban centres. India has a competitive advantage over its Asian and Western counterparts thanks to its vast reserve of highly trained medical professionals. In India, the price of surgery is around one-tenth of what it would be in the United States or Western Europe. Healthcare costs 10.5% of global GDP on average per country's GDP, making it a high-cost industry for both end-users and providers. (World Healthcare Outlook; EIU, The Economist). Numerous ancillary sectors, including medicines on one extreme & health insurance sector on the other, are supported by the costs.

DATA MINNING APPLICATIONS IN HEALTHCARE

Diagnosis, treatment, prevention, hospital resource management, medical devices, clinical data, new drugs, drug interactions, etc. are just a few examples of what the healthcare industry covers. Data mining techniques are successfully applied to the data produced by these industries, leading to improved management, cost savings, and decision making. Data mining's many uses in healthcare span administration and management, public health, medication discovery, decision support systems, and predictive analytics (Islam et al., 2018). Predictive analytics are used for a variety of purposes, such as predicting hospitalisation, readmission, length of stay, etc. All participants in an industry can benefit from employing data mining techniques.

Extraction of latent patterns, prediction of future outcomes, and the construction of fact-based decision support systems are all part of knowledge discovery in healthcare data (Chawla & Davis, 2013; Celi et al., 2014; Zhou et al., 2010; Santos et al., 2013). Decision support systems can be used for everything from coming up with a treatment strategy to identifying potential complications to providing patients with individualised care to calculating the likelihood of illness and its prognosis. Data mining techniques are also useful for constructing a variety of different applications, including those for gauging the efficacy of treatments, managing data and health, fostering positive customer relationships, and even uncovering instances of fraud and malpractice.

Data mining is utilised in healthcare administration for things like cost prediction, resource utilisation, patient length of stay, and recommendation engines on various different application platforms. When it comes to organising patients, setting up appointments, making suggestions, anticipating groups of patients, and planning for their visits. Key performance indicators, device performance, home healthcare services, training and practise, online forums, and review boards are some other uses.

Models, such as predictive and descriptive models, are used in the development of data mining applications. Supervised learning is used in predictive models while unsupervised learning is used in descriptive models. Clustering, association, correlation, and other statistical measures are utilised for developing descriptive models. Classification & prediction techniques are utilised for model construction. Algorithms like Linear Discriminant Analysis (LDA), Decision Trees (DT), swarm intelligence (SI), Naive Bayes (NB), and regression techniques like logistic regression, linear regression, partial least square, etc. are frequently used in healthcare systems. Biometric data, sensor data, handwritten notes, clinical data, pictures, etc. are only some examples of the wide variety of data used in the healthcare business. Data mining methods are used to extract information like patterns & associations from various types of data. Figure 1 shows how data mining techniques can be implemented in a healthcare setting.

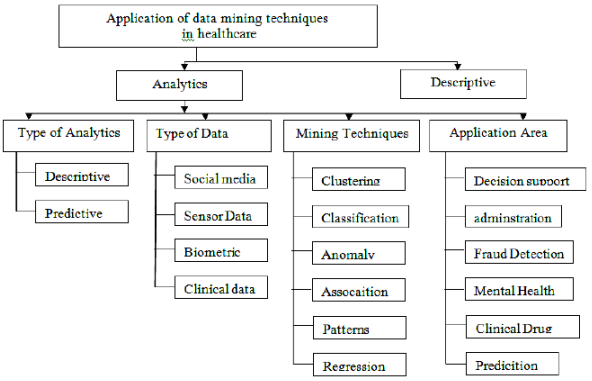

Figure 1 Data mining's Application in the healthcare

Intervention in cognitive development, individualized mental health care, the creation of preventative health programs, the selection of target audiences, the estimation of lifetime value, the provision of platforms for the expert visualization of data, the prevention of the spread of communicable diseases, etc. Drug interactions and side effects can be

uncovered by data mining in the drug discovery process. Additionally, data mining is used for patient privacy research, policy development, data quality research, data sharing research, and sentiment analysis.

