The Fusion of Oncology with Artificial Intelligence is Known as Intelligent Oncology

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Abstract

We here describe an all-encompassing and organised idea called intelligent oncology, which takes into account the ideologies and technologies that are being increasingly studied for prospective uses of Artificial Intelligence (AI) in oncology. In order to further cancer prevention, screening, early diagnosis, and precision therapy, intelligent oncology is characterised as a cross-disciplinary speciality that incorporates oncology, radiology, pathology, molecular biology, multi-omics, and computer sciences. Rapid advancements in AI technologies including natural language processing, machine/deep learning, computer vision, and robotic process automation have aided in the development of intelligent oncology. We are optimistic that intelligent oncology will play a crucial role in the future of fundamental, translational, and clinical oncology even if the field's applications and concepts are still in their infancy and face numerous obstacles and problems.

Keywords: Artificial intelligence • Oncology • Cancer prevention • Cancer screening • Deep learning • Machine learning

Introduction

Artificial Intelligence (AI) is the use of a computer, robot, or other machine to carry out intelligent behaviour that resembles that of a human. AI has become a crucial component of healthcare as a result of the great uses of increasingly sophisticated AI technology in medical settings in recent years. There is little doubt that these medical applications will significantly influence the state of healthcare in the future. The idea of intelligent oncology has developed as a result of the ongoing discussion of important scientific concerns and the growing application of AI technologies in clinical oncology. We define it as the integration of clinical oncology, imaging, pathology, molecular biology, and multi-omics with artificial intelligence. In general, preclinical and clinical medicine, public health, and computer sciences are all involved in intelligent oncology. In order to construct the intelligently ecological chain in the process of cancer care, intelligent oncology is planned to use fundamental AI techniques such as nature language processing, machine/deep learning, computer vision, biometric identification, and robotic process automation. In the end, intelligent oncology will increase the precision and effectiveness of cancer management in risk assessment, early diagnosis and treatment, prognosis, and prevention and screening. The core meaning of intelligent oncology, in contrast to intelligent oncology excludes statistical analysis, omics analysis, and clinical trials with more medical characteristics in precision medicine and personalised medicine. By the use of a priori knowledge and data mining, Machine Learning (ML) algorithms provide machines the ability to learn, predict, and think. ML can be separated into supervised learning and unsupervised learning according to various construction methodologies. The major distinction between them is whether or not the target label is included in the training dataset. By using data-label pairs to train an ideal model, supervised learning then employs the model to forecast potential labels or values for illuminating data. Classification and regression are the typical tasks that supervised ML algorithms are best suited for. Several supervised learning techniques, including Naive Bayes, logistic regression, k-Nearest Neighbours (KNN), Decision Trees (DT), Support Vector Machines (SVM), and random forests, are available for intelligent oncology (RF). Unsupervised learning approaches require the computation of an optimisation model based on the similarity between training samples because the input data do not have associated labels. Unsupervised learning, which clusters unlabeled original data by computing potential structures or features, is essentially a statistical tool. In oncology, a variety of unsupervised learning techniques, including Principal Component Analysis (PCA), Singular Value Decomposition (SVD), k-means, mean-shift, hierarchical clustering, DBSCAN, optics clustering, and others, are used for cancer screening, prognosis analysis, key-marker extraction, feature dimension reduction, and gene representation clustering. Based on the multi-layer neural network topology, DL is a subfield of ML. DL algorithms are able to process far larger datasets than traditional ML models and extract potential sophisticated semantic characteristics via multilayer nonlinear transformations. 9,10 While being challenging to comprehend and interpret, these semantic properties allow for extremely accurate completion of the intended task, which is what gives machines intelligence. DL is a useful tool for precisely resolving tumor-related problems, enabling the clinical application of intelligent oncology research. The backbone modes in DL approaches that ensure the fundamental performance of applications are Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Long Short-Term Memory (LSTM), Fully Convolutional Networks (FCN), Generative Adversarial Networks (GAN), and others. Graph Convolutional Networks (GCN), attention, multi-head attention, transformer, Variational Transform (ViT), Auto-Encoder (AE), Variational Auto-Encoder (VAE), deep clustering, and others have recently been developed and employed for intelligent cancer research. Moreover, contrastive learning techniques have been widely applied in intelligent oncology tasks to address the issue of the high cost of annotation in medical data and to maximise every raw data. The contrastive learning algorithm is a useful tool for automatically extracting latent information from data with no annotations by using a self-supervised approach, such as digital pa. One of the main areas of AI is NLP, which enables computers to comprehend human language from text, audio, and video It is helpful for clinical use and oncology research. In NLP algorithms, there are three primary steps: receiving, transforming, and creating. Traditionally, symbolic and statistical methodologies are used by NLP systems to complete tasks. Symbolic techniques use a set of rules that are either manually created or discovered through machine learning by simulating various linguistic events. ML algorithms are frequently used in statistical approaches to learn about language phenomena. Due to the widespread use of DL, multi-layer network-based NLP algorithms have gained popularity. There are numerous effective NLP models, including ULMFiT, Transformer-XL, Google PaLM, GPT-3, and bidirectional encoder representations from transformer (BERT). By automatically creating standard medical records, NLP can increase the effectiveness of clinicians during clinical treatment. NLP techniques can automatically extract important information from unstructured text data for cancer research. It can process free text documentation, such as clinical notes for oncology patients and pathology and radiology reports. single cell omics, spatial transcriptomics, disease, and others By enabling two-way, real-time interactive conversations between the patient and the doctor or other precision medicine and personalised medicine in oncology, is focused on the development, advancement, and application of AI technologies in tumour screening, diagnosis, treatment, and prognosis prediction, which could help clinicians meet clinical needs. The field of practitioner at a different location, telemedicine aims to improve the health of its patients. The foundation for achieving remote diagnosis, remote surgery, and remote teaching is the ability to transmit large-scale medical images such as Computed Tomography (CT), magnetic resonance imaging (MRI), Positron Emission Tomography (PET-CT), endoscopy, and pathological whole slide images in real time. To create augmented reality (AR) scenarios for remote surgery, telemedicine can create virtual reality (VR) scenes and merge them with actual scenes. The on-demand availability of computer system resources, particularly data storage (cloud storage), and processing power, is known as cloud computing. Cloud computing is an appropriate answer because AI needs a lot of processing power. It offers a solid foundation for the sturdiness and adaptability of intelligent oncology applications by sharing cloud computing resources.

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