



Artificial Intelligence (AI) in Oncology

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Abstract

Majorly Morbidity and Mortality rates worldwide can be accounted for Cancer. It is estimated that 19.3 million new cancer cases were seen in 2020 and this number is expected to increase in the coming decades. Estimations is made that by 2040, diagnoses of 30.2 million new cancer cases can be seen. Globally early diagnosis of cancer still remains a major challenge and effective screening doesn't cover all the risk populations. Only a set of privileged patients gain benefits from the novel cancer drugs hence there is a need to make the treatment of cancer more affordable and personalized. The collection of captured data from health systems and oncology providers is a complex and diverse process. The capacity of a human brain to analyze all these structured and unstructured data requires an urgent need to implement alternative strategies to process these big modern data. Artificial intelligence and machine learning are becoming increasingly important tools to tackle these complex problems in oncology providing personalized cancer care.

Keywords: Morbidity, Mortality, Cancer, Artificial intelligence, Machine Learning, Diagnosis of Cancer

Introduction

Artificial intelligence (AI) refers to the intelligence made by machines which is made by humans for the benefit of humans.

Diagnosing cancer at an early stage increases the chance of performing effective treatment in many tumour groups. Key approaches include screening patients who are at risk but have no symptoms, and rapidly and appropriately investigating those who do. AI can directly make the fastest and most intuitive judgment to solve problems. In addition, AI can find information in images that the human eye cannot recognize. This is of great significance for the early diagnosis of tumors based on image data.

Review of Literature

1. Applying Artificial Intelligence in the Detection of cancer in the Early Stage.

The simulation of Human Intelligence in Machines that have been programmed to convert input raw data into decision-making actions is hence referred to as Artificial intelligence (AI).

AI is programmed to make decisions by using deep learning and computer-guided programs that analyze and process the raw data and execute a possible clinical decision for effective treatment. New methods and Techniques are required for predicting cancer at the early stage is required, as existing methods might give less accurate results for early detection and personalized medicine. The potential to use smart, intelligent computer systems in interpreting images for diagnosing early stages of cancer with the help of AI. Greater precision and accuracy have created a revolution in the healthcare system i.e., AI in digital diagnosis. Early detection will help in increasing survival rates. Early detection of cancer with precise accuracy is a future-oriented goal.

2. Emerging roles of Artificial intelligence in the development of Cancer Drug and precision therapy

Independent learning ability and strong logical reasoning is found in Artificial intelligence (AI), it also helps to stimulate the thinking process of the human brain. Optimizing the existing mode of anticancer drug research can be profoundly done by AI technologies like machine learning with certain limitations. We can see the development of artificial intelligence technologies mainly deep learning and machine learning in the research of the anti-cancer drug. How cancer cells become resistant to anti-cancer drugs can be understood, which will in turn help in the development of improved drugs and adjust drug use. The identification of neoantigens resulting in tumor immunotherapy efficacy is improved by AI. Radiologists can use AI to map target areas and plan radiation treatment accordingly. The use of chemotherapy drugs and their tolerance can be managed by AI. Doctors can use AI to make correct decisions regarding surgeries and also help oncologists to improve patients' treatment plans with respect to cancer.

3. Brief Introduction on Artificial Intelligence in Oncology

A significant rate of Morbimortality is associated with Cancer globally. Advances to improve Diagnosis, screening, survivorship, and management are seen in the last decade but challenges in providing data-oriented and personalized care are still noticed. Predictions and automation provided by AI can be seen as a potential solution to improve healthcare services and to promote precision in the research related to cancer such as improvement of clinical practices, and a better understanding of mutated cells and molecules. AI can be unitized to examine the current state of oncology which includes application on current and future perspectives.

4. Importance of AI in Early Diagnosis of Cancer.

World health Organization 's key priority is improving the proportion of patients being diagnosed with early stage of cancer. Screening programmers' have led to the improving the survival rate in many tumor groups being patient selection and risk stratification challenge with concerns about limited diagnostic workforces mainly due to the pandemic causing strain on pathology and radiology services. This paper talks about how artificial intelligence algorithms help in assisting clinicians:

- Screening patients who are asymptomatic and at risk of cancer.
- Symptomatic patients are investigated and triaged.
- More effective diagnosing cancer recurrence.

Overview of historic models such as deep learning, logistic regression, and neural networking by highlighting their early applications. Computational analysis which includes electronic healthcare records such as diagnostic images, peripheral blood, pathology slides, and many other data types can be used for the analysis. This paper also lightens on how to use these data to diagnose cancer. The potential clinical implications of artificial intelligence algorithms with the overview of currently used models in clinal practice can also be known with data security and reporting standards.

