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Harnessing AI for Early Cancer Detection through Imaging and Genetics

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Abstract

As a result, early diagnosis of cancer is important to enhance the survival rates and treatment procedures. The latest developments in Artificial Intelligence have made changes to Oncology by improving the diagnostic accuracy with the help of images and processing of genetic information. This article discusses the possibility of diagnosing cancer at an early stage using the help of AI-powered tools combined with imaging and genetic data of the patients. AI algorithms especially deep learning models can process medical image and large genomic data set much quicker and accurately than conventional methods and find small patterns that signify the cancerous change that even the experts can overlook. Further, AI optimizes direct screening strategies that strengthen differential diagnostic possibilities based on outcomes that consider specific genetic risk factors for specific persons. Opportunities include the use of new data sources and streams, automation and prediction of human behaviors, moving to continuous AI, increased demand for data, and personalization of experiences and services. On the same note, there are disadvantages of AI which include; data privacy, multi-modal data integration, and interpretability of the AI models. It is therefore their suggestion that AI researchers, clinicians, and geneticists need to work closely in order to apply these Technologies for Clinicals. The combination of AI, imaging and genetics can really change the future of cancer diagnosis, patient outcome, and costs by enabling early, more conservative treatment. This approach could therefore offer a potential for more specific and preventive style of cancer care in the future.

Keywords: Artificial Intelligence, Cancer Detection, Deep Learning, Genetic Markers, Medical Imaging, Personalized Screening.

1 INTRODUCTION

Cancer one of the biggest diseases that are seemingly taking a toll of millions of people all over the world today. Thus, the detection of MCF-7 cancer cells at an early stage is essential to increase patient's life expectancy and survival. Artificial intelligence is a new potent weapon that has the potential to transform the global effort in screening and diagnosing cancer and provide new dimension in precision medicine and patient tailor treatment strategies.

This piece seeks to analyse how Artificial Intelligence may change the ways in which cancer is diagnosed with the help of enhanced imaging systems and genetic sequencing. It looks at the ways by

which convolutional neural networks are improving the efficiency and effectiveness of image-based cancer detection. It also focuses on the subject of using AI in interaction with the genetic data to search for cancer risk factors and biomarkers. Besides, it outlines the problems related to the AI-based cancer detectors and discusses the ethical questions of the usage of artificial intelligence in medicine (Hunduma et al., 2024).

2 THE PROMISE OF AI IN CANCER DETECTION

Cancer is one of the biggest diseases in the world that affected so many people; however, the introduction of Artificial Intelligence (AI) open the new window in the potential for early diagnosis and better for patients. Another significant focus, implemented by the World Health Organization as one of its principal goals, is the increase of the percentage of early-stage cancer diagnoses, and improving this indicator has reached a new milestone with the help of AI technologies in health care.

Types of AI Used in Cancer Detection

AI consists of multiple approaches which include ML and DL and have been used in the fight against cancer detection. ML algorithm is used to automatically work for any data pattern and make the decision based on previous experience. These algorithms can be supervised where the outcome data is given or the unsupervised where the outcome data is not available (Girma et al., 2024). In figure 1 displays the AI in Cancer Detection.

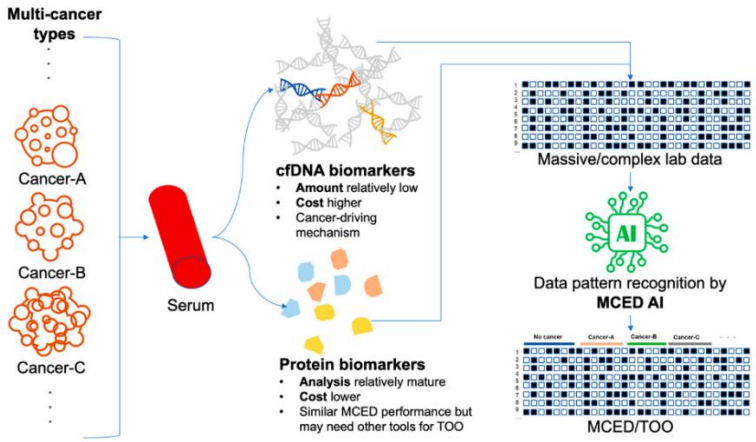

Figure 1: AI in Cancer Detection

ML subclass, deep learning, works with the help of architectures which are similar to the one in a human brain but interconnected. DL architectures such as Convolutional neural networks (CNNs) has transformed the computer-vision research since they help in the use of color images as input data. CNNs have demonstrated unprecedented efficiency in detecting cancer with some of the models having the AUC at 0. 97 in diagnosis of lung carcinoma.

