Brain MRI Tumor Detection AI

Manual

A ResNet18-based classifier with a Gradio web interface for detecting brain tumors from MRI images.

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Group 11
Diego Lopez[*]
Issam Alzouby[†]
Jake Pinos[‡]
Purva Jagtap[§]
Liliana Coste[¶]

Contents

[*] dlopez18@charlotte.edu
[†] ialzouby@charlotte.edu
[‡] jpinos@charlotte.edu
[§] pjagtap1@charlotte.edu
[¶] lcoste@charlotte.edu

Overview

This application detects the presence of a brain tumor from an MRI image using a ResNet18-based CNN and provides a simple Gradio web UI. Predictions include the label (Tumor / No Tumor) and a confidence score. This manual explains how to install, run, and use the system, with clear walkthroughs for common tasks.

Deployment & Installation

- Ensure Python 3.10+ on Windows, macOS, or Linux. CPU works; a CUDA-enabled GPU is optional for faster training/inference.
- Required libraries are listed in `requirements.txt` (torch, torchvision, gradio, opencv-python, nibabel, SimpleITK, scikit-learn, numpy, pandas, pillow, matplotlib, tqdm, streamlit).

```
~$ git clone https://github.com/purva115/brain_tumor_predictor.
git
~$ pip install -r requirements.txt
```

Model file:

- A pretrained model is included at `models/brain_tumor_model.pth`.
- Dataset (if training) should be under `data/BrainMRI/{yes,no}`.

Main Features

- ResNet18-based classifier for MRI tumor detection.
- Gradio web app (`src/app.py`) for point-and-click inference.
- CLI backend inference (`python -m src.inference.test_inference`).
- Utilities for basic anomaly check and report generation in `src/inference/`.

Primary Walkthrough: Predict from the Web App

Steps to run the interface and get a prediction.

