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Novel Versus Traditional Oncology in Medicine, Revolutionized Artificial Intelligence

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A B S T R A C T

Over the last decade, AI has helped solve several health issues, including cancer. Deep learning, a dynamic AI discipline that facilitates autonomous feature extraction is rapidly used in scientific and clinical cancer research. For example, deep learning has effectively handled previously intractable problems. Oncology medication discovery and translational oncology are areas where AI has shown potential. Validation and generalizability issues, interpretation issues, and the growing knowledge gap between clinical and data science professionals continue. If we can overcome these obstacles, AI has the potential to revolutionize oncology and bring cancer care into the 21st century. Innovative AI methodologies and applications will generate key cancer discoveries in the future decade. This study examines AI's potential role in oncology practice, discussing new advancements.

Keywords: Biomarkers, Cancer, Diagnostic, Prognosis

1. Introduction

AI has helped solve several health issues, including cancer, over the last decade. Deep learning, a dynamic AI discipline that facilitates autonomous feature extraction, is rapidly being used in scientific and clinical cancer research. For example, deep learning has effectively handled previously intractable problems(1). AI will play an increasingly important role in medicine and healthcare because of developments in computer power, learning algorithms, and enormous datasets (big data) from medical records and wearable health monitors.

Experts expect AI to influence chronic illness management and clinical decision-making greatly. While still in its infancy, AI algorithms offer promise in fields including radiology, pathology, and oncology(2). This development prompts a question. Will AI eventually replace specific clinicians, such as radiologists, or will it help them become more effective? This study examines AI's potential role in oncology practice, discussing new advancements.

2.Personalized Medicine:

Artificial intelligence is driving the shift to precision medicine. Several worldwide contests are launched to revolutionize AI in health care further, yielding unique algorithms to solve complex tasks . The FDA has finally started approving clinical medical devices based on deep learning. The FDA authorized the Arteries cloud-based imaging technology in 2018 to assist clinicians track tumors using MRI and CT scans of lung and liver cancer patients. The FDA classified PAIGE.AI as a Breakthrough Device in 2019. Startups like employ deep learning to detect, diagnose, and predict cancer(3)

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Next-generation sequencing (NGS) technology has revolutionized precision oncology(4). NGS has several clinical applications, including risk prediction, early illness detection, sequencing and medical imaging diagnosis, accurate prognosis, biomarker discovery, and therapeutic target discovery(5).Another biomarker is mast cell. Mast cells play an essential role in immune and allergic responses (6).

NGS creates huge datasets that require specialized bioinformatics resources to analyze. These AI applications increase cancer diagnosis and prognostication with NGS and high-resolution medical imaging. Despite technological advancements, AI still has major limits, and NGS has yet to be verified in clinical settings. The future of AI and precision oncology seems bright if we keep pushing forward with innovation and technology.

3.AI for Imaging Oncology:

Medical imaging is crucial for detecting cancer, tracking its course, and predicting prognosis. For example, mammography is the first line of breast cancer imaging. Ultrasound is suggested for younger ladies with thick breasts. early illness identification is critical to minimizing mortality. Health care in low- and middle-income nations is limited by a lack of qualified radiologists. These situations would revolutionize the healthcare industry. Radiologists using AI could analyze mammography pictures faster and more accurately, which is critical for early cancer identification. They could also identify tumors independent of breast density (7). Contrasting AI systems with human interaction in interpreting imaging data for lung cancer diagnosis(8) and skin cancer (9)showed similar concordance or performance.

The development of new Artificial Intelligence (AI) machine learning algorithms is revolutionizing medicine. With significant advancements in computer processing, AI-based solutions are already boosting diagnostic and treatment accuracy and efficiency across specialties. Due to the rising use of AI in radiology. These ideas raise whether AI-based systems will someday replace physicians in specific specialties or only complement their job(2).

Early cancer identification is critical to saving lives. Many researchers and physicians have tried to harness the power of AI (or, more specifically, CNN) for application to clinical radiology and pathology since it eliminates the need to generate detailed features by hand. Classification of dermoscopy pictures is one example of significant impact(9).Thus, AI can label skin lesions (including melanoma) as correctly as professional dermatologists. This breakthrough may enable universal access to dermatologist-level diagnosis for dermatologists outside of the clinic. AI is now as accurate as medical professionals in interpreting mammograms for breast cancer screening)(10). In CT scans, deep neural networks may also identify larger lymph nodes and colon polyps(11).

Because computer vision is one of the most effective implementations of AI techniques, there is natural interest in radiology, where there are many digitized pictures. This ranges from aided diagnosis to outcome prediction.