DATA ANALYTICS

Healthcare data contains variety of data formats that includes images, EHR, clinical data such as X-Ray, Computed Tomography (CT) scan, sensor data, genomic data, management information such as billing, insurance claims etc. Healthcare analytics refers to effective utilization of healthcare data to develop business insights using analytical approaches. Analytics refers to building methods to capture, store, process and present data in a meaningful manner. Analytics aims to derive solutions from data that can be incorporated for business decisions. Analytical approaches include models developed using statistical and prediction methods to plan, manage, measure and derive evidence based decisions. The data driven decision making methods benefit healthcare institutions to cut cost, manage business process, predict diseases and improve treatment effectiveness (He *et al.* 2017).

Predictive analytics use statistical methods and machine learning techniques on historical and real time data to predict the future likelihood of scenarios (Archenaa & Anitha 2015). Example includes prediction of readmission of patients which benefit healthcare institutions to improve the treatment effectiveness and can reduce the number of patients visit to hospital thereby saving time and money.

The benefit of application of analytics to a healthcare institution depends on the institutional capability of data quality, privacy, security and analytical skills (Mezghani *et al.* 2015; Kim & Park 2017). The application of data analytics is primarily targeted to clinical diagnosis, clinical research, service system for hospital operations and also patient service, insurance, disease transmission and disease prevention. Application of data analytics facilitate healthcare professionals to discover hidden knowledge, evidence based treatments, to derive and develop strategic decisions (Ivan *et al.* 2016), to make predictions and explore organizational challenges and opportunities (Khalifa & Zabani 2016). Other opportunities include promoting of research cum innovative studies based on data and evidences, developing personalized medicines, preventive medicine, improving IT enabled services as well as support, drug interactions and efficiency.

In the clinical diagnosis, data analytics is widely used to determine the cause, effect and prognosis of a disease. Disease diagnosis from EHR is actively researched using various data mining and predictive analytics techniques. Predictive analytics extend the information of diseases presence to establishing the relationship between associated factors thereby improving management, planning and treatment. For preventing disease spread, data analytics use regional data, spatio-temporal, mobile data etc. to monitor and control of disease transmission.

FEATURE SELECTION

Features present in the data carry different percentage of information pertaining to differentiate the classes. Features can be rich in information or redundant in information and sometimes irrelevant. The nature of information contained inside features affect the performance of the classifiers. Irrelevant and redundant features affect the performance in a negative way. It is difficult to rule out the effectiveness of a feature with respect to the class. Also there exists statistical relationship between features which accounts for class discrimination. High correlation and negative relationship between features affect the discrimination power of the classes. Feature selection aims to measure the interdependencies between a feature and the class. Feature selection uses ranking, scoring, relationship methods to find the influential features in a dataset. The amount of information contained by a feature is also used to select the features; features with poor information are removed (Liu & Yu 2005; Benabdeslem & Hindawi 2014). Also certain features contain the same information that cause redundancy and adds noise to the classifier. Redundant features also increase the feature dimensions and using the similar information features, the classifier's performance gets affected in terms of speed and computation. When features are independent, the learning ability to discriminate classes becomes easy (Domingos 2012) while correlated features adds noise to the classifier.

Feature selection is a process of building a subset with features that contain maximum information of the classes. The information contained in the feature is used by the machine learning models to discriminate the classes. Feature selection can be useful for dimensionality reduction, as real world dataset contains more number of features. High dimension of features affects the computation time and efficiency of the classifier. Also the presence of more features could shift the nature of the data mining problem. Feature selection methods can be grouped into filter method, wrapper method, embedded method and hybrid methods. In a filter method the feature are selected free from learning models while wrapper method use learning models to measure the importance of features. A feature is accounted for its information, consistency, distance and dependency while evaluated for its importance. An embedded method measures the features as a part of model building process and uses properties of the learning model. Ensemble models of feature selection are designed to manage the stableness of feature selection method. The stability of the method is usually affected with respect to number of classes and number of samples in a dataset. Information gain, Gain ratio, symmetric uncertainty, correlation based feature selection, minimum redundancy

maximum relevance, sequential forward selection, sequential backward elimination and Meta search algorithms are some of the popular feature selection methods used for selecting relevant features and removing irrelevant features.