Benefits of AI-Assisted Cancer Screening

AI-assisted cancer screening offers several significant advantages:

- Enhanced Accuracy: AI tools can treat a large amount of multi-modal data to find some weak signals, which may be even unnoticed by observers. The use of this capability may help minimize false-positive diagnosis, which may lead to overall enhanced attendability of diagnosticians.
- Faster Analysis: AI based diagnosis process can be near real time, as it tooks minutes to scan the tissue samples and analyzing it takes only a second while the conventional methods may take days.
- Improved Triage: Detecting high risk, allows to filter the most important cases and bring the most dangerous one to the list of radiologist's cases on the first turn.
- Personalized Risk Assessment: AI can either use patients' clinical data for enrolment to specific screening programs that might detect the disease at an early stage in patients at high risk for it based on the routine clinical data of those patients.
- Reduced Unnecessary Procedures: Consequently, when diagnosis is negative for cancer, AI based systems can prevent patients from receiving multiple follow-up biopsies, thus alleviating the stress experienced by the former as well as be cost saving to the healthcare system.
- Expanded Access: The use of AI tools can provide accurate and fast diagnosis of oncology imaging to regions where there are few specialists including rural and low-income regions.

Current Limitations of AI Cancer Detection

Despite its promise, AI in cancer detection is still in its early stages and faces several challenges:

- The "Black Box" Problem: There are challenges experienced with AI decision-making processes since the health care professional cannot explain or analyze the decision-making process of the AI systems.
- Potential for Bias: Some believe that external factors can be incorporated into these algorithms and thus not recommend themselves for communities who may suffer from discrimination in their treatment or in the medical examinations they receive.
- Hallucinations: As with other forms of advanced technologies, medical artificial intelligence also has a problem with the creation of fake or purely fictional news given by the algorithms that work with the data.
- Need for Validation: As with any diagnostic or therapeutic technology, there is often a hope that AI optimisation of a certain task in medicine will quickly prove to be effective and viable for clinical use – however, often the firstapeutic AI tools still badly need large prospective validation studies to demonstrate the efficiency and safety of their utilisation in the clinic.
- Integration Challenges: I also noticed some challenges being brought about by integration of AI tools into clinical practices including the following logistical and technical challenges.

With time and as researchers work to eliminate these limitations, then the part played by AI in the detection of cancer is likely to increase. The ultimate aim is to diagnose the patients at stages of cancer that can be easily managed with the hope of minimizing morbidity and mortality and reversing the course of the diseases. AI seems to be a fascinating tool with regard to this subject, however, one should not consider it as a direct substitution to a human doctor who diagnoses and plans the ways of cancer treatment.

3 AI-POWERED MEDICAL IMAGING FOR CANCER

Medical imaging especially for the diagnosis of cancer has been dramatically enhanced by Artificial Intelligence (AI). This technology can be as versatile as changing most features of oncology including diagnosis, treatment and identification of new anticancer drugs (Asnakew et al., 2024).

Convolutional Neural Networks for Image Analysis

Recent studies suggest that Convolutional Neural Networks (CNNs) are a futuristic tool in cancer imaging. Such architectures of deep learning are ideal for the analysis given that they learn directly from the images as densitometry scans. CNNs have been used in the diagnosis of cancer with some of them having high performance measures such as the AUC of 0. Four studies employed the use of CT in diagnosing lung cancer; 97% of the studies used chest CT. In figure 2 provide AI-Powered Medical Imaging for Cancer.