5. Current and Future Perspective of Artificial Intelligence in Oncology.

Landscapes and Horizons of oncology are concretely being reshaped by Artificial Intelligence (AI), giving rise to new opportunities in improving the management of cancer patients. AI-Based Federal Drug Administration (FDA) approved devices are already being used and hence have a huge impact on clinical practices. The use of AI-based Devices for Specific cancer types like breast, lung, and prostate cancers is having advantages in the clinical study. Future perspectives of AI in oncology are based on the creation of multidisciplinary platforms to understand the importance of all neoplasms which includes rare tumors with precision is the main challenge for finalizing the AI revolution in oncology.

Problem statement

Morbidity and Mortality worldwide can be accounted for Cancer. It is estimated that 19.3 million new cancer cases were seen in 2020 and this number is expected to increase in the coming decades. Estimations is made that by 2040, diagnoses of 30.2 million new cancer cases can be seen.

New advancements for cancer diagnoses and management is continuously being made which are reducing the cancer mortality over the last few decades yet 10 million deaths related to cancer have been seen in 2020. Upgradation and promotion of innovation in healthcare, especially in cancer care is significantly imperative.

Need for the Study

Globally early diagnosis of cancer still remains a major challenge and effective screening doesn't cover all the risk populations. Only a set of privileged patients gain benefits from the novel cancer drugs hence there is a need to make the treatment of cancer more affordable and personalized. New anticancer treatment development is a resource-intensive and time-consuming process, yet the success rate and patient enrollment are still a challenge and researchers focus mainly on the diagnosis and treatment of cancer.

The collection of captured data from health systems and oncology providers is a complex and diverse process. Dictated or typed notes from doctors', findings from the laboratory, imaging data, histopathological, and data gained from patient histories are some examples of unpredictable data. So, obtaining meaningful insights in clinical data and analysis rely on adequate data extraction, it's processing, analysis, interpretation, and integration of these crude medical data which lacks relevance.

The capacity of a human brain to analyze all these structured and unstructured data requires an urgent need to implement alternative strategies to process these big modern data. Artificial intelligence and machine learning is becoming increasingly important tools to tackle these complex problems in oncology providing personalized cancer care.

Objective

- Implementation of AI in oncology
- Use of AI to segregate and analyze unstructured data in Cancer-related medical data and give those data meaning with the help of AI
- Finally, the Diagnosis of cancer through AI

Conceptual explanation

AI - Artificial intelligence is a field of computer science that focuses on simulating intelligent behavior in machines. To support judgements or carry out specific tasks, it depends on computers to follow algorithms created by humans or learned by computers. AI's area of machine learning describes the method by which a computer can continuously incorporate fresh data into an iterative model to enhance its performance. A kind of machine learning called deep learning (DL) uses multi-layered computational units that mimic human intellect to implement mathematical algorithms. Neural networks with many architectural types are among them (e.g., recurrent neural networks, convolutional neural network and long term short memory).

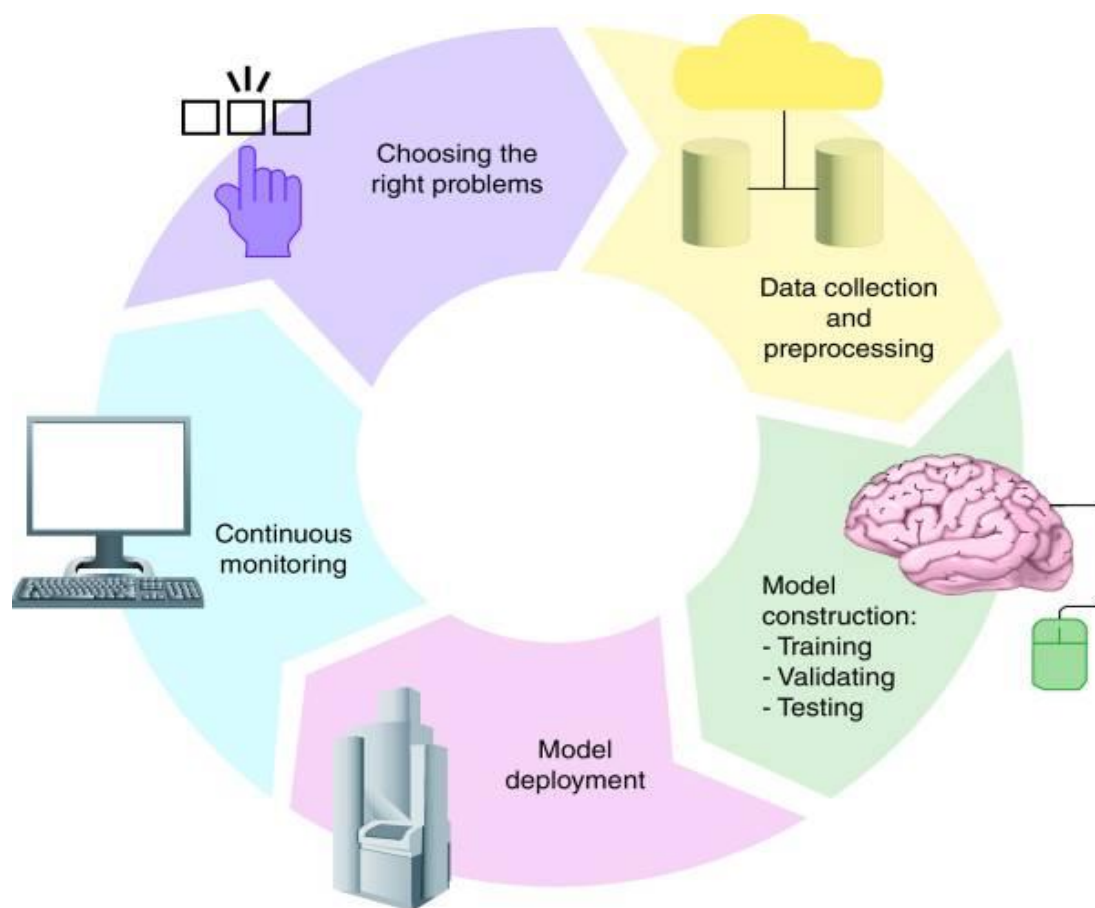
Oncology - In medical oncology focuses on the early identification, treatment, prevention, and diagnosis of cancer. Oncologists are doctors who specialise in the treatment of cancer patients.