CLINICAL DIAGNOSTIC REASONING

Disease diagnosis is a process of establishing the type of disease from the symptoms and sign. The decision on a particular type of disease is reasoned from collected information from patient's history and examination. On the other hand, some diseases are difficult to rule out from symptoms as symptoms can be a sign of mixed diseases. Thus a diagnostic reasoning is required to find the association of symptoms and diseases. The diagnostic reasoning is an attempt to distinguish the symptoms and classify the symptoms into corresponding disease categories. Such reasoning helps device treatment plans in order to prevent the disease reoccurrence. Decision support systems help physician in decision making and the decision making process involves utilizing medical data, reasoning, differential diagnosis, pattern recognition and diagnostic cases. Finding of different disease conditions from data and eliminating the least possible scenarios, understanding the associations and patterns between disease symptoms and conditions to rule out the disease symptoms from case based reasoning rules are some of the characteristics of advanced decision making systems. In a decision support system, the ability to distinguish, discover patterns, selecting strong possibilities are achieved using data mining algorithms.

ENSEMBLE MACHINE LEARNING FOR HEALTHCARE DATA ANALYSIS

Electronic Healthcare Records (EHR) consists of patients health related information collected from hospitals, healthcare centers, lab tests, etc. Representing this kind of data is available in structured and unstructured format. Considering this data, early disease diagnosis is possible, which can prevent severe health problems and reduce mortality rates. Machine Learning (ML) plays a vital role in creating useful insights from healthcare data. Disease classification with existing data is also an important problem in the healthcare sector. ML is also used to extract healthcare knowledge by applying innovative methods to improve classification performance (Johnson, et al., 2018). These classification models can improve patient care by enhancing the model decision. Recent studies have proved that classification using a single model obtains less classification accuracy compared to combined model classification. These combinations of multiple models are termed as Ensemble Learning (EL) (Zhang & Ma, 2012). The advantage of the ensemble is that it is a combination of the best models which perform well compared to the individual classifiers.

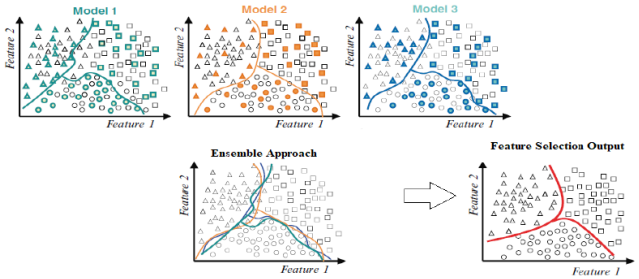

Figure 2 Representation of Feature Selection using Ensemble Approach

Likewise, when the dimensionality of data increases, the main preprocessing tool applied is feature selection (Guyon & Elisseeff, 2003). The combination of different feature selection models significantly improves the ability to select appropriate features without degrading the classification performance. It is proved that ensemble feature selection performs more effectively than a single selector (Barbara, 2019). The flow of ensemble feature selection is represented in Figure 2 A similar kind of approach is carried out for ensemble classification also. There are several ensemble methods used for ensemble for analyzing structured and unstructured data:

- As shown in Figure 3, the combining strategy for the ensemble classifier model is of two types (Frayman Yakov et al., 2002). One is a co-operative ensemble classifier and the other one is a competitive ensemble classifier.

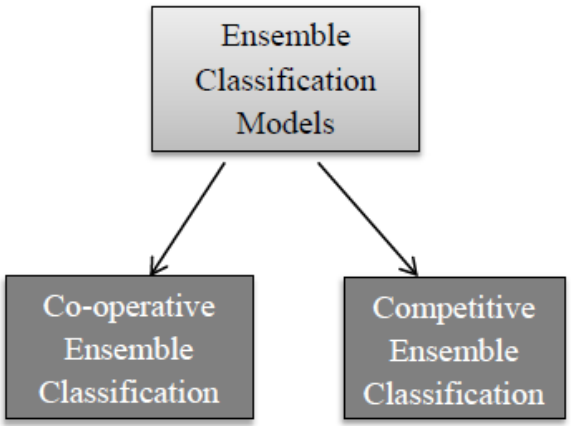

Figure 3: Types of Combining Ensemble Classifier Models

- The co-operative ensemble classification is a combination of classifiers where all the classifiers will make some contribution to the final EL model. Averaging classifiers, weighted averaging classifiers, and stack generalization classifiers are examples of co-operative ensemble classifier techniques. In addition, competitive ensemble (Yakov Frayman et al. 2002) classification chooses the most appropriate classifiers among

several classifiers. The two main approaches to competitive learning are:

