NeuroScan ML - Brain MRI Classifier to Detect Tumors

Project Objective:

To build a machine learning model that analyzes brain MRI images to automatically classify whether a tumor is present, and optionally, identify the tumor type.

Problem Statement:

- Brain tumors are life-threatening and require early detection.
- Manual MRI analysis is time-consuming and may vary between radiologists.
- An ML-based tool offers fast, consistent, and accurate tumor detection.

Workflow:

1. Data Collection:
   - Use datasets like Kaggle Brain MRI Dataset, Figshare, OpenNeuro, or BraTS.

2. Data Preprocessing:
   - Resize images (e.g., 128x128).
   - Normalize pixel values.
   - Label encoding (e.g., Tumor, No Tumor).

3. Model Building:
   - ML models: SVM, Random Forest.
   - Preferred: CNN with TensorFlow or PyTorch.

4. Training & Evaluation:
   - Train/Test split.
   - Metrics: Accuracy, Precision, Recall, F1 Score.

5. Prediction & Visualization:

- Predict tumor presence from MRI image.
- Optionally show tumor region using Grad-CAM.

6. Deployment (Optional):

- Web app using Flask or Streamlit.

Tech Stack:

- Python
- Libraries: NumPy, OpenCV, TensorFlow/Keras, scikit-learn, matplotlib
- Optional: Flask/Streamlit, Grad-CAM

Expected Output:

- A trained ML model with over 90% accuracy.
- GUI for uploading MRI images and getting instant predictions.

Extensions (Optional):

- Tumor segmentation (U-Net, Mask R-CNN).
- Multi-class classification for tumor types.
- Explainable AI (Grad-CAM) integration.