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**A Study of Multimodal Deep Learning Approach for Malignant Tumor
Classification**

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ABSTRACT

A multimodal deep learning approach for malignant tumor classification integrates multiple types of medical data to improve the accuracy and reliability of cancer diagnosis. Traditional tumor classification methods often rely on a single source of information, such as medical imaging or clinical data, which may limit diagnostic precision. In contrast, multimodal deep learning combines diverse data modalities including medical images (such as MRI, CT scans, and histopathological images), genomic information, and patient clinical records. By leveraging advanced deep learning architectures such as convolutional neural networks (CNNs), recurrent neural networks (RNNs), and transformer-based models, the system can learn complex patterns and relationships across different data sources. This integrated analysis enables the model to capture both structural and biological characteristics of tumors, which significantly enhances classification performance. Multimodal frameworks also reduce the risk of misdiagnosis by providing complementary information from different modalities, leading to more robust decision-making. Additionally, these models support early detection of malignant tumors and assist clinicians in determining appropriate treatment strategies. Recent studies have demonstrated that multimodal deep learning models outperform unimodal approaches in terms of sensitivity, specificity, and overall diagnostic accuracy. Therefore, the adoption of multimodal deep learning techniques represents a promising advancement in medical imaging and oncology, contributing to improved clinical outcomes and personalized cancer care.