- Gating: It works on the concept of divide and conquer, that is, breaking complex problems into small problems to solve them easily.
- Rule–based switching: Certain conditions are applied to the model. The output of one model is given as an input to the other model. This thesis proposed competitive based EL for different types of data.
- The majority voting methods can be applied to feature selection and classification tasks. It works on the concept of how many classifiers agree for classification based on dataset, i.e., the maximum number of votes received by the classifier that exceeds more than 50%, selection of only those classifiers for the ensemble (Barrett & Cairns, 2008).
- Weighted majority voting is applicable by assigning weight to the classifier based on the performance of the classifier. Sometimes, for certain datasets, some classifiers are better than others, so to differentiate the performance, add weight to the suitable classifiers. This assistance leads to improved classification performance.
- Bagging ensemble algorithm called Bootstrap Aggregation (Barrett & Cairns, 2008), which is suitable for small datasets. To deal with large datasets, they are divided into small datasets and these datasets are used for voting mechanisms. This technique avoids over-fitting problems.
- Boosting (Schapire, 2003) helps to convert a weak classifier into a strong classifier to improve the classification performance. It helps to reduce the errors caused by weak classifiers. Moreover, boosting algorithms such as Adaboost and Gradient boosting are used for the classification task.

LITERATURE REVIEW

Raja Krishnamoorthi et al. (2022) Diabetes is a chronic disease that continues to be a major global problem since it has an effect on the health of the entire population. It is a metabolic condition that results in high blood sugar levels as well as a variety of other problems, such as stroke, kidney failure, heart, & nerve problems. Many experts have worked to develop a trustworthy diabetes prediction model over the years. This topic still has many open research concerns because there aren't many appropriate data sets or prediction methods, which requires researchers to use big data analytics & ML-based methods. The paper examines healthcare predictive analytics & makes use of four different ML algorithms to address the problems. The study's major goal was to look into how big data analytics & machine learning-based approaches might be used to treat diabetes. To aid in diabetes prediction & development of preventative measures, health professionals or other interested parties are working to develop classification models. The authors undertake a review of the literature on machine models and then suggest an intelligent framework for diabetes prediction based on their findings. The authors offer and evaluate an intelligent ML-based architecture for diabetes prediction in addition to offering a critical overview of ML techniques. The authors of this study constructed and assessed the DT-based RF & SVM learning models for diabetes prediction, which are the most well-liked techniques in the literature at the time of publication. This study suggests creating an original, intelligent diabetes mellitus prediction framework (IDMPF) that makes use of ML. According to the framework, it was developed after a detailed review of the pre-existing prediction models discovered in the literature & assessment of their applicability to diabetes. The authors employ the framework to describe training procedures, model evaluation methods, diabetes prediction issues, and potential remedies. The survey's results could be useful to health professionals, stakeholders, students, & researchers working on diabetes prediction research & development. The recommended work has a low error rate and offers 83% accuracy.

Sanghmitra Patnaik et al. (2021) A national policy called AI for All in India advances the idea of upgrading & empowering all people with specialized knowledge in order to further the common good. The main focus is on using technology in ways that have the biggest social benefit. India's use of AI is heavily influenced by social benefit optimization as opposed to top line growth maximization. Through technological intervention in a variety of fields, including healthcare, education, and agriculture, AI aims to address all problems. This paper's major focus is on machine learning in the context of the healthcare industry. In order to examine the use of machine learning, this paper's main emphasis area is the healthcare industry (ML). The purpose of ML is to make it easier for regular people to freely access healthcare facilities. India is increasingly faced with significant obstacles in the areas of healthcare quality, accessibility, and price. In remote places, people struggle with insufficient connectivity. Few healthcare professionals are available to address their issues. The expanding application of ML is anticipated to open up possibilities for solving some of the long-standing issues in the healthcare industry. It would provide the government more power to address the demands of the general public in this critical area.

