Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, January 2023

APPLICATIONS OF 'ARTIFICIAL INTELLIGENCE' IN EARLY DIAGNOSIS OF CANCER

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Abstract
Artificial Intelligence (AI) is growing rapidly in all sectors, including healthcare. AI has been critical in diagnosing, decision-making, and treating chronic disease management and prevention, particularly in cancer research. Researchers are finding new ways to utilize the capabilities of AI in the healthcare field. Researchers use AI, Machine Learning, and Deep learning to improve cancer care and patient outcomes. The emergence of high-performance computers has accelerated the advancement of technologies in the healthcare sector in recent years. AI and machine learning (ML) is utilized to develop an array of tools for cancer imaging. AI and ML are rapidly transforming the scientific landscape by creating several machines and tools that can work with or without human intervention. If Artificial Intelligence technology is integrated into cancer care, it could improve the accuracy and speed of diagnosis, leading to better health outcomes. AI-guided clinical care plays a vital role in reducing health disparities, especially in low-resource settings. In some cases, AI has helped accurately detect and diagnose different kinds of cancer by analyzing tissue scans better than pathologists. Machine learning employs various statistical, probabilistic, and optimization techniques enabling computers to learn from past examples and detect hard-to-discern patterns from complex data sets. Such a capability is helpful for the medical field, particularly those applications that depend on complex detection. The digitized domains in healthcare, such as imaging, are adopting AI and ML to benefit from the technology while working efficiently.

Key Words: artificial intelligence, data, detection, machine learning, research, technology

Introduction
Artificial Intelligence helps in several ways when it comes to cancer. One such way is the screening and diagnosis of the deadly disease. Many research institutes are leveraging the capabilities of AI and its subsets, including ML and deep learning, to improve cancer screening for various kinds of cancer. Researchers utilize ML and deep learning approaches to automate cancer detection from digital images.

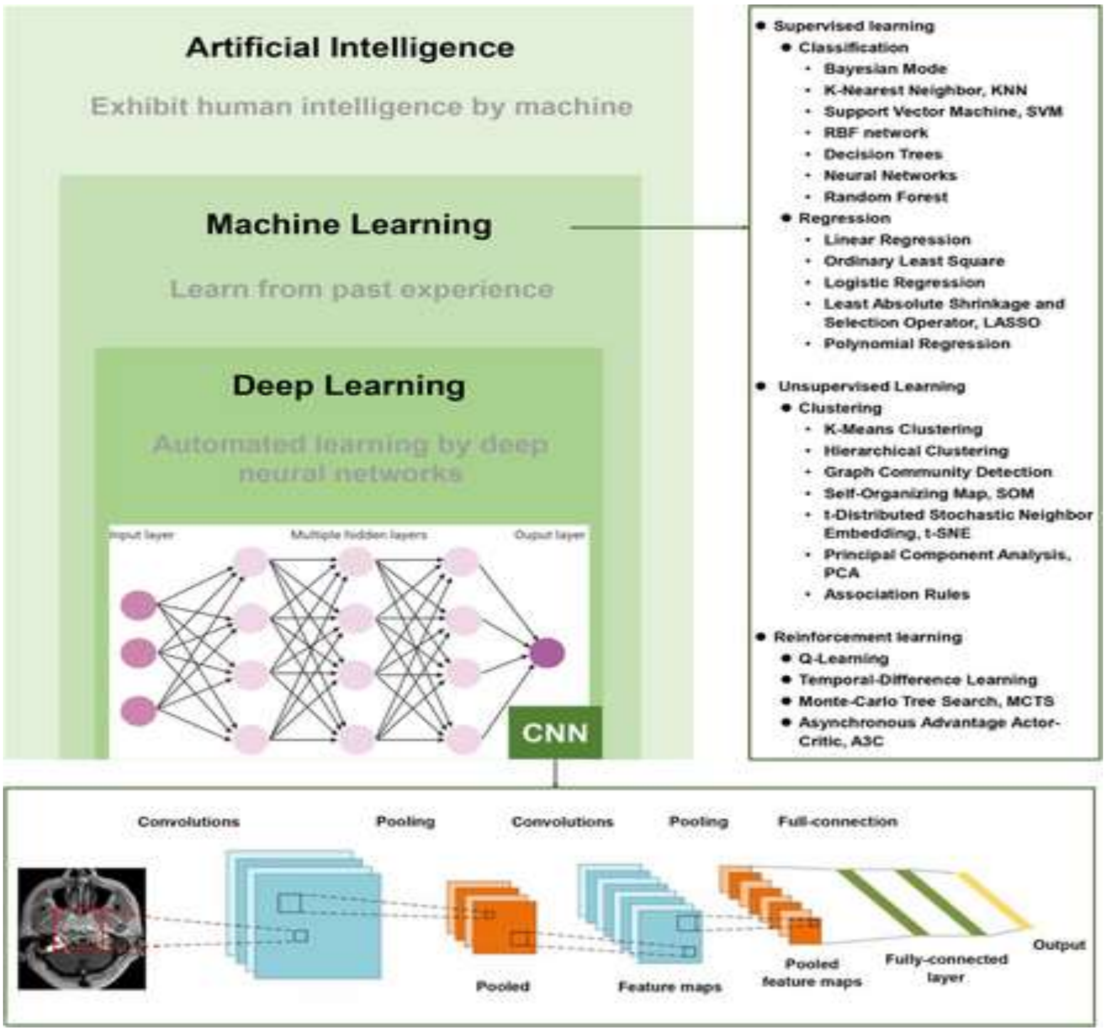
Helps Genomic Characterization of Cancerous Tumors
Instead of using traditional genomic sequencing, several AI methods can help identify specific gene mutations from tumor pathology images. AI can analyze the pathology images and allow the researchers to distinguish between common cancer sub-types and predict commonly mutated genes from the images. It is mainly a challenging problem to identify mutations using noninvasive techniques. However, with the current advancement in the field of AI and ML, it may be easier to identify gene mutations in innovative ways with the help of these technologies.