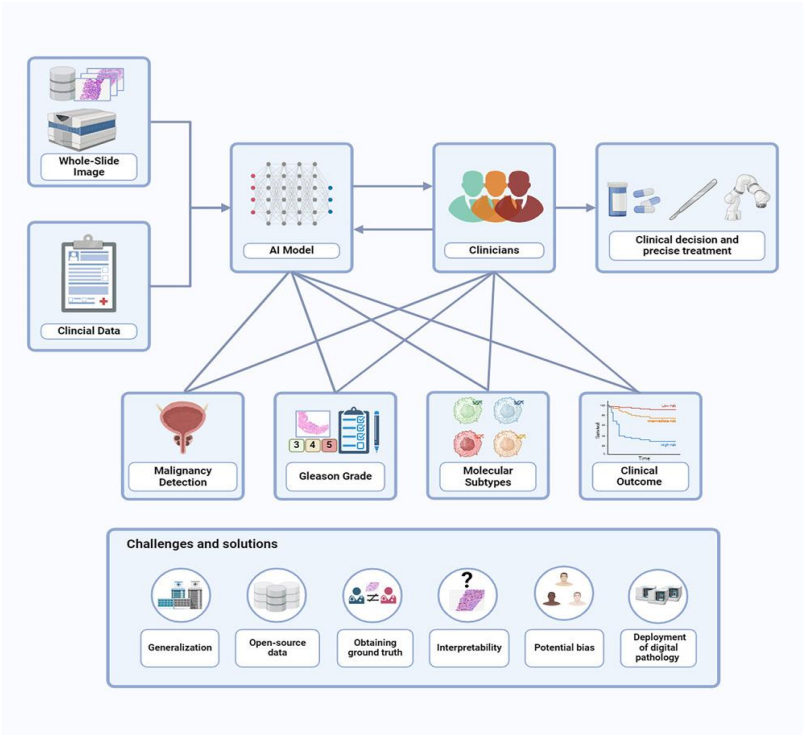

Figure 2: AI-Powered Medical Imaging for Cancer

CNNs are specifically designed to detect intricate features within images and drastically enhance the process of image interpretation where it was once antithetical to give quantitative results and was a qualitative analysis. These networks are trained on large image datasets of human medical images

where it enables them to learn to identify features which might be hard for the human eye to see even when given enough experience.

Key Imaging Modalities Enhanced by AI

AI has enhanced various imaging modalities used in cancer detection and diagnosis:

- Computed Tomography (CT): Deep learning models to independent pulmonary nodules in CT scans have also been set as it increase the effectiveness of the lung cancer screening methods.
- Mammography: Breast lesion detection in mammograms have been performed using deep learning in an effort to minimize the false positive cases and increase the early detection of breast diseases.
- Magnetic Resonance Imaging (MRI): The review also pointed out that artificial intelligence methods can accurately detect the major intracranial tumors such as high grade gliomas, low grade gliomas and cerebral metastases.
- Digital Breast Tomosynthesis (DBT): Defect diagnosis is doable with AI models and they have been implemented for detecting between normal or abnormal DBT images for early-rate breast cancer.

With the help of AI integration in such imaging techniques, there has been a general improvement in the detection and characterization of cancer. Of for instance, when radiologists were asked to use deep learning models in detection as well as management of pulmonary nodule, their efficiency increased while the time spent on reading decreased.

Case Studies of AI Imaging Success

Several case studies highlight the success of AI in cancer imaging:

- Lung Cancer Detection: Automated detection of Pulmonary Nodules is now possible with the help of AI systems with classification, measurement and even malignancy predictions. Such systems have been reported to possess impressive reliability in the diagnosis of precancerous proliferation.
- Brain Tumor Classification: There are AI models which can detect and categorize different kinds of brain tumor such as gliomas, meningiomas, and pituitary adenomas etc with good performance.
- Breast Cancer Screening: The recent deep learning models are now used for analysis of mammograms and DBT images which has shown good efficacy in diagnosing and classifying breast lesions.
- Treatment Response Prediction: Radiomics with machine learning has been applied in determining the prognosis of different cancers treatment such as nasopharyngeal carcinoma to radiation therapy, and non-small cell lung cancer to neoadjuvant chemotherapy.

