Original Article

Using Artificial Intelligence to Predict Clinical Requirements in Healthcare

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Abstract

The world is now undergoing a revolution because of advances in artificial intelligence. In recent decades, it has been used in almost all sectors, including medical forecasting. Medical prediction attempts to forecast the risk of getting a disease, as well as the disease's survival and geographical spread. Current evidence-based therapy relies heavily on prediction, the healthcare sector is one of the most populous and rapidly expanding AI markets. The use of genetics, wearable sensors, biotechnology, and artificial intelligence increases the amount of healthcare data available and accelerates the development of analytics tools, laying the groundwork for precision medicine; advances in identifying diseases while sparing patients from invasive tests; and enables a diagnosis and treatment plan that are tailored to the individual patient's needs, environment, and lifestyle. As part of this study, we provide a survey of current practices for disease management. Artificial intelligence approaches, like machine learning (ML) and deep learning (DL) methods, have become more popular and have increased the effectiveness of both diagnosis and prognosis.

Keywords: Healthcare, prediction, predictive medicine, disease management, artificial intelligence (AI)

INTRODUCTION

The healthcare industry faces several obstacles. Although the field of predictive medicine is relatively new, the idea behind it has been around for quite some time. To evaluate an individual's susceptibility to disease, predictive medicine often relies on a series of laboratory and genetic testing. (Kaur et al., 2022). Despite the many offered alternatives, medical forecasting remains a difficult and labor-intensive process. Objectives of predictive medicine include (i) gathering and cataloguing patient attributes (Inouye et al., 2018) (ii) assessing the data to anticipate the patient's losses for a desired result; and (iii) Predicting which therapy would be most successful for individual, then taking action prior to its occurrence. There is a growing field called "medical informatics," which combines computer science, information science, and healthcare. When it comes to health and biomedical information, this subfield focuses on the tools, technologies, and practices that are necessary to improve the information's collection, archiving, retrieval, and application. These ideas are essential to the development of quality measurement as a field of study. Artificial intelligence technology gives numerous services. Health information privacy and security are also protected by them, along with increased precision, effectiveness, and public interest. The remaining sections are grouped as follows. Section 2 discusses the area of predictive medicine. The third section discusses some suggested efforts in the sphere of medical prediction. The fourth section provides a comparative analysis of the mentioned works. Finally, in Section 5, we draw some final conclusions and examine the findings.

MEDICINE PREDICTION

The majority of medical practices are becoming virtualized as a result of the revolution occurring in medicine. This revolution in medicine and biology has been made possible by advances in computing that have allowed for the analysis of "big data" collections, their use in both social & economic networks, as well as the development of digital consumer products that quantify individual data. (Kaur et al., 2021). In order to predict the occurrence of a disease in the future, predictive medicine considers a variety of risk variables, including but not limited to age, sex, clinically recorded data, and more. New technologies enable faster identification of infectious pathogens and production of effective vaccinations. New healthcare systems, patient data, and medical records all stand to benefit from the use of artificial intelligence techniques ranging from ML to DL, artificial intelligence tools are also very effective in making accurate diagnoses of a wide range of ailments. These models are being built by integrating artificial intelligence with methodologies from the field of biology.

LITERATURE REVIEW

(Chaurasia and Pal, 2021) suggested a solution for identifying BC based on Rep Tree, RBF Network, and Simple Logical data mining approaches. These methods were used to forecast the breast cancer data set's survival rate. The