Accelerates Drug Discovery
Research is going on to identify novel approaches for creating new drugs for cancer treatment, and scientists are utilizing the power of AI in multiple ways for the same. As discussed earlier, gene

mutations are complex, and AI tools can help us identify the issues related to them to uncover cancer treatment. Therefore, identifying such complicated procedures can help researchers work on new drugs to combat the disease.

Improves Cancer Surveillance

Real-time AI application to population-based cancer data is intended to revolutionize cancer treatment. Researchers are working on deep learning algorithms to automatically extract tumor traits from pathology reports, saving countless hours of human processing. This will make it easier for us to comprehend how new diagnostic techniques, therapies, and other elements impact patient outcomes. Additionally, real-time data analysis will make it possible to connect newly diagnosed patients with clinical studies that might be helpful to them.



Final Thought

There is a lot of promise in the future uses of AI in cancer research and therapy. In order to take advantage of these prospects, investments will need to be increased, and some obstacles will need to be addressed. The use of AI in cancer research and treatment is still in its infancy. Instead of using those procedures in clinical practice, most research focuses on developing new ways. Nevertheless, it is clear that incorporating multidimensional heterogeneous data, together with various feature selection and classification algorithms, can develop useful AI tools for inference in the cancer domain. The standard for cancer biopsies is treating the tissue to be tested with staining solutions that reveal cellular details that help a pathologist identify whether a sample is cancerous, and if so, give some idea of cancer severity. Fixing and staining the tissue can take several hours, and although pathologists are very skilled, making a diagnosis based on the size and shape of cells-enhanced by the staining process—can differ between individuals.

