Brain Tumor Detection Using Deep Learning

Project Overview

Brain tumor detection is a critical task in medical imaging that requires accurate and efficient identification of tumors from MRI scans. This project leverages **deep learning techniques** to automate the detection and classification of brain tumors, assisting radiologists in early diagnosis and treatment planning.

Objectives

- Develop a **deep learning-based model** for detecting and classifying brain tumors.
- Utilize **MRI scans** as the primary dataset for analysis.
- Improve **diagnostic accuracy** and reduce the time required for detection.
- Provide a **user-friendly interface** for medical professionals.

Technology Stack

- **Programming Language**: Python
- **Frameworks & Libraries**: TensorFlow/Keras, OpenCV, NumPy, Matplotlib
- **Deep Learning Model**: Convolutional Neural Networks (CNN)
- **Dataset**: Publicly available MRI datasets (e.g., Kaggle, BRATS dataset)
- **GUI**: Streamlit or Tkinter for user interaction
- **Deployment**: Flask/Django (for web application), AWS/GCP for cloud deployment

Methodology

1. **Data Collection & Preprocessing**
   - Collect MRI scan datasets (Tumor vs. Non-Tumor images).
   - Normalize and augment images to improve model generalization.
   - Convert images to grayscale and resize for uniform processing.
2. **Model Development**
   - Implement a **CNN-based model** for feature extraction.
   - Train on labeled MRI scans with supervised learning.
   - Optimize the model using techniques like dropout, batch normalization, and hyperparameter tuning.
3. **Evaluation & Testing**
   - Use metrics like **accuracy, precision, recall, and F1-score** for model evaluation.
   - Validate performance using **cross-validation**.
4. **User Interface & Deployment**
   - Develop a **web-based or desktop application** for doctors to upload MRI scans.
   - Display tumor detection results with probability scores.
   - Deploy the model using **Flask/Django** on cloud servers.

Expected Outcomes

- A **high-accuracy** brain tumor detection system.
- A **real-time, automated tool** for medical professionals.
- Improved **early diagnosis** for better patient outcomes.