These examples show that AI can play a major and positive role increasing the sensitivity and specificity of preliminary cancer diagnoses in various types of cancer and by using structural and functional imaging methods.

Application of Intelligent imaging in diagnosing cancer has improving significantly in the last few years. Through sparse and structured representations based on deep learning and convolutional neural networks, AI has improved and standardized cancer diagnosis in a multiplicity of contexts pertaining to the imaging field. This technology is still being developed and with advancement in these years it will bring about a drastic change in the treatments of cancer with improved methods in diagnosing the specific type of cancer and a tailored treatment plan for it.

4 LEVERAGING AI AND GENETICS FOR EARLY DETECTION

AI has been incorporated with genetics to enable enhanced methods of calculating early stages of cancer. These combined efforts have the potential of positively transforming the ways through which healthcare workers diagnose risks of cancer among patients, and thereby promote efficient means of intervention (Lulie & Wondie, 2024).

AI Analysis of Genomic Data

Artificial intelligence based algorithms utilized in genomics have proven to be rather effective at detecting mutations in the genes and dysfunctional proteins that potentially cause the development of cancer. These algorithms have the capacity to notice interactions that are non-linear or even multi-stage, which is not easily detected using the conventional approach; for instance, genome-wide association studies (GWAS) have been successful in identifying genetic variations which have an interaction with each other to give rise to increased cancer risk.

AI-time-series algorithms have been found to be especially useful for the detection of functionally conserved DNA sequence signatures that may indicate large scale regulatory regions, gene function and gene splicing if applied to genomic sequence data. This increased ability to identify complex signals within genetic data holds the likelihood to improve the current understanding of cancer processes and boost the efficacy of initial diagnosis.

Nevertheless, the primary challenge of applying AI in genetic analysis is how patient's genetic data will be collected, analyzed, and utilized. While researchers continue to battle with these challenges, there is an application of the use of AI to develop a way of getting useful information from the genetic data and thus help in early detection of cancer.

Integrating Imaging and Genetic Biomarkers

Co-operation of computer image analysis technology and genetic biomarkers seems to be beneficial in terms of improving cancer detection reliability. New researches revealed the advantages of the analysis of medical images for diagnostics and prognosis of diseases, in addition to genetic biomarkers.

AI has opened up opportunities for the researchers to work on a vast database of genomic sequences and to expand the sequencing of genomic data. This has helped in combining the genetic information with the imaging information thus improving the type of models used in cancer detection.

For instance, a study that considers four types of image features along with the genetic data and demographics got a high Area Under the Curve (AUC) of 0. 949 in testing data. This combination of data sources shown in Figure 3 signifies the possibility of using AI for the integration of the various pieces of information for enhancing the assessment of the risk of cancer.

Personalized Cancer Risk Assessment

AI is currently the main force behind the change of screening recommendations for cancer, from age-dependent ones to risk-dependent ones. These developed AI solutions can take into account a vast array of data on the patient's history, imaging results, and gene profile in order to derive more accurate short-term risk assessments for developing cancer.

Of the many tools, the ProFound AI® Risk has been revealed in one article to be capable of identifying women at a higher likelihood of developing breast cancer up to a level of 2. They indicate a 4 times more of accuracy in comparison to conventional risk models. This tool analyses several points in the patients' scans and delivers a short-term risk assessment depending on age, breast density and other features.

