The Review Of
DIABETIC
STUDIES
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The Role Of Artificial Intelligence In Early Detection Of Breast Cancer

Taiseer Yehia Ghazwi*

Samtah General Hospital-Samtah, Samtah-86735, Saudi Arabia
**Corresponding author: Taiseer Yehia Ghazwi*

Abstract

Introduction: Early cancer diagnosis increases the likelihood of implementing an effective treatment in many tumor groups. Out of all cancer types, breast cancer is currently the most prevalent kind that affects women globally. Genetics, lifestyle, and environmental factors are among the many factors that have led to the increase in the prevalence of breast cancer among women from all socioeconomic backgrounds. As a result, appropriate screening for prompt diagnosis and treatment becomes crucial to the fight against the condition. Early breast cancer diagnosis could be revolutionized with the help of Artificial intelligence (AI) machine learning, which trains computers to recognize complex patterns in data and make predictions.
Aim of the Study: The purpose of the present review is to understand the role of Artificial intelligence (AI) in early diagnosis of breast cancer.
Methodology: The review is a comprehensive research of PUBMED since the year 2005-2022.
Conclusion: Artificial intelligence (AI) is revolutionizing many aspects of our lives with its many applications. Results are even more easily and conveniently obtained when AI is used in the current screening process for breast cancer. Important strategies involve identifying patients who are at risk but do not exhibit symptoms, and promptly and suitably examining those who do. Among the advantages of using AI techniques for breast cancer screening are faster and more precise results. However, there are numerous obstacles in the way of AI integration that must be methodically overcome.

Keywords: Artificial intelligence (AI), Early detection of breast cancer, Breast cancer screening, Pubmed data base.

Introduction

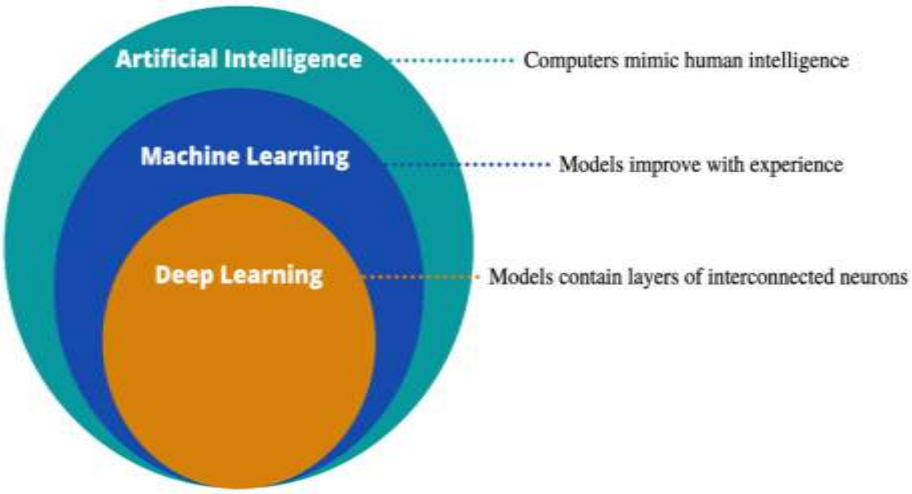
One of the most significant issues affecting women in the twenty-first century is breast cancer. It is the most common cancer among women worldwide and a serious health issue. Breast cancer is the cause of many fatalities. It significantly impacts women's mental and physical health. Treatment for breast cancer is more successful if it is discovered early. Later stages of treatment have poor efficacy. Thus, more cases and fewer deaths can be reported when early diagnosis and prevention are implemented. A relatively new and developing field that shows great promise for improving the prognosis of breast cancer patients is the integration of artificial intelligence (AI) into screening techniques.[1] On this planet, human intelligence has always prevailed over all other forms of intelligence. The capacity to apply prior knowledge, adjust to changing circumstances and decipher patterns is what makes humans intelligent. The ability to replicate the same skills is key to AI's success. Digital pathology is important to the diagnostic field because it produces high-resolution images from tissue specimens mounted on glass slides.[2]

A crucial part of contemporary medical practice is served by digital pathology. Clinicians and pathologists now have an easier time handling and storing information thanks to faster and less expensive options. AI and digital pathology can now work together, providing opportunities for image-based diagnosis thanks to developments in machine learning. Digital pathology has made it simpler to analyze data on pathological samples and has resulted in a deeper comprehension of the information acquired. Greater amounts and frequently more efficient data collection, integration, and analysis are possible with digital methods than with traditional ones.[3]

The following describes a few of the ways that AI algorithms function. High-quality training images are essential for AI algorithms. The pathologist's job is to manually locate and label any abnormalities or areas that may be pathologically significant. In the best of circumstances, professionals in the field handle it. Qualitative assessment provides fast and precise cell type identification as well as insight into morphological, biologically significant, and histological patterns. Qualitative analysis provides access to tissue-side data that cannot be manually evaluated. The margin of error for manual methods is larger than for digital methods because human data collection and processing may not be as accurate as it would be for a computer powered by artificial intelligence [4,5]

Various techniques used by artificial intelligence in breast cancer screening:
1. Machine Learning
2. Deep Learning
3. Radiomics

Fig.1 Sub-division of Artificial intelligence.[11]



