DEEP LEARNING AND ENSEMBLE MODELS FOR BRAIN TUMOR CLASSIFICATION USING MEDICAL IMAGING

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The proposed study focuses on the early and accurate detection of brain tumors using advanced machine learning and deep learning techniques, combined with medical imaging data, to improve patient outcomes. Relevant information is gathered in the research by utilizing a Kaggle-based dataset and a publicly available collection of medical imaging data. Augmentation and clean-up preprocessing methods are applied to increase dataset diversity. The dataset is divided into 80 % training and 20 % testing. Models are built using deep learning approaches such as Convolutional Neural Networks (CNN), MobileNetV2, and Multi-Layer Perceptron (MLP). To enhance robustness, 5-fold cross-validation is used to evaluate model performance. The system is developed as a web-based application using the Streamlit framework to demonstrate real-time clinical applicability. The CNN model achieves an accuracy of 93%, while MobileNetV2 reaches 94%. The combined ensemble model, integrating CNN, MobileNetV2, and MLP, achieves a significantly higher accuracy of 97% compared to baseline models like VGG16 and ResNet50, which show 90% and 92% accuracy, respectively. Cross-validation confirms the stability and reliable performance of the ensemble model, with over 95% precision and recall. This indicates that the model is highly dependable in classifying tumors. The high accuracy and ease of deployment via Streamlit mean these models can be practically implemented in clinical settings. They provide rapid and accurate diagnoses of brain tumors without requiring additional database integration. This facilitates easier diagnosis and improves patient care.

Keywords: Brain tumor detection, Machine learning, Deep learning, Multi-modal classification, Web deployment