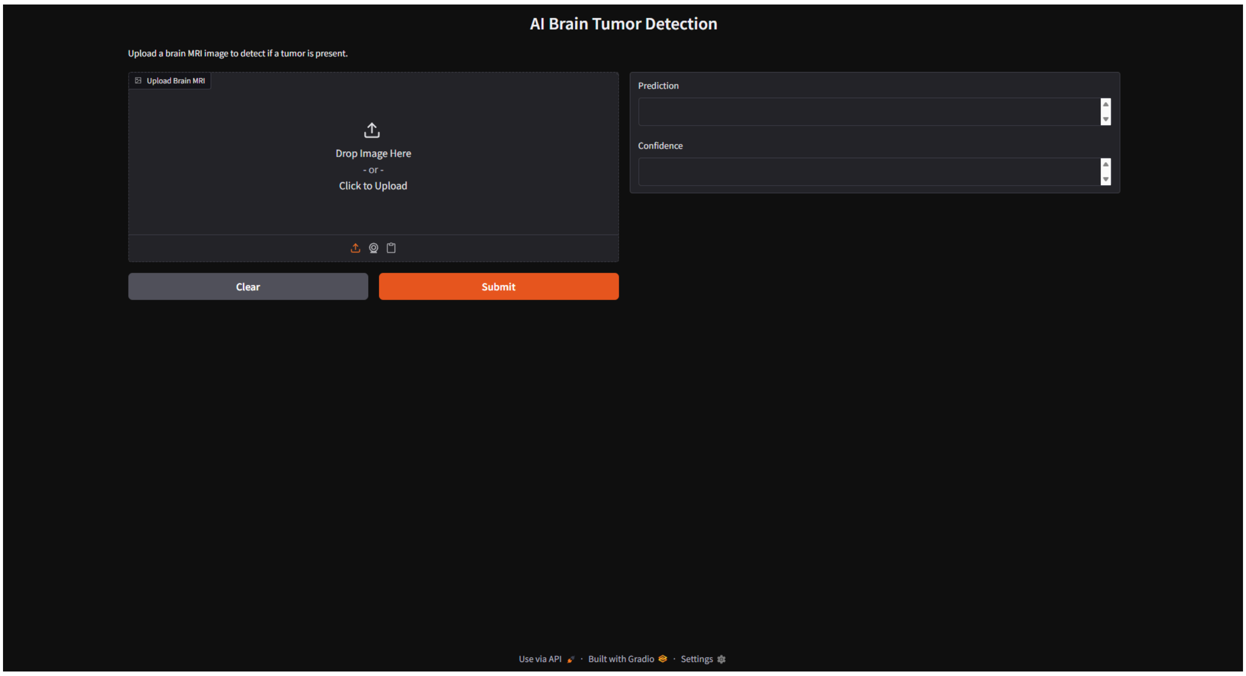
```
~$ python -m src.app
```

1. Your browser opens Gradio “AI Brain Tumor Detection”.
2. Click “Upload Brain MRI” and select a JPG/PNG image.
3. Click Submit to see Prediction and Confidence.

Screenshot Guide

The following screenshots illustrate the main steps of using the web app.

1. Launch the app and confirm the browser page.

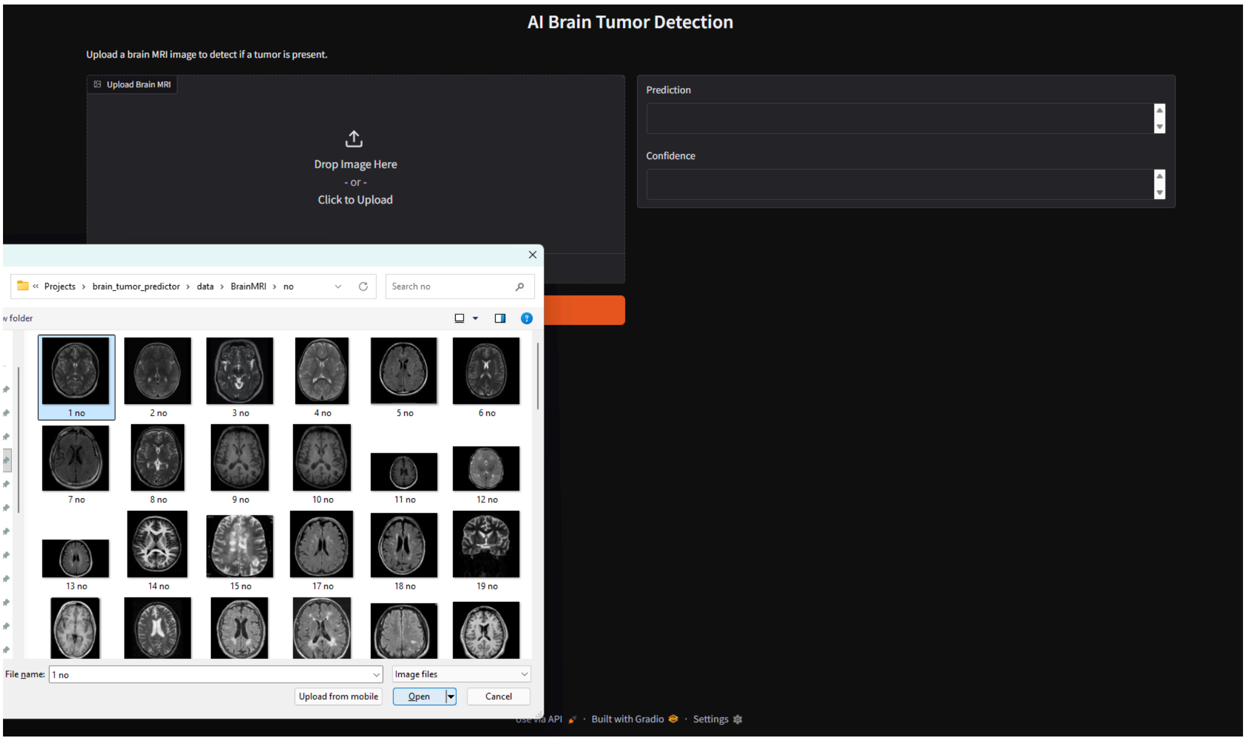


AI Brain Tumor Detection

Upload a brain MRI image to detect if a tumor is present.