Irene Y. Chen et al. (2021) The utilization of ML in healthcare involves a variety of ethical issues, particularly because models have the potential to accentuate already present health imbalances. Here, we discuss moral issues for fair ML in the development of healthcare. We specifically frame social justice through the prism of ML ethics in healthcare. We highlight obstacles in a suggested pipeline of ethical machine learning in health, from problem selection through post-deployment concerns, and we describe ongoing work in that

pipeline. We conclude by discussing suggestions for overcoming these difficulties.

Fernando López-Martínez **et al. (2020)** The two most significant and popular components for innovation & predictive analytics in healthcare right now are big data & AI, which are driving the digital revolution of healthcare. The Keralty group is already creating a ML & data integration-based intelligent big data analytics platform. We talk about how this platform is the organization's new foundation for enhancing value-based care, population health management, and new forthcoming problems in healthcare. Better healthcare outcomes, improved clinical operations, lower healthcare costs, and the production of precise medical information are all advantages of employing this new data platform for community & population health. The platform's huge, standardized datasets can be used by a number of machine learning algorithms the authors have created to enhance clinical decision support, diagnosis, or public health actions. Electronic health records (EHR), hospital information systems (HIS), radiology information systems (RIS), laboratory information systems (LIS), such as data produced by public health platforms, mobile data, social media, & clinical web portals, are all sources of data that have been integrated into the platform. Big data approaches are used to store, retrieve, process, & transform this enormous volume of data. In to enhance the decision-making process for population health management, this article describes the construction of a digital health platform in a healthcare institution in Colombia that integrates operational, clinical, & business data sources with advanced analytics.

Prableen Kaur et al. (2018) In this study, big data and its use in healthcare applications are briefly introduced. It has been noted that the healthcare industry's rapid data development is being managed with the help of big data architecture & approaches. Here, an empirical study is first conducted to examine the function of big data in the healthcare sector. Big data has been used extensively in the healthcare field, as has been seen. Nowadays, it is difficult to predict how big data and machine learning will affect the healthcare sector. It has been noted that the majority of writers that used big data analytics & machine learning to diagnose diseases did not place a high priority on data security and privacy. Here, an innovative approach to handling large data in the medical business has been developed, utilizing modern security mechanisms and machine learning. The innovation is in the usage of data security layer and optimal storage to uphold security and privacy. Several methods have been implemented, including dynamic data encryption, end point validation, granular access control, activity monitoring, & masking encryption. The proposed hybrid four-layer healthcare architecture appears to be a more efficient big data system for disease diagnosis.

Affreen Ara et al. (2017) In the healthcare industry today, petabytes of data are kept in clinical, pharmaceutical, & relevant academic archives. Wearable sensors like activity trackers, continuous glucose monitors, & implantable defibrillators continuously broadcast trillions of bytes of structured and unstructured data. By providing patients with convenient access to guidance and knowledge from medical professionals, modern machine learning diabetes management software enable many patients live better lives. Traditional businesses have been drawn into the digital revolution by the introduction of digital gadgets and sophisticated analytics. The study examines Zion China's technical E-Followup solution that was primarily based on conventional business intelligence & used data from multiple on-premises devices & cloud storage. They had other technical objectives in this engagement as well as a desire for a clever, quick, and affordable approach to continuously feed data from devices to the cloud. The outcomes show how they successfully managed enormous data quantities and enhanced data analysis.

CONCLUSION

This research work deals with providing better healthcare infrastructure including analysis of diseases, addressing the limitations of the existing diseases and develop Medical Disease Diagnosis System (*MDDS*). It also focuses on the latest trends in the advancement of healthcare system, risk factor analysis of few specific heart-related diseases and the development of machine learning-based model for ignored preterm birth cases in the field of obstetrics. Machine learning based heart disease prediction system developed in this study is quite suitable for present Indian scenario. This viable tool can be accessed via internet. This study offers promising results suggesting potential use of ML based heart disease prediction system as a screening tool to diagnose heart diseases in primary healthcare centres in India which would otherwise get undetected. Issues of affordability and accessibility in healthcare sector of India can be addressed using machine learning based models which can be easily accessed via internet even in the rural parts of the country.