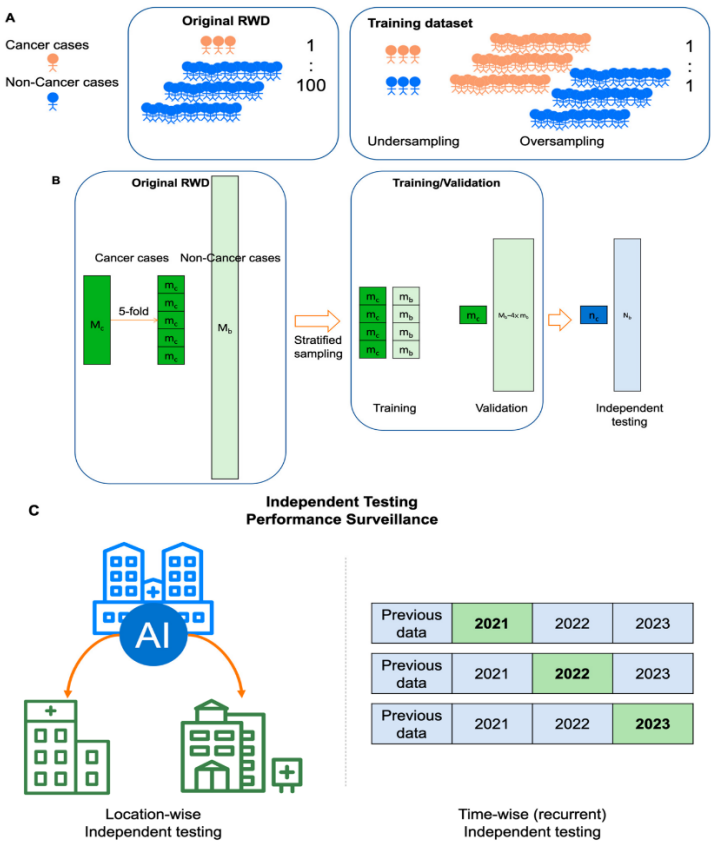

Figure 3: Personalized Cancer Risk Assessment

The combination of artificial intelligence and genetic data for risk assessment have worked out well. For example, researchers have calculated that if 12% of the women at high risk had been offered supplementation screening on the basis of AI risk assessment 59% of cancers might have been identified as against 24% if the lifetime risk model had been used.

This latest development in risk assessment is enabling radiologists to offer better and individualized screening strategies that can preferably detect cancer at early stages thus enhancing the treatment process. Over time AI models introduce more extensive range of predictors in risk assessment and this results in improved accuracy of the tailored risk evaluations.

With the use of artificial intelligence and genetics for an early detection of cancer, healthcare industries are aiming to get into the better future of cancer screening and prevention. With this integration, it will be possible to enhance patients' status and, therefore, decrease additional healthcare expenses linked with last-stage cancer diagnosis and treatment.

5 CHALLENGES IN IMPLEMENTING AI CANCER DETECTION

The use of AI in cancer detection has shown some positive prospects, the following are some of the major challenges that need to be met prior a proper implementation and applications of AI in health care departments (Sharma et al., 2024).

Data Privacy and Security Concerns

Due to the fact that most AI applications in the healthcare field operate on a large amount of data, the safeguarding of patients' data is now a prerequisite for AI research. That medical data is exerting a continuously increasing growth is changing the security and privacy needs in healthcare. This means that liberal digitization of these pieces of information is unavoidable, and thus sound security measures have to be put in place to ensure that these big datasets are well handled.

Primary concerns include, first of all, vulnerabilities of the method associated with re-identification of anonymized data. Cognitive work in the past has examined how novel computational techniques could re-identify people in databases for health care despite the fact that all personal details have been removed from the health records. This reality enhances the privacy hazards connected with permit private AI corporations to possess patient health information.

These implications underscore the challenge of identification most especially in such areas of specialty as dermatology, where blurring out patients' faces may prove difficult; if the focus is on a lesions of the head, for instance, there is not much one can do about it. In addition, most of the existing AI use cases within healthcare entail the usage of both protected ePHI and unprotected user data, including health measuring gadgets on smart gadgets or search history. The use of these two distinct data sources can boast a risk of re identification through data triangulation.

Need for Large, Diverse Training Datasets

AI techniques in their very essence, presuppose the availability of massive data for training optimized models. The main challenge for deploying AI algorithms in oncology imaging is the lack of representative datasets that include the variability of cancers to represent different populations and conditions of the images. However, the existence of such data is generally not easy to obtain and is, therefore, a major concern.

The distribution of data used for training AI algorithms can itself be a source of bias, raising ethical concerns. Since most input relies on electronic health records, AI applications based on such data are disproportionately sensitive to findings seen in socio-economic classes that can afford formal healthcare and health insurance. This bias can lead to suboptimal recommendations for marginalized communities, simply because the network learns from historically suboptimal treatment patterns without understanding the underlying socio-economic factors.

