BRAIN TUMOR DETECTION USING CONVOLUTIONAL NEURAL NETWORKS AND MACHINE LEARNING MODELS

Thinusan B., Sharangan K., Tharsujan K.* and Rajeetha T.
Department of Computer Science and Informatics, Uva Wellassa University, Badulla, Sri Lanka.
**kunarasatharsujan@gmail.com*

Brain tumors pose significant health risks, with timely and accurate diagnosis being critical to improving patient outcomes. However, manual classification of brain tumors remains challenging due to the complex nature of tumor characteristics and the time-intensive nature of the process. This study seeks to address these challenges by creating advanced machine learning models, including Convolutional Neural Networks (CNNs), Support Vector Machines (SVMs), and hybrid models, to classify brain tumors into four categories: pituitary, meningioma, glioma, and non-tumor. Utilizing a dataset of brain MRI images, preprocessing techniques such as image normalization, resizing, and augmentation were applied to enhance model robustness and generalization. The dataset was divided into training and testing sets in proportions of 87% and 13%, respectively, ensuring a comprehensive evaluation of model performance. Leveraging the LeVit model as a combination of ViT and CNN elements, and involving data augmentation and optimal hyperparameter tuning with the Optuna module, the system was developed to optimize classification accuracy. The proposed automated system achieved a test accuracy of 99%, demonstrating its potential for reliable and efficient brain tumor detection. By improving the accuracy and speed of brain tumor diagnosis, this system contributes to more effective patient management and timely treatment interventions, ultimately aiding in the reduction of mortality rates associated with brain tumors. The automated classification system presents significant advancements by contributing to the medical field.

***Keywords**: CNN, Deep learning, Hybrid model, Image processing, SVM.*