AI systems can speed up cancer screening and detection. The 2017 Kaggle Data Science Bowl, an international competition for ML scientists, was built on automated lung nodule detection and classification. This competition and other research groups produced many effective CNN-based models with accuracies ranging from 80% to 95%, suggesting potential for lung cancer screening(12). CNNs may also partition tumor volumes, which may be useful in radiation treatment planning(13, 14). Breast cancer screening with AI has also been a hot topic, with its own data science competitionsculminating in a CNN system capable of 90% sensitivity detection(15, 16)

AI may also identify radiographic anatomic aspects of cancers that doctors cannot dependably detect. However, a CNN-based model identified extranodal extension (ENE) of tumors in head and neck cancer lymph nodes with >85% accuracy on diagnostic, contrast-enhanced CT images(17). The identification of ENE is critical in the prognosis and therapy of head and neck cancer patients, and hence this model has clinical use.

The emerging subject of radiogenomics uses radiographic image analysis to predict underlying genotypic features. Recently, CNNs were used on brain MRIs of patients with low-grade glioma. Based on raw imaging data alone, CNNs can predict IDH mutation and MGMT methylation status with 85% to 95% accuracy(18, 19)

4.Digital pathology:

Digital pathology will soon change pathology labs. Pathology has long relied on microscopic examination of stained cells and tissues. It will reduce labor intensive microscopic tasks, increase efficiency, and preserve quality for enhanced clinical care. Artificial intelligence (AI) in digital pathology improves efficiency and lowers subjectivity by standardizing methods. Digital pathology also allows for greater picture viewing and more consistent color information. This allows for successful identification of disease-specific biomarkers for diagnosis, prognosis, and therapy (20, 21)AI algorithms in digital pathology will never replace human competence and the ethical-legal issues that come with it. The benefits of AI in digital pathology and precision oncology are apparent. Given the rapidly expanding area of pathology and rising number of diagnoses, it is clear that creating novel tools to enhance human capabilities in pathology and precision medicine would be very beneficial. Traditional glass slide diagnosis is unsatisfactory, thus digital pathology with AI algorithms is fast increasing to solve the issue. In light of the evolution of first and second-generation diagnostic pathology methodologies, a third generation of AI algorithms in digital pathology and precision oncology is coming to help pathologists enhance patient care(22).

5.AI for genomic data:

AI will so become particularly crucial in genomic. Deep learning is useful in cancer genomics for two reasons. First, it facilitates multitask learning, when AI learns many tasks simultaneously by sharing elements of a model. During training, an optimizer algorithm minimizes user-defined losses. Second, it enables multimodal learning, which combines diverse data kinds (such as sequencing and chromatin accessibility) as inputs. During this process, AI automatically learns to mix various data types. Because cancer is a complicated illness, multilayered data is preferred(23)
One interesting scenario is FNH. Hepatocyte hyperplasia with a central stellate scar is seen in FNH. Using AI id cancer biomarkers is critical because if you want to rely on traditional methods, the accuracy will not be good enough. For example, in liver pathology, AFP is generally can be in normal limits, even in hepatoblastoma (24)It is vital to identify the diagnostic biomarkers can improve patient outcomes and prognoses. For example, microsatellite instability (MSI) can aid in predicting gastric cancer prognosis(25).

6.Limitation:

Currently, there is a considerable gap between research and the needs of the pathology community. The gap can be closed by collaborating with all stakeholders, including scientists, physicians, industry, regulatory agencies, and patient advocacy groups =(26). Notably, most deep learning systems are characterized as black boxes since they cannot explain their judgments(20). AI algorithms' clinical, legal, and regulatory challenges must be explained despite their expanding benefits. The concept that AI would replace pathologists is fanciful now since the two parties complement rather than compete. Although AI will continue to make choices in some domains, people are deemed superior at gathering information and making decisions than robots or systems.

7.Knowledge and experience:

There are gaps in knowledge that need to be filled for AI to influence clinical oncology positively. Data science and machine learning (ML) education is currently lacking for physicians, which limits their capacity to grasp DL processes, use algorithms correctly and perform research. Additionally, most data scientists lack oncological expertise, restricting their capacity to find clinical use cases that are significant and appropriate. Clinical oncology departments and bioinformatics and data science divisions should work together more frequently and develop strategic relationships with technology companies when suitable.

8.Conclusion:

In the last decade, AI has reawakened. With the proliferation of electronic data, technical advancements, and pioneering research in deep learning neural networks, AI is set to transform the medical industry and oncologic treatment. Oncology medication discovery and translational oncology are areas where AI has shown potential. Validation and generalizability issues, interpretation issues, and the growing knowledge gap between clinical and data science professionals continue. If we can overcome these obstacles, AI has the potential to revolutionize oncology and bring cancer care into the 21st century.Innovative AI methodologies and applications will generate key cancer discoveries in the future decade.

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