accuracy of the three categorization systems for forecasting the cancer survival rate was determined by comparing them. The objective of the research (Lim et al., 2021) to extract tumour characteristics for breast cancer diagnosis was accomplished. The automated breast cancer diagnosis method proposed by (Karabatak et al., 2009) is based on association rules (AR) as well as a neural network. Using these inputs, the second layer of the neural network categorized the breast cancer data. As a solution to the difficulty of classifying medical data, (Seera and Lim, 2014) proposed a hybrid intelligent system that integrates the Fuzzy-Min-Max neural net, Random Forest (RF), and the Classification-and-Regression Tree model. The suggested system may be used by medical professionals as a clinical decision-making tool to aid in the delivery of healthcare. (Avşar et al., 2019) suggested a computer-aided diagnostic approach to differentiate between benign and malignant breast tumors. A backward elimination strategy to feature selection as well as a classifier Random Forest were combined in two phases of their method. In the test phase, the average accuracy of the classification for the Wisconsin Breast Cancer Diagnosis Dataset (WBCDD) & Wisconsin Breast Cancer Prognostic Dataset was between 99.70 and 99.82%. (WBCPD). (Ahmed et al., 2016) suggested a Computer-Aided Diagnosis (CAD) technique that employs an unsupervised DBN (deep belief network) pathway accompanied by a supervised (back propagation path) for the diagnosis of breast cancer. (Bhardwaj and Tiwari, 2015) presented a classification problem-solving method called GONN. To illustrate their findings, the authors used the WBCD database available in the UCI Machine Learning repository to evaluate GONN against a classical model and a classical Back propagation model in terms of classification accuracy, sensitivity, specificity, ROC curves, and AUC scores. Wang et al. (2016) proposed a DL-based method for identifying metastatic breast cancer. On the Camelyon16 dataset, this approach was tested. Although the recommended strategy was computationally expensive, it improved the accuracy, precision, and clinical usefulness of pathology diagnosis. In this paper (Shankar et al., 2021) the authors presented a decentralized electronic health care system that would be capable of autonomously diagnosing a patient's condition by utilizing the patient's personal information, without the requirement for human participation. The Internet was used to make this service accessible. The technology will promptly alert the doctor if a patient's condition changes. Asynchronous communication was used by the many system agents, who were spread across several places, to communicate with one another. (Nuankaew et al., 2021) gave a plan for finding informative genes that used genetic algorithms, harmony search algorithms, and support vector machines. (SVM).

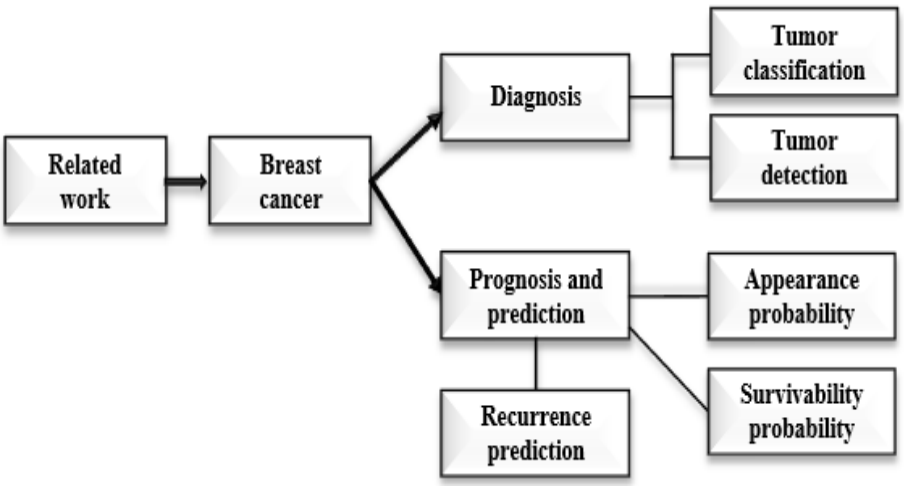

Figure 1: Summary of the examined studies as a flowchart

However, heuristic approaches vary from issue to problem and are often dependent on a local optimum which falls short of the best possible global answer Figure 1 depicts a flowchart that outlines the reviewed research in this study.

