**Introduction:**

This project presents a deep learning pipeline for automated brain tumor detection and classification, integrating both segmentation and classification tasks to enhance tumor analysis. A U-Net architecture is employed to segment tumor regions from T1-weighted MRI scans by producing binary masks that localize tumor areas. For classification, a fine-tuned ResNet-50 model categorizes the detected tumors into three classes: meningioma, glioma, and pituitary. The models were trained and evaluated on a publicly available dataset annotated for both segmentation and classification, ensuring consistency and reliability in performance assessment.

**Dataset:**

﻿For this project, we used a publicly available dataset of brain MRI scans, containing a total of 3,064 samples. Each sample includes a patient ID, the MRI image itself, the type of tumor, a segmentation mask, and the tumor’s boundary. To fairly evaluate our model, we split the dataset into training, validation, and test sets. Importantly, we made sure that no single patient appeared in more than one split; even though some patients have multiple MRI scans. This prevents data leakage and ensures that the model is tested on entirely unseen patients. More details about the dataset are provided below.

TABLE 1. Distribution of Tumor Types in Dataset

|  |  |  |
| --- | --- | --- |
| ***Tumor Type*** | ***Num of Samples*** | ***Percentage*** |
| *Meningioma* | *708* | *23.1%* |
| *Glioma* | *1,426* | *46.5%* |
| *Pituitary* | *930* | *30.4%* |

Dataset download link: <https://paperswithcode.com/dataset/brain-tumor-dataset>

**Results:**

**Metrics:**

Dice Score: 0.7495(on test set)

Accuracy: 96% (on test set)