REFERENCES

1. Davari Dolatabadi, S. E. Z. Khadem, and B. M. Asl, “Automated diagnosis of coronary artery disease (CAD) patients using optimized SVM,” Comput. Methods Programs Biomed., vol. 138, pp. 117–126, Jan. 2017

2. Elisseeff, “An introduction to variable and feature selection,” Journal of Machine Learning Research, vol. 3. pp. 1157–1182, 2003

3. H. Shahana and V. Preeja, “Survey on feature subset selection for high dimensional data,” in International Conference on Circuit,

Power and Computing Technologies (ICCPCT), pp. 1–4, 2016.
4. Khare, M. Jeon, I. Sethi and B. Xu, "Machine Learning Theory and Applications for Healthcare", Journal of Healthcare Engineering, vol. 2017, pp. 1-2, 2017. Available: 10.1155/2017/5263570
5. Nagpal and D. Gaur, "ModifiedFAST: A New Optimal Feature Subset Selection Algorithm," J. Inf. Commun. Converg. Eng., vol. 13, no. 2, pp. 113–122, 2015.
6. Ramachandran et al., "Increasing Expenditure on Health Care Incurred by Diabetic Subjects in a Developing Country: A study from India", Diabetes Care, vol. 30, no. 2, pp. 252- 256, 2007. Available: 10.2337/dc06-0144
7. Sharma and K. K. Paliwal, "Linear discriminant analysis for the small sample size problem: an overview," Int. J. Mach. Learn. Cybern., vol. 6, no. 3, pp. 443–454, Jun. 2015.
8. Singh and B. Pandey, "An Efficient Diagnosis System for Detection of Liver Disease Using a Novel Integrated Method Based on Principal Component Analysis and K-Nearest Neighbor (PCA-KNN)," in Intelligent Systems, IGI Global, pp. 1015–1030, 2018.
9. Abdar, M 2015, 'Using Decision Trees in Data Mining for Predicting,Factors Influencing of Heart Disease', Carpathian Journal of,,Electronic & Computer Engineering, vol. 8, no. 2, pp. 31-36
10. Abouzahra, M, Sartipi, K, Armstrong, D & Tan, J 2014, 'Integrating, Data from EHRs to Enhance Clinical Decision Making: The,,Inflammatory Bowel Disease Case', IEEE 27th International Symposium on Computer-Based Medical Systems, New York, USA, pp. 531-532.
11. AbuKhousa, E, Mohamed, N & Al-Jaroodi, J 2012, 'e-Health cloud: opportunities and challenges', Future internet, vol. 4, no. 3, pp. 621-645.
12. Adabag, S, Rector, TS, Anand, IS, McMurray, JJ, Zile, M, Komajda, M & Carson, PE 2014, 'A prediction model for sudden cardiac death in patients with heart failure and preserved ejection fraction', European journal of heart failure, vol. 16, no. 11, pp. 1175-1182.
13. Adams, M. (Aprils 21st, 2005) Rising popularity of Medical Tourism reveals deterioration of U.S. Healthcare system. *News Target* An empirical investigation. *Journal of International Marketing.* Volume 3 Iss.4 pp57-83.
14. ahera kazemi, " A study of effective factors for attracting Medical Tourism in Iran", 2007 Lulea University of Technology, 2008-o21 ISSN 1653 0187 ISRN LTU PB EX 08/21 --SE
15. Akrivos, E, Papaioannou, V, Maglaveras, N & Chouvarda, I 2018, 'Prediction of Cardiac Arrest in Intensive Care Patients Through Machine Learning', in Precision Medicine Powered by pHealth and Connected Health, Springer, Singapore, vol. 66, pp. 25-29.
16. J. L. Warford, *Environment, Health and Sustainable Development: the Role of Economic Instruments and Policies*, Discussion Paper: Director-General's Council on the Earth Summit Action Programme for Health and Environment. Geneva, World Health
17. Jensen, PB, Jensen, LJ & Brunak, S 2012, 'Mining electronic health records: towards better research applications and clinical care', Nature Reviews Genetics, vol. 13, no. 6, pp. 395-405.
18. Tseng, WT, Chiang, WF, Liu, SY, Roan, J, & Lin, CN 2015, 'The Application of Data Mining Techniques to Oral Cancer Prognosis', Journal of Medical Systems, vol.5, no.39, pp.1-7.

Corresponding Author

Kunal Gupta*

Research Scholar, Kalinga University