To counter this problem, it is required that the training data comes from several continents, geographically diverse, multicultural. This diversity is necessary to make sure that these networks are usable all over the world. On the same note, such data sharing across the jurisdictions has its own unique issues, which include; differences in laws on the handling of PIPEDA 'personal health information' in different regions.

Regulatory and Approval Hurdles

The advances in AI in healthcare have been very fast, and this have resulted in tools and applications in the health care that still have some level of non adaption of regulatory standards hence it has some level of ethical and legal implications. The status of AI compared to the traditional health technologies can be different and it is complicated to apply the existing regulatory principles.

AI systems are also known to fall into certain types of errors and biases and at other times, are difficult to be supervised by human medical professionals because of the 'black box' issue. This one aspect of opacity inherent in how AI arrives at its decisions is therefore a key issue of concern with regard to medical decision making.

These issues indicate that approval and post-approval monitoring processes of such technologies require specialty regulatory systems. Refinement is possible at all stages of the AI cycle of use, including the action that, in relation to AI, is similar to clinical trials carried out with pharmaceuticals but in view of the specificity of the objects, it is carried out in a different way.

Moreover, about the matters which need to be foreseen, learned, and avoided: how algorithms reproduce or amplify existing bias. This is high level of awareness of risks and can be managed by risk minimization techniques as explained by the follow measures; Training sets that have been rated as low risk of bias.

It is therefore important that these challenges should be solved in order to enhance the use of AI in cancer detection. There is a need for interprofessional stakeholder engagement, including developers of AI, healthcare givers, policymakers and regulatory agencies to make sure that AI is utilized in a way that maximize the benefits without negating the rights of patients, ethical considerations, and legal demands.

6 IMPROVING AI PERFORMANCE AND ACCURACY

With AI proving to have vast potential as a cancer diagnostic tool, researchers are then working on way to improve the existing AI models. These developments are designed to address factors including insufficient data or contextual information, biases, and the requirement for valid future models. In this way, the application of innovative methods allows revealing important prospects for using artificial neural networks in the diagnosis of cancer (Yimer & Tilwani, 2024).

Ensemble Learning Approaches

Ensemble learning has been adopted as a useful approach for improving the system performance in the diagnosis of cancer. In this approach, one first compiles many individual models and integrates them to form a much better model called ensemble model. In the perspective of skin cancer detection, ensemble methods have been found to be promising, mainly because of the complexity that derives from dermatological images.

Researchers have employed various ensemble techniques, including:

- Bagging (Bootstrap Aggregating): This method builds many numbers of decision tree models where each model is trained with different data sets, which minimizes the overfitting and increases the luckiness for the model.
- Boosting: It trains small models of moderate sizes and gives higher importance to the misclassified instances creating an ensemble model.
- Stacking: The first one is the multi-task training where one trains multiple low variance base models and a high variance meta-model to combine the predictions efficiently.
- Random Subspace Method: It is also known as Feature Bagging, whereby each of the base models is trained with random subspace of features in a bid to minimize the problem of overfitting.

In a research conducted in the recent past, the scientists used an ensemble of different category of machine learning algorithms for the diagnosis of skin cancer. They were also employed, XGBoost, Multi-Layer Perceptron, Support Vector Machine, and Random Forest. Ideally, the performance of these algorithms in the ensemble was complementing each other in an attempt to deliver higher accuracy and reliability in identifying malignant lesion.

Federated Learning for Data Sharing

Another way of breaking such a bias is through federated learning (FL), which is a shift from centralized data, into diverse multiple systems in combating cancer research with more data sets. This decentralized approach also helps researchers in carrying out advanced analytical modeling without data moving from its original location solving key issues of data sharing and privacy.

Key advantages of federated learning include:

- Eliminating barriers between different data sets, global accessibility to various information sources.
- Expanding the range of data sources and reducing prejudices by targeting a wider number of people in a population.
- Increase the size of data set which will be achievable by considering data that was previously out of reach.
- Preserving the Patient's right to privacy through de-identified patient-information databases.