The death rate has been significantly lowered by breast cancer screening. AI integration improves the success rate of treatment when used in screening procedures like biopsy slide inspection. Recent years have seen a rise in interest in this field, and it appears to have a very bright future. Using computer vision, lesion detection, or pattern recognition for lesion detection for classification of lesions according to BIRADS (Breast Imaging Reporting and Data System) and systematic reporting (diagnosis), computational radiology performs tasks that were previously performed by experts.[6]
Additionally, it entails the extraction of imaging biomarkers in order to model therapy responses according to prognostic and predictive values. Among the essential AI components needed for breast cancer imaging are machine learning and deep learning. Large datasets are stored via machine learning and then used to train prediction models and decipher generalizations. [3] The newest area of machine learning, known as "deep learning," uses artificial neural networks to build a system that can identify and categorize images. The two main uses of AI in breast cancer screening are the classification of tumors as benign or malignant and object detection (segmentation). [7-9]
A popular technique in AI systems is radiomics. It takes what is known as a feature—quantitative aspects—from an image [6]. This is typically the result of pattern recognition algorithms, which identify portions of images and return a set of numbers that correspond to a quantitative feature of the visible portion of the image. The foundation of radiomics is the notion that different activities occurring at the genetic and molecular levels are represented by extracted features. Computational algorithms used in machine learning leverage image features obtained through radiomics to provide insights into disease outcomes. [9]
Unsupervised and supervised machine learning are the two categories of machine learning that radiomics offers. Unsupervised machine learning categorizes data without utilizing any pre-existing information or information gleaned from the provided image. AI is trained using an existing data archive

as the first step in the supervised machine learning process. As in the supervised machine learning approach, deep learning functions by processing an image through a multi-neural layer or network, which reduces the image to a set of numbers that indicate features to be provided.[10]
A subset of machine learning (ML) called deep learning (DL) builds complex architectures that are comparable to the interconnected neurons found in the human brain. Model development, training, and evaluation features are offered by well-known Python-based deep learning frameworks like PyTorch (Facebook) and Tensorflow (Google). Additionally, without the need for local software installation, Google offers a free online notebook environment called Google Colaboratory that enables cloud-based Python usage and GPU access.[11]

Table-1: Possible Advantages and Drawbacks of Machine Learning and Deep Learning. [11]

Deep Learning	Machine Learning
Features generated by the model	Features are pre-specified
Computationally more intensive	Computationally less intensive
ROI segmentation optional	Requires ROI segmentation
Perform better on large datasets	Perform better on small datasets
Features difficult to quantify	Features are easily quantified

AI is used in the field of breast cancer treatment to enable early detection through the utilization of data from biopsy slides and radiomics. This is corroborated by an international endeavor to produce learning algorithms that interpret mammograms by decreasing the quantity of false positives. The likelihood of spotting metastatic breast cancer in whole slide photos from lymph node biopsies has increased thanks to AI. AI algorithms behave differently in different populations due to variations in individual risk factors and predispositions.[12]
The most widely used technique for screening for breast cancer is mammography. The result is a high-resolution image that can be stored and used in the future without regard to age or body type. There are two formats available for full-field digital mammography systems: input (raw images) and output (post-processing). AI uses image analysis to identify breast density, breast mass, breast mass segmentation, and cancer risk. Breast masses are frequently found in patients with breast cancer, which makes detecting them one of the most crucial computer-aided diagnosis (CAD) procedures. There are two types of calcifications that show up on mammography as tiny spots: macrocalcification and microcalcification. Microcalcifications can currently be found using CAD systems. [13,14]
There are two types of calcifications that show up on mammography as tiny spots: macrocalcification and microcalcification. Microcalcifications can currently be found using CAD systems. The diagnosis is directly impacted by breast mass segmentation, which is recognized as true segmentation. Using fuzzy contours, breast masses from the mammography are automatically segmented. Because breast segmentation varies from person to person, it can be challenging to identify. The patient's prognosis is significantly improved by proper segmentation using AI.[15,16]

Future Challenges of Artificial Intelligence
Image data is the foundation of AI models used in cancer management. The issue with this specific facet is the widespread underutilization in many hospitals of patient histories stored as electronic health records. Hospital software systems around the world need to include easy-to-access databases and user-friendly software. This is a challenging task that currently requires the combined efforts of the medical and engineering communities. Establishing confidence among physicians to use AI to assist in decision-making presents another difficulty with its application. Physicians need to receive sufficient training on AI technology.[17]
When employing AI techniques, there are numerous ethical concerns to take into account, including those involving patient autonomy, privacy violations, data confidentiality, and consent. Numerous precautions are taken to avoid confidentiality violations, and laws are in place to monitor malpractice. The lack of widespread use of radiomics in current clinical practice is another barrier to using AI for breast cancer screening. Large prospective studies are more credible than most conducted retrospective studies, which are typically smaller in scope.[18]

Conclusion:

Breast cancer has been shown to be extremely difficult for both patients and the medical community. Early cancer diagnosis has become simpler with the use of AI in various screening techniques. AI is used in breast cancer screening in a number of ways, including radiomics, deep learning, and machine learning. However, there are restrictions on using AI. There are numerous laws in place to control the application of AI. Artificial Intelligence has the capability to identify calcification, which can aid in patient diagnosis and management. It can also detect breast mass, density, and tissue segmentation. These obstacles should be addressed with additional study and technological advancements, increasing the acceptance of AI-based screening techniques and enhancing the general quality of life for cancer patients.

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Conflict of Interest

Authors declare they don’t have any conflict of interest.

Ethical Approval

Not Applicable

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