Title: Performance Analysis of CNN Architecture in Brain Tumor Classification Applying Rectified Linear Unit (ReLU), Swish, ad Mish Advance Activation Functions

Abstract— This study evaluates the impact of advanced activation functions, specifically ReLU, Swish, and Mish, on the performance of Convolutional Neural Network (CNN) architectures in classifying brain tumors from MRI scans. The research compares and analyzes the classification accuracy, efficiency, and robustness of CNN models incorporating Swish and Mish activation functions against the traditional model with ReLU activation function. The results demonstrate that both Swish and Mish activation functions significantly enhance the performance of CNN models, with Swish showing the highest overall accuracy and robustness. The Swish-activated CNN model achieved an accuracy of 97.79%, outperforming the ReLU model's 95.42% and the Mish model's 96.19%. The study highlights the superior precision, recall, and F1-scores of the Swish model across all tumor classes, including glioma, meningioma, and pituitary tumors. The findings suggest that adopting advanced activation functions, particularly Swish, can lead to more accurate and reliable brain tumor classification. The research also emphasizes the importance of optimizing CNN architectures and implementing techniques such as early stopping and learning rate schedules to further enhance model performance. This study provides valuable insights into the potential synergies between different CNN architectures and advanced activation functions, aiming to improve diagnostic capabilities and achieve higher accuracy rates in brain tumor classification.

Keywords— Performance Analysis, Brain Tumor Classification,CNN, ReLU, Swish, Mish