In an effort to obtain more rapid, comprehensive, and objective information from biopsy samples, bioengineers at the University of Illinois have built a unique microscope that combines standard visible light microscopy with infrared light. The research is led by Rohit Bhargava, Ph.D., a professor of bioengineering and the founding director of the Cancer Center at Illinois. The team is using machine learning, a type of AI, to process the signals from the hybrid microscope to create unique images of cancer samples that carry much more information than a standard pathology stain. The technique was created by adding an infrared laser and specialized lenses to the standard light microscope found in labs and clinics. The set-up captures both high resolution optical images and infrared molecular signals emitting from a sample bathed in white and infrared light.

“We built the hybrid microscope with commercially available components,” explained Bhargava. “Numerous labs with optical microscopes will be able to build similar instruments, which will help this new approach to be disseminated widely and rapidly.” A key component of the new system is a machine learning program. The computer program combines the white light and infrared signals that bounce off the biopsy sample under the microscope. The result is an image that mimics the type obtained if the sample were stained in a traditional pathology lab—created in minutes instead of hours. The pathology dye stain and the digital “stain” constructed by AI both highlight the size and pattern of the cells in the tissue, with certain patterns being characteristic of cancerous tissues. However, AI gathers information contained in the sample that cannot be seen with the human eye. “Cancer cells have differences in their chemical composition and metabolism”, explained Bhargava. “Information from the infrared signal gives a readout of the molecular composition of the tissues that can be analyzed by AI for decision-making in pathology.”

The extra molecular data reveals specific characteristics of the tumor and the surrounding healthy tissues that can provide better and more consistent information about the cancer’s progression. Because infrared light has multiple wavelengths with different chemical information, the researchers are refining the AI computational programs so it can analyze the different types of cells and diseases. The goal is to achieve extremely precise and reproducible “cancer mapping.”
The technique promises to speed up results, reduce costs and provide what Bhargava calls an “all-digital” analysis of cancer pathology. The team is also exploring use of the hybrid microscope for additional biomedical applications such as forensics and polymer science.

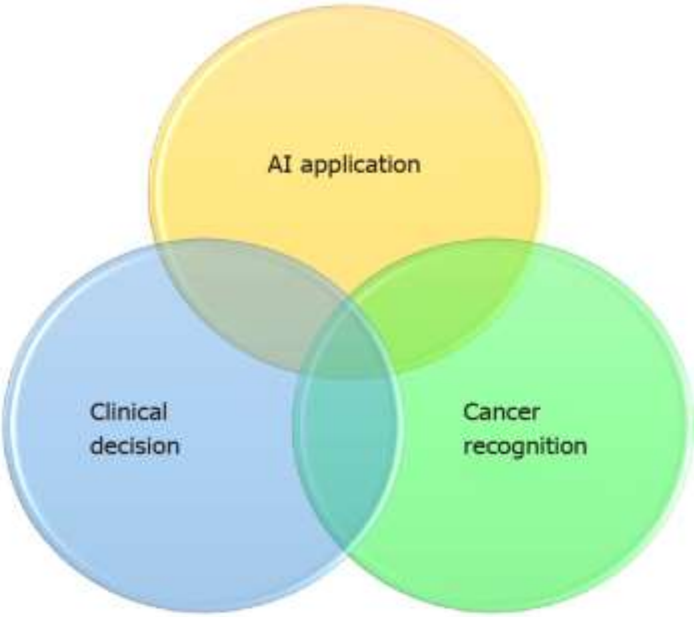
The automatic detection of cancer has already been in practice and will become generalized. Computer-aided diagnosis (CAD) is growing, and the detection and classification of cancer has been achieved in the identification of the subtypes of leukemia with dense convolutional neural networks and residual convolutional neural networks. A CAD system with a massive artificial neural network based on the soft tissue technique detected lung cancer in X-ray images. Infection of Helicobacter pylori was predicted with endoscopic images by artificial intelligence (AI). A faster region-based convolutional neural network was applied to diagnose the T stage of gastric cancer in enhanced computed tomography (CT) images of gastric cancer. Digital images of pathological data in cancer have been utilized in cancer diagnosis. Digital pathology using whole-slide images may contribute into the “remote” assessment. Automated image analysis and AI applications are increasing in the field of thyroid pathology. Cancer recognition by AI has become more accurate and precise, accompanied by the progress of neural networks and calculation capacity. It is time to think of ways to manage teaching AI in cancer therapeutics.

