

A Deep Learning Techniques for Brain Tumor Detection Using MRI Imaging : A Review

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Abstract: Brain tumor detection has become one of the most active research areas in medical image analysis due to its direct impact on patient survival and treatment outcomes. The rapid growth of artificial intelligence (AI) and deep learning has enabled automated and highly accurate diagnosis from medical imaging modalities, particularly Magnetic Resonance Imaging (MRI). Among deep learning approaches, Convolutional Neural Networks (CNNs) have shown remarkable potential in capturing complex spatial patterns and distinguishing between tumor and non-tumor tissues. This review paper provides a comprehensive analysis of existing deep learning models and methodologies applied in brain tumor detection, classification, and segmentation. It discusses advancements in CNN architectures, data preprocessing strategies, feature extraction techniques, and performance evaluation metrics. Additionally, the paper explores the limitations of current methods, such as data imbalance, model interpretability, and generalization challenges, while highlighting potential solutions and future research directions. The review emphasizes how CNN-based models contribute to early diagnosis, reduce radiologist workload, and improve decision support in neuro-oncology. Overall, this study aims to consolidate current findings, identify research gaps, and guide the development of more robust and clinically applicable deep learning frameworks for brain tumor detection.

Keywords: Brain Tumor Detection, Deep Learning, Convolutional Neural Network (CNN), MRI Image Analysis, Medical Image Classification, Artificial Intelligence, Neuroimaging, Tumor Segmentation, Diagnostic Automation, Healthcare Technology