One research that incorporated FL in cancer specifically glioblastoma was done. Big datasets with little and varied heterogeneity were accessed in real-time manner without the necessity to physically transfer, clean, or normalize the data, while maintaining anonymized patient information storage. The derived consensus model exhibited a substantially better performance in comparison with prior models on the collaborator data and out-of-sample data.

Continuous Model Updating and Refinement

As a result of the effectiveness of the AI models in diagnosis of cancer, constant monitoring and intermittent updating is desirable. This approach thus serves to reduce negative impact of drift in relation to care decisions and resource allocation. Scholars recommend special focus on data pre-processing, errors' correction, and data standardization that would improve AI's performance.

Key considerations for continuous model improvement include:

- Increasing the size of training data with images of all the possible variants: different skin color, age, and body type, etc.
- To address the above issues, samples are collected at various angles with different lighting conditions and using different equipment to enhance the model's generalization.
- Updating models with images from new technologies by retraining in case of change in the image acquisition technology.

The above strategies help the researchers to develop appropriate and sustainable methods in enhancing the AI models to fit the real situation of clinical practice. With the development of the AI applications in the field of cancer detection, it will be highly important to enhance patient's quality and serve the aims of precision medicine.

7 THE FUTURE OF AI IN CANCER CARE

Currently, the application of AI in cancerology has a great potential to transform the treatment of cancer inter alia through inventing new methods of prevention, diagnostics, treatment, and patient care. To this end, there is conviction that the applicability of AI in the area of cancer research and health-care delivery will expand in the future as the technology advances (Lulie & Wondie, 2024).

AI-Enabled Cancer Prevention

AI has a significant potential in changing the strategies of cancer prevention by processing large quantities of information originating from different sources, including the patients' medical records, genetic data, and environmental factors. Such assessment may support in identifying an individual's chance of cancer and possibly design appropriate prevention policies. Machine learning and deep learning would also help researchers to deduce hard-to-find patterns and trends that are clear predictors of cancer so that early diagnosis could be made.

An area, which holds a lot of potential regarding the use of AI in the fight against cancer, is early detection based on image analysis. By integrating AI technology the methods used in screening for cancer can be made much more accurate and faster especially when used in imaging. For instance, there is proof that research committed by NCI have managed to demonstrate that by using imaging algorithms in AI, breast cancer in mammography can be detected alongside with the likelihood of invasive breast cancer in the future.

Integrating AI Across the Care Continuum

AI is expected to bring changes on the continuum of cancer care, from prevention, detection, treatment, as well as post-diagnosis and post-treatment care. In the area of diagnosis, AI based system will help the pathologist to accurately diagnose cancer and also minimize on errors. Of equal importance and similarly caused by the use of AI, one can perform the genetic subtyping of the brain tumour sample during the surgery and cut down the time of initiating a treatment plan by at least half.

In treatment planning, AI is revolutionizing various aspects of cancer care:

- Radiotherapy: Due to AI, tumour margins can be clearly demarcated, treatment planning can be made comprehensive and real-time modification can be done that enhances the consumption of radioactive elements for therapeutic purposes with least impact on the normal tissues.
- Chemotherapy: Then AI models can forecast about the patient reactions in different treatments that will help to elaborate the precise and effective plan.
- Immunotherapy: AI utilizes data from patients' DNA and scans to choose which patients are most suitable for treatment and which treatment they are likely to benefit from most.
- Targeted therapy: It helps in the pinpointing of particular molecular receptors as to treat with individual therapy.

- Surgery: AI makes navigation and support to the user real-time and helps to improve the accuracy of the surgeries.

Potential for Global Impact

AI in cancer care has great potential to enhance patients' quality of care in the future on the international level. AI tools may assist in delivering high-quality care to patients at different centers including those in rural areas or those who cannot access cancer specialists or in low-income settings hence improving the cancer care disparities.

However, there are some areas which still requires improvement which may bring AI to the bar of what is expected in the treatment of cancer. These include:

- Data quality and standardization: This is because there is no universally agreed format for cancer related heath information that can facilitate the process of verifying AI models.
- Integration into clinical practice: The utilization of AI in clinical practice and the integration of AI in the existing practice activities and frameworks represent major concerns because the latter should closely reflect the activities and problems of the former.
- Ethical considerations: It is therefore important to make an effort that AI model should be trained from diverse data to avoid relaying some medical biases.