Figure 1: The Gradio “AI Brain Tumor Detection” home screen open in the browser. The URL bar and window title are visible.

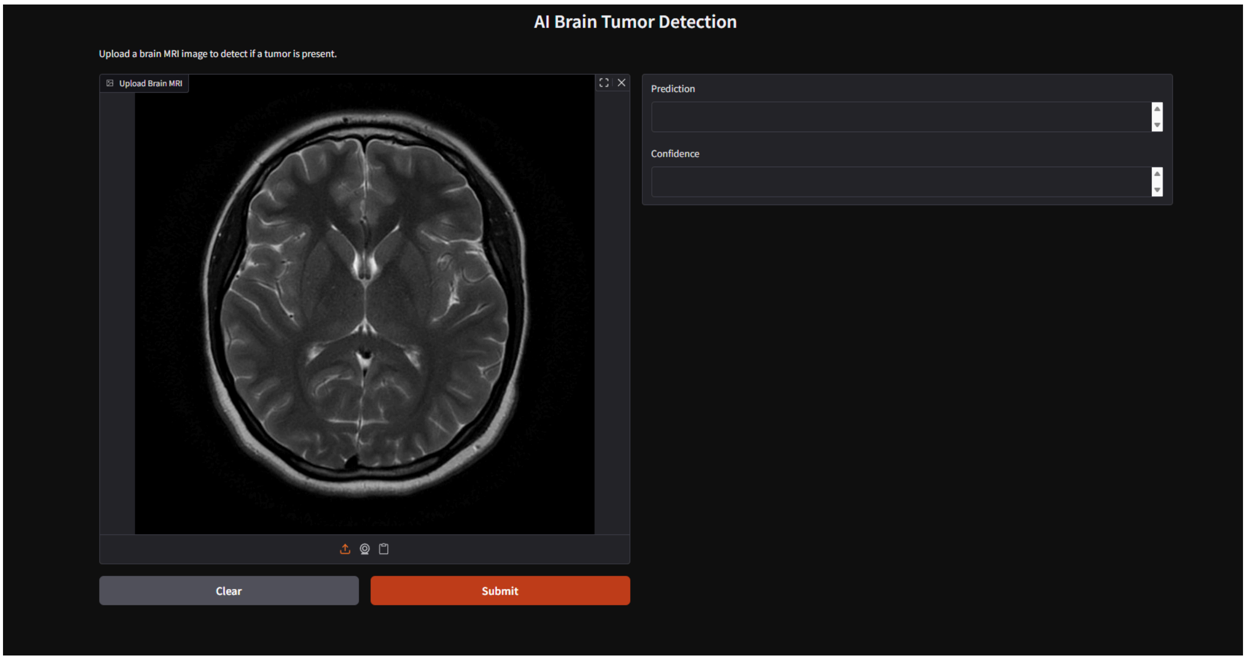
2. Upload a brain MRI image and prepare to submit.



AI Brain Tumor Detection

Upload a brain MRI image to detect if a tumor is present.

Figure 2: The upload component with a sample MRI file selected and visible file chooser.

