

## ARTICLE

# Application of AI Technology in Tumor medical Imaging

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### ABSTRACT

Artificial intelligence AI has many algorithms, , there are many applications in central nervous system tumors, lung cancer, breast cancer, prostate cancer, orthopaedic tumors, etc., with the norms and support of national policies, AI technology in tumor medical imaging will be ushered broadly.

## 1. Introduction

The term “artificial intelligence” was first introduced and adopted at the Dartmouth College Symposium in 1956, and since the beginning of the 21st century, the research and application of AI in medical imaging has developed rapidly, especially in tumor imaging, and there have been more clinical research and applications in tumor detection, qualitative diagnosis, automatic structured reporting, tumor extraction, and tumor radiation target organ sketching.

## 2. The Classic AI Algorithm and Its Application in Medical Imaging

The current classical AI algorithm can be summarized as a collection theory classification, based on probability statistical classification, graph-based classification, spa-

tial geometric classification, based on cross-disciplinary classification, and so on, each classification contains some commonly used algorithms, such as the artificial intelligence algorithm based on probability statistics has simple Bayes, logic regression, maximum entropy, etc. The deep learning algorithm which simulates human neural network is one of the algorithms belonging to the interdisciplinary classification.

## 3. Application of AI Technology in Medical Imaging

According to statistics, more than 90% of the information stored in hospitals comes from medical imaging equipment, AI in medical imaging equipment can make low-dose CT, PET images by reconstructing high-dose images, reduce radiation risk; AI has also made some substantial

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developments in the diagnosis of ultrasound imaging and the analysis of pathological slicing. In terms of intelligent services, Medical Imaging AI provides intelligent services ranging from assisted detection, assisted diagnostics, accurate diagnosis, quantitative follow-up to precision therapy. Image classification, target detection, object segmentation and image generation are key issues in AI image processing, which are particularly important in medical imaging analysis and processing<sup>[1]</sup>. Deep learning is a very wide range of algorithms, common types include regional convolutional neural network algorithms, spatial pyramid pooling algorithms, fast R-CNN algorithms, Faster R-CNN algorithms, YOLO algorithms, etc. In addition, more and more target detection algorithms are now abandoning the design of anchorbox. One of the most innovative target detection algorithms is called detr. This algorithm extracts features from the input picture, adds position coding, puts it into the transformer, and directly gets the target location, size, and category. This novel design completely abandons post-processing, reduces the need for calculation of target detection, and improves the efficiency of target detection<sup>[2]</sup>.

## 4. The Application of AI Technology in Tumor Imaging

### 4.1 Application of Artificial Intelligence in Central Nervous System Tumors

The purpose of brain tumor segmentation is to identify the location of the tumor and the area where the tumor is immersed outward, i.e. to identify tumor tissue, necrotic tissue, and surrounding edema. Soltaninejad et al.<sup>[3]</sup>, using machine learning algorithms based on 3D Super voxel, analyzed MR images from 2 clinical databases (11 samples and 30 cases, respectively) with Dice coefficient of 0.84, 0.89, which have high accuracy. On the basis of identifying and dividing brain tumors, artificial intelligence algorithms can also be used to grade gliomas, identify glioma recurrence and post-treatment necrosis, prognosis prediction of gliomas, and predict the prognosis of gliomas.

### 4.2 Applications of Human Intelligence in Lung Cancer

Artificial intelligence has shown good clinical application value in lung cancer detection and staging. Masood et al. used deep learning algorithm to analyze chest CT images from multiple databases, and the average accuracy of diagnosis reached 84.58%, and the accuracy of lung cancer t1-T4 staging reached 77.89% ~ 90.14%. Sun et al.

conducted a comparative study on deep learning algorithm and traditional shallow learning algorithm. The data came from Lung Image Database Consortium (LIDC), which contained 13,668 chest CT images. The results showed that the AUC of deep learning was  $0.899 \pm 0.018$  and that of shallow learning was  $0.848 \pm 0.026$ <sup>[4]</sup>. Artificial intelligence identification of pulmonary nodules is also a major research direction for domestic companies.

### 4.3 Applications of Artificial Intelligence in Breast Cancer

In 2016, Quellec et al. proposed a new computer-aided detection and diagnosis system for mammography, which relies on the MIL (a weak supervised learning method) paradigm and uses only whole-image level labels. They first divide the breast adaptively into multiple regions, then extract and combine features of detected lesions from each region to classify mammograms as normal or abnormal. Becker et al. applied deep learning algorithm to classify 632 patients (550 benign and 82 malignant). The total time of computer classification of benign and malignant was 3.7s and the AUC could reach 0.84. The three doctors with high to low experience spent 28 minutes, 22 minutes and 25 minutes respectively, with an AUC of 0.79 ~ 0.88, indicating that artificial intelligence can achieve similar accuracy in the classification of benign and malignant breast cancer as imaging doctors, and can significantly improve work efficiency.

### 4.4 Application Sofa in Prostate Cancer

In western countries Prostate cancer is the first incidence of malignant tumors in male, in recent years, the incidence of China has also shown a clear upward trend. Wang et al. compared the diagnostic accuracy of deep learning algorithms and non-deep learning algorithms in prostate cancer and benign hyperplasia based on MR images, the AUC of Deep Learning AUC was 0.83 and the AUC of non-deep learning algorithm was only 0.70, that means it is better to use depth study to identify the performance.

### 4.5 Application of Artificial Intelligence in Bone Tumors

The quality of life of patients with spinal metastases is significantly reduced, so early detection has great significance. Wang et al. used deep learning algorithm to analyze the sagittal MR images of the spine of 26 patients with spinal metastasis. After combining the analysis results of the twin neuron network, the diagnostic sensitivity reached 90%.

In addition to the above-mentioned tumors, AI has also

been used in other tumors such as liver tumors.

## 5. Industrial Status of Medical Imaging Artificial Intelligence in China

In July 2017, China released the Development Plan for The Next Generation of Artificial Intelligence, which proposes the development of intelligent disease prediction, intelligent diagnosis, intelligent treatment mode and intelligent medical system. The establishment of medical imaging AI model often needs a large amount of data support, at this stage, each research team is prone to form data silos, data labeling consistency is low, gold standard is missing, and quality control, data security and privacy protection are also problems, there are significant differences in the understanding and implementation ability of various participants in medical imaging AI. From ethical point of view, the current research on medical imaging AI is still insufficient to pay attention to the questions of the patient's right to know, privacy protection and other medical ethics issues, data security issues and the safety of patients' treatment<sup>[5]</sup>.

Among the physicians and researchers in China, young and middle-aged physicians, senior doctors and radiologists are generally concerned about AI technology, and the researchers involved in AI research are mostly young students, preferring to be younger, which brings broad prospects for the development of the AI industry. In addition<sup>[6]</sup>, China's hospitals need to improve the current system of talent in-

roduction, attract high-end talent in China's medical imaging in the field of artificial intelligence innovation and development, is conducive to China's medical imaging AI industry towards the direction of standardization and normalization.

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