Recognition and AI Application

It may be possible that deep learning approaches such as a pretrained biomedical text mining model in natural language corpora apply to the recognition of cancer by AI. The concept of the adversarial nets framework has advanced the field of recognition. The recognition mechanism of AI application can be translated to human language via the indication of attention. Future perspectives on cancer recognition in AI may need to focus on the translation of AI and human languages. Liver cancer survival can be predicted with deep learning-based multiomics integration. Autoencoder architecture was used to integrate RNA sequencing (RNA-Seq) data, DNA methylation data and microRNA sequencing (miRNA-Seq) data of hepatocellular carcinoma in the cancer genome atlas (TCGA) database. Data coordination with TCGA-Assembler was the first step to provide proper data for AI. A similarity network fusion approach predicted cancer subtypes and survival. A gene signature for the metastasis-related recurrence of hepatocellular carcinoma was identified with a classifier model consisting of class prediction algorithms, support vector machine (SVM), nearest centroid, 3-nearest neighbor, 1-nearest neighbor, linear discriminant analysis, and compound covariate prediction, to assess the risk of cancer recurrence in the early stage. Gene mutation sets were identified in liver cancers, including hepatitis-positive samples. SVM learning is useful for classifying and subtyping cancer. Tumor pathology, such as subtyping, grading and staging, can be predicted by deep learning-based AI. Clustering and machine learning methods have been used to classify immunotherapy-responsive triple-negative breast cancer patients. Progressive non-muscle-invasive bladder cancer and muscle-invasive bladder cancer were classified based on the molecular subtype of immunotherapy responsiveness. An interesting classifier model called cancer of unknown primary-AI-Dx predicted the tumor primary site and molecular subtype in RNA profiling.

Application of Artificial Intelligence Technology in Cancer Treatment

Enhanced clinical workflow with AI interventions has been suggested in cancer treatment, which includes AI-guided detection and characterization, AI-guided treatment planning and monitoring, and AI-oriented optimization of the outcome. AI tools can be used in detection of abnormalities, characterization of suspected lesion, and determination of prognosis or response to the treatment. AI technology provides robust tumor descriptors in segmentation, diagnosis, staging and imaging genomics. Radiomic feature extraction from CT images of lung cancer patients was successful to show association with gene expression and prognostic performance. CT-based radiomic features may predict distant metastasis for lung adenocarcinoma patients. The approach in evaluation and validation of novel biomarkers incor-porates modified criteria in image data into Response Evaluation Criteria in Solid Tumours in cancer therapy[26]. The results of clinical study in metastatic non-small- cell lung cancer demonstrated that the treatment of pembrolizumab in combination with chemotherapy showed longer overall survival and progression-free survival than chemotherapy alone in the patients without epidermal growth factor receptor or anaplastic lymphoma kinase mutations.



Early Natural language processing Clinical data in human language are translated into AI language to allow AI to recognize cancer Middle Machine learning AI learns the feature of the data to generate the recognition model Late Deep learning AI modeling is further evaluated and modified. Human interprets the results of the AI modeling prediction and decides the clinical treatment strategy.

Conclusion

Artificial intelligence and machine learning techniques are breaking into biomedical research and health care, which importantly includes cancer research and oncology, where the potential applications are vast. These include detection and diagnosis of cancer, subtype classification, optimization of cancer treatment and identification of new therapeutic targets in drug discovery. While big data used to train machine learning models may already exist, leveraging this opportunity to realize the full promise of artificial intelligence in both the cancer research space and the clinical space will first require significant obstacles to be surmounted. In this Viewpoint article, we asked four experts for their opinions on how we can begin to implement artificial intelligence while ensuring standards are maintained so as transform cancer diagnosis and the prognosis and treatment of patients with cancer and to drive biological discovery.

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