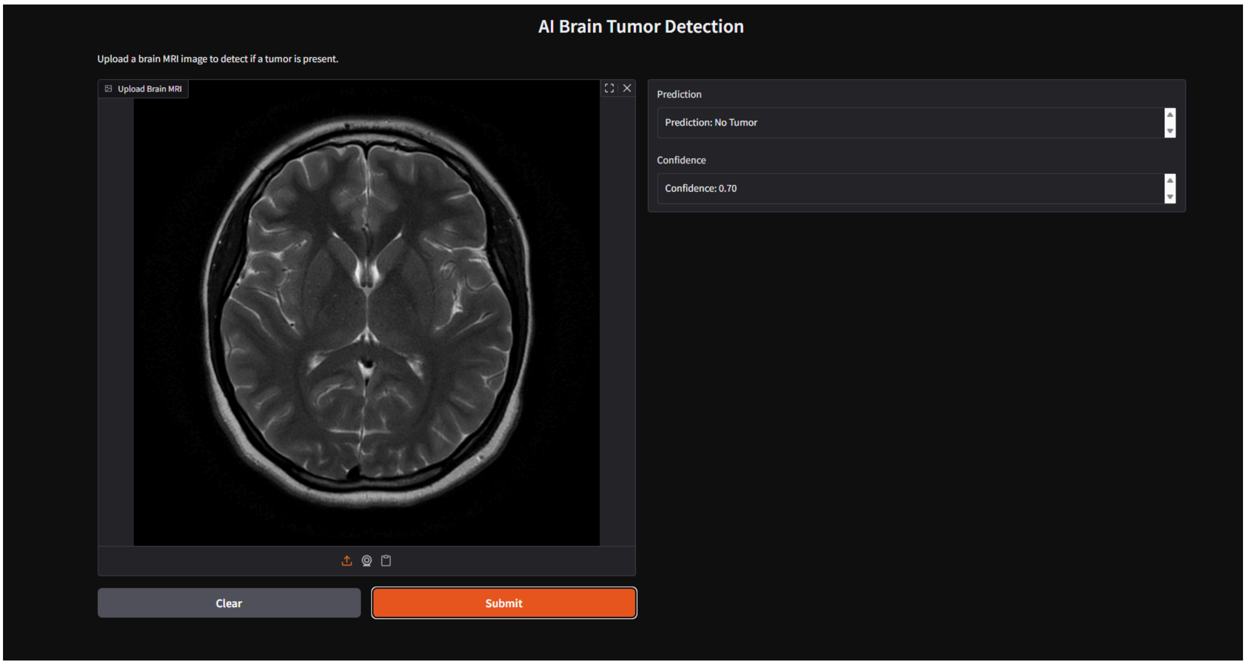


AI Brain Tumor Detection

Upload a brain MRI image to detect if a tumor is present.

Figure 3: The interface showing the selected MRI and the cursor or button on Submit.

3. Review the prediction and confidence.



Prediction: No Tumor

Confidence: 0.70

Figure 4: The results section displaying the predicted class (e.g., “No Tumor”) and the associated confidence score in large, readable text.

Backend Inference (no UI)

Use the backend pipeline to verify predictions from the console.

```
~$ python -m src.inference.test_inference
```

1. When prompted, provide the path to an MRI image.
2. The console prints the predicted label and confidence.
3. Use Ctrl+C to exit when done.

Screenshots to add:

- Show the command prompt running the module. Include the full command line.
- Show sample input image path entered. Make sure the path is readable.
- Show the resulting printed prediction and confidence in the terminal.

Retrain the Model

Prerequisites:

- Place data as `data/BrainMRI/yes` and `data/BrainMRI/no`.

Train:

```
~$ python -m src.training.train_model
```

Outputs:

- A trained model checkpoint is saved (update `models/brain_tumor_model.pth` as needed).
- After training, re-run the app: `python -m src.app`.

Screenshots to add:

- Show the dataset folders in your file explorer. Ensure both yes/no classes are visible.
- Show the training script running with progress/epoch logs. Capture at least one epoch.
- Show the updated `models/brain_tumor_model.pth` timestamp in the folder.

Data & Formats

- Input: single MRI image (JPG/PNG). Gradio passes a file path to the pipeline.
- Expected classes: `yes` (tumor) and `no` (no tumor) for training.
- Typical preprocessing: resizing, normalization, optional channel conversion.

Troubleshooting

- Ensure requirements are installed without errors. Try upgrading pip.
- Check that `models/brain_tumor_model.pth` exists.
- Verify the image is a valid JPG/PNG and not corrupted.
- Check console logs from `src/app.py` for tracebacks.
- Training and inference work on CPU. For GPU, install a CUDA-compatible PyTorch build.

System Requirements

- OS: Windows 10/11, macOS 12+, or Linux.
- Python: 3.10 or newer.
- Hardware: 8 GB RAM minimum (training benefits from 16 GB+). Optional NVIDIA GPU with CUDA.

How to Get Help

- Read `README.md` for quick commands and repository structure.
- Review scripts in `src/` for reference usage (e.g., `src/app.py`, `src/inference/inference_pipeline.py`).
- If issues persist, include error messages and steps to reproduce when asking for support.