Even though the terms "Onco" and "logy" both refer to studies, not all tumours result in masses. There are numerous cancers that can develop from blood cells, connective tissue, or epithelial cells, including those seen in the breast ducts and lungs and sarcomas (such as leukaemias and lymphomas).

While the words "Onco" and "logy" both refer to research, not all tumours produce masses. There are several cancers, including those seen in the breast ducts, the lungs, and sarcomas, that can arise from blood cells, connective tissue, or epithelial cells (such as leukaemias and lymphomas).

AI in Oncology diagnosis - Neural networks in Artificial Intelligence (AI) might have a different architectural approach and the use of these to apply mathematical rules to the medical data provided can be useful to analyze the unstructured data. This can be achieved by natural language processing (NLP) techniques and recurrent neural networks which are deep learning (DL) algorithms in AI that can be used for this problem. Imaging files are explored by convolutional neural networks which is the most promising AI architectures for image-related files.

Correct problem selection, data collection, pre-processing, training, internal validation, testing, optimizing, evaluation, and external validation are carried out by the development and validation of Machine learning (ML) Models. Importance is given to every step to create a reliable machine-learning model which can be used in clinical practice. When a model is deployed application and its results are constantly checked for any drifts or lack of good performance, to ensure the model consistency that can occur. Specific metric is defined for each problem within the ML models. The Receiver Operating Characteristic curve (ROC curve) is the most commonly used metric. This curve plots the true and false positive rate and the area under the ROC curve (AUROC) represents the accuracy level. Assessment of specificity, sensitivity, and precision is checked by using confusion matrix.



Flywheel of Artificial Intelligence.

Graphic representation of the artificial Intelligence and data cycle for building effective and responsible machine learning models for healthcare.

Discussion

Artificial intelligence (AI) has the potential to play a significant role in oncology, particularly in the early detection and diagnosis of cancer, as well as in the selection of personalized treatment options

Early detection of cancer is crucial for improving patient outcomes, as the disease is typically more difficult to treat in its later stages. AI technologies, such as machine learning algorithms, can help analyze large amounts of data and identify patterns that may indicate the presence of cancer.

AI can also be used to help predict which treatment options are most likely to be effective for a given patient. By analyzing a patient's medical history, genetic information, and other data, AI algorithms can help

doctors determine which medications or therapies are most likely to be effective, and tailor treatment plans accordingly.

In Oncology, AI use Image analysis: AI algorithms can analyze medical images, such as CT scans and mammograms, to identify abnormalities and detect cancer. These algorithms can be trained to recognize patterns and features that are indicative of cancer, and they can flag images for further review by a radiologist or oncologist.

AI in early Diagnosis: AI algorithms can analyze patient data, including medical history, genetic information, and test results, to help diagnose cancer. This can be particularly useful in cases where the cancer is rare or the symptoms are subtle, as it can help identify the most appropriate treatment options.

In the future, AI technologies may also be used to help monitor cancer treatment and identify potential problems or complications. For example, AI algorithms could analyze a patient's vital signs and other data to identify early warning signs of treatment side effects or complications, allowing doctors to intervene and adjust treatment plans as needed.

Overall, AI has the potential to improve cancer care by helping doctors detect, diagnose, and treat cancer more effectively. However, it is important to note that AI is still a developing field, and more research is needed to fully understand its potential and limitations in oncology

Conclusion and Suggestions

AI has already had a significant impact in healthcare and will continue to revolutionize medicine. The potential is tremendous and has applications in cancer research, screening, diagnosis, treatment and monitoring.

Overall considered, AI is providing a growing impact to all scientific branches, including oncology and its related fields

It is not difficult to conclude that AI can profoundly optimize existing models of detecting cancer and bring benefits to the existence of humans.

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Review of Literature

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