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TITLE – DeepBrain: An Explainable Deep Learning Approach for Brain Tumor Classification Using MobileNetV2

ABSTRACT

# This project presents *DeepBrain*, a clinically motivated deep learning-based system for automatic brain tumor classification using MobileNetV2 and Grad-CAM visualization. The solution leverages transfer learning with MobileNetV2 and fine-tunes it using a custom training pipeline enhanced with data augmentation, dropout, batch normalization, and L2 regularization layers. The dataset used is categorized into four distinct classes: glioma, meningioma, pituitary tumor, and no tumor, and is split into training, validation, and test sets with image size standardized to 224×224 pixels.

# The backend is deployed using FastAPI, exposing endpoints for prediction and PDF generation. The frontend is built with HTML, CSS, and JavaScript, providing a user-friendly interface for uploading images, receiving predictions with class probabilities, and visualizing Grad-CAM overlays for explainability. The model's output is summarized in a downloadable PDF containing the diagnosis, Grad-CAM results, and treatment recommendations for each image.

# The model is evaluated using accuracy, confusion matrix, ROC-AUC curves, and classification reports. The system also supports batch image classification, dynamic prediction progress bars, patient name entry, and auto-cleaning of temporary data. This end-to-end application is tailored for clinical use, telemedicine, and educational settings, enabling fast, interpretable, and reliable brain tumor detection.

# Keywords:

Brain Tumor Classification, MobileNetV2, Deep Learning, Grad-CAM, FastAPI, Explainable AI, Medical Image Analysis.

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