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AI-Assisted Brain Tumor Prediction

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Abstract: Artificial intelligence (AI) has emerged as a transformative force in the field of medical imaging, especially in the detection and prediction of brain tumors. Its potential is particularly valuable in improving the accuracy and efficiency of identifying and analysing brain tumors, which is crucial for early diagnosis, treatment planning, and patient care. Traditional diagnostic methods, such as manually interpreting MRI, CT, and other imaging scans, often rely heavily on the expertise of radiologists. However, these methods can be time-consuming and susceptible to human error and variability. Integrating AI into these diagnostic workflows can significantly speed up the decision-making process, enhance diagnostic accuracy, and ensure more consistent results. This review paper explores recent advancements in AI-powered brain tumor detection, with a focus on machine learning (ML) and deep learning (DL) techniques. It highlights various AI models and algorithms—such as convolutional neural networks (CNNs), support vector machines (SVMs), random forests, and ensemble learning methodsthat are being used to detect, classify, and segment brain tumors in medical images. These models are trained using large datasets of labelled images, enabling them to recognize complex patterns and make predictions aligned with clinical outcomes. The paper also sheds light on how AI is advancing several critical aspects of brain tumor analysis, including tumor detection, segmentation, volumetric measurement, and classification (e.g., gliomas, meningiomas, metastases). Beyond simply identifying tumors, AI systems are becoming increasingly capable of distinguishing between benign and malignant types, predicting tumor progression, and evaluating treatment responses. Additionally, the paper discusses the concept of radiomics—extracting quantitative features from medical images and applying AI to relate these features to patient prognosis and survival outcomes.

Keywords: Brain Tumor Detections, Systematic Literature Review, Machine Learning, Artificial Intelligence Diagnostic Accuracy

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