Breast cancer diagnosis and prognosis

This section includes research that used different AI classification methods to categorize breast cancer. Breast cancer is a common and leading cause of cancer in women. Its frequency as a public health issue has grown in recent years. AI use algorithms to process enormous amounts of healthcare data to assist clinical practice (Razzaghi et al., 2019). When breast cancer is detected in its earliest stages, treatment is often less invasive. Computer-assisted detection and diagnostic technologies have greatly helped in the early identification of breast cancer, which in turn has increased survival rates. However, the following technical concerns need to be taken into account: (1) Costs for computation and memory (2) Availability of data, AI training requires huge volumes of structured, thorough data. Nevertheless, the current data are scattered, inadequate, and unstructured, which raises the likelihood of error. (3) Issue of overfitting, which arises when a model is well-suited to its training data but has trouble generalizing to novel data (validation data). The evaluated literature on the illness of breast cancer is summarized in Table 1. The first column denotes the work being explored; the second, the dataset being utilized in the article; the third, the technique being used to treat the illness; the fourth; limits of the proposed work the fifth, the findings.

Table 1: Strategies for managing breast cancer disease

References	Dataset used	Techniques	Limitations	Outcome
[4]	Collected from WBCD	Artificial neural network (applied four methods)	Used single data set with few variables	LVQ outperformed
Chaurasia and Pal, 2021	From medical centre	Simple logistic, RBF network, Rep tree	Limited data	Simple logistic method outperformed
Lim et al., 2021	WBCD	Support vector machine, K-means	This method has not been applied to a big, sparse dataset.	Tumor Classification Feature Selection
Karabatak et al., 2009	WBCD	Neural network	Applied to a one data set	classification of tumors
Seera and Lim, 2014	WBCDD and WBCPD	Random forest	RF is too slow for real-time predictions	Tumor categorization
Bhardwaj and Tiwari, 2015	WBCD	GONN	Enhancements are made only to the crossover and mutation operators.	Tumor Classification
Wang et al., 2016	From Camelyon 16	Deep learning	Identification of Metastatic Cancer	Computationally costly

General issues posed by AI use in healthcare

This study demonstrates that artificial intelligence delivers significant advancements to the health-care profession, but that following research obstacles remain: (1) Data availability and quality - Because they are in several forms, dispersed across various systems, and often have restricted access, large-scale high-quality clinical dataset acquisition is a particularly challenging process (Kaur et al., 2021 (2) Security & confidentiality Since data security is one of the most pressing concerns facing those who design AI systems, a number of academics have shown an interest in the concept and volunteered to work on a solution. The requirement for enormous volumes of healthcare data may threaten patient data privacy. (3) Bias problem; AI Automated systems learn to form conclusions based on their training phase, which may involve bias. (4) The majority of examined studies are computationally costly, which is detrimental for both clinicians and patients. (5) The most important role in the healthcare industry is studying and confirming the community's approval of the proposed remedy. (6) Deaths and errors - An Artificial intelligence system may make mistakes in disease diagnosis, medicine recommendation, or predicting a patient's response to a specific treatment.

CONCLUSION

Prediction in medicine is a significant obstacle for doctors since it has a direct effect on their everyday work. The mortality rate has increased dramatically over the last decade, necessitating methodologies and instruments for precise and timely illness identification. According to our assessment of the literature, medical prediction is of great interest to researchers, especially the detection and prediction of breast cancer utilizing artificial intelligence methodologies and approaches such as artificial neural networks, deep learning, and data mining, among others. The tactics they use are effective terms of accuracy, but most of them require a significant investment of time during the training period. This study addressed some of the major obstacles blocking the use of AI in healthcare. To overcome these constraints, the following options might be proposed: a high availability and generation of high-quality data for the development of an effective Artificial intelligence system. To provide accurate results, researchers and creators of AI systems need access to high-quality databases without compromising patient privacy. Therefore, further study must be conducted in this field with the goal of generating hybrid methodologies that might be used to predictive medicine. When applied as diagnostics, prognostic, and therapeutic tools, the advantages of building a deep learning method for breast cancer disease management will become apparent. Though there are many obstacles to using AI in healthcare, we see huge potential for it to improve decision-making support, medical assistance for both doctors and patients, and prediction.

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