With time, the allopa of AI and cancer research is expected to usher a new era of fighting cancer with better, more tailored and efficient approaches to enhancing the quality of life of millions of patients globally.

8 ETHICAL CONSIDERATIONS

With the advancement in AI in the field of cancer diagnosis, and treatment it also has a number of consequent ethical issues that have to be considered. These concerns range over fairness, human supervision and management of patients' trust, all of which are very important in addressing the appropriate application of AI in health sector (Sharma et al., 2024; Deksissa Bejji et al., 2024).

Addressing AI Bias and Fairness

Another important ethical issue is the issue of bias, which is important when diagnosing cancer with the help of artificial intelligence. Machine learning algorithms are learned from data and hence may reproduce existing bias in the society especially in the health sector. Such biases may prove to be detrimental to the aforementioned groups of patients, and they include racial and ethnic minorities, patients belonging to low socio-economic status and sexual and gender minorities.

To overcome these challenges, greater care has to be taken in obtaining datasets that can in turn represent the entire population when the AI is being developed and trained. This involves the systematic collection of data from various sources with a view of learning about the demographic characteristics of the target population as well as their health needs. There is information that AI should be audited

and validated at least once a year to specify potential biases and to guarantee its fairness in healthcare of various population groups.

Maintaining Human Oversight

Given the positive indications exhibited by the application of AI in cancer detection, continued human supervision cannot be overemphasized. Cancer is a very complex disease, its treatment and management needs a compassionate, cultural sensitive approach which is only possible by human touch. Excessive reliance on AI can create an unsympathetic environment with low human values in it and therefore patient humanness may degrade and the rapport that clinicians have with patients may be lost.

To this effect, it is good to incorporate a human interpreter in AI and keep connection points with people in the whole care process. This approach minimizes any risks of embarrassing the patient or undermining his/her dignity and also acts as a way of making sure that the role of AI is to support experts and not replace them in cancer treatments.

Patient Trust and Acceptance

Any move to integrate AI technologies in healthcare institutions require the acceptance by the patients as well as the healthcare professionals. AI ownership and accountability is important because the decision making of some AI algorithms lack transparency hence it may intervene with the autonomy of the patient.

This is particularly the case when it comes to trust, which further means that education has to be given a crucial role. Clinician and patients should be taught some basic facts about the bias of the AI systems that are used, how biases can be handled together with the impact of using AI in health care decisions. Such an educational process might contribute to the create of common knowledge base and facilitate an open discussion of AI application in cancer treatment.

It is imperative to consider and respond to all these ethical issues so that AI can be properly adopted for the right purpose of helping management of cancer diseases. While embracing the flexibility offered by the AI technology, the principles of fairness, the requirement of human supervision, and the need for patient trust will offer the best approach in the healthcare community to reap from the AI while following the core medical ethical principles.

9 CONCLUSION

AI application in cancer detection and treatment changes the situation in oncology significantly. That it can improve medical imaging as a tool, interpret genetic information and offer customization in risk factors promises to dramatically help in early diagnosis and improving patients' quality of life. Combining AI with production of professionals is changing the approach to cancer treatment and diagnosis by opening new opportunities to diagnose cancer at early stage and develop individual

treatment plans. But issues about data privacy, bias, and regulatory compliance are some of the areas that need much attention in order to promote the correct application of these technologies. The role of the AI in cancer care will only grow in the future and holds the promises to revolutionalize prevention, diagnosis and treatment in the clinical settings. Going forward, with the advancement of AI, use of AI in cancer research as well as in the clinical practice is expected to increase in the near future hence may act as the solution to ensure delivery of quality health care across the world. To maximise such potential, there is the need to continue working on the ethical issues, human supervision, and patients' trust. When it is properly combined with technologies based on complex AI systems and ethic, the AI could bring significant contribution in the fight to cancer around the globe, benefitting the lives of millions of people with the disease.

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