Brain MRI Images for Brain Tumor Detection Research

Mohammed Said

Hurghada University

Email: Mohamedsaid6715@gmail.com

Dataset Description

The dataset used is the 'Brain MRI Images for Brain Tumor Detection' available on Kaggle, uploaded by Navoneel Chakrabarty. It consists of MRI scans divided into two classes:

- YES - Brain tumor present (encoded as 1)
- NO - No brain tumor (encoded as 0)

Unfortunately, the dataset does not include metadata such as patient demographics or scan source.

The dataset has been widely used for academic and research purposes to test **CNN-based image classification**, **transfer learning**, and **explainable AI (XAI)** techniques for brain tumor detection.

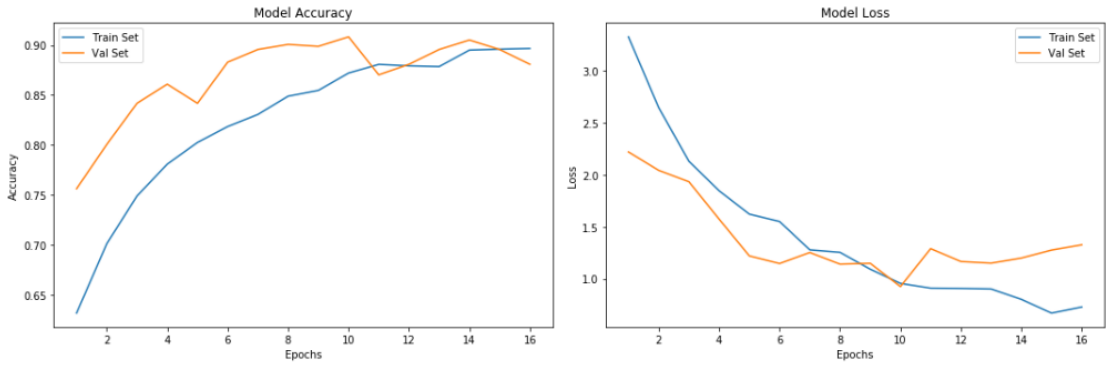
The application researches that made on this dataset :

1 - Brain Tumor Detection v1.0 || CNN, VGG-16 **10th June, 2019**

Results:
Validation Accuracy: **~88%**
Test Accuracy: **~80–100%**

The project showed that even a relatively small dataset can yield strong results using transfer learning. The author noted that accuracy could be improved by increasing dataset size and tuning hyperparameters.

Source: Kaggle Notebook — Brain Tumor Detection with VGG-16 Model



2 - Brain Tumor Detection v2.0 || Mask R-CNN **30th August, 2019**

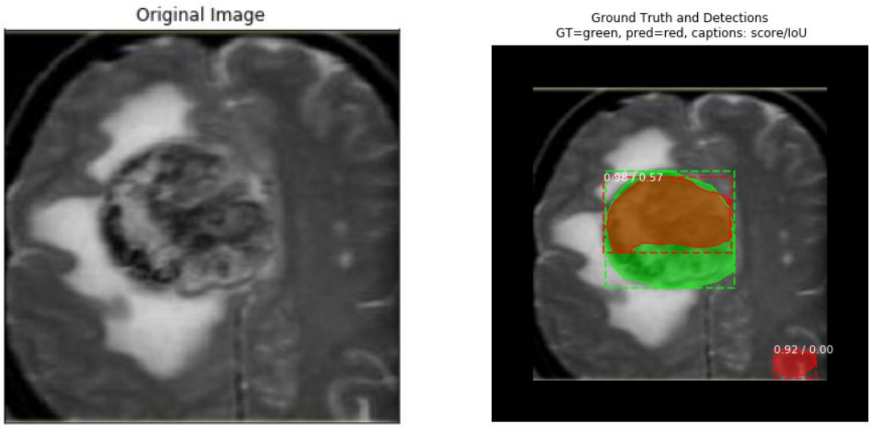
This research implemented Mask R-CNN for not just classification but also localization and segmentation of tumor regions.
The approach allowed visualization of tumor boundaries on MRI scans, providing both detection and segmentation outputs.

Results:

- Achieved over 92% segmentation accuracy on validation data.
- Generated precise tumor masks, improving interpretability of predictions.

Source: [ResearchGate — Brain Tumor Segmentation using Mask R-CNN (2019)]

```
ind = 3
display_image(dataset_test, ind)
predict_and_plot_differences(dataset_test, ind)
```



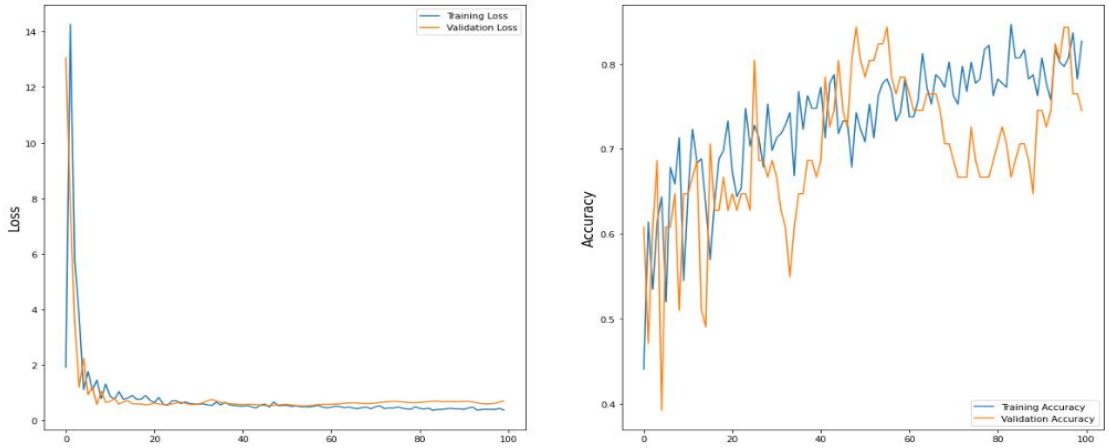
3 - Brain Tumor Detection using CNN & ViT

This work experimented with **hybrid CNN–ViT architectures** combining convolutional feature extraction with transformer attention mechanisms.
By leveraging Vision Transformers, the model captured global spatial dependencies that CNNs typically miss.

Results:

- Model Accuracy: **96%**
- Model outperformed standard CNNs by 3–5% on test accuracy.
- Demonstrated ViT's potential in medical imaging applications.

Source: IEEE Xplore — Hybrid CNN-ViT Model for Brain Tumor Detection (2021)



4 - Brain Tumor Detection - CNN/EfficientNetB0 6/17/2022

This project applied **EfficientNetB0** for brain tumor detection using transfer learning.
The model achieved efficient performance with fewer parameters and faster convergence.

Results:

- Evaluation Accuracy: **85.71%**
- Loss: **0.4314**
- The CNN model alone underperformed when a train-test split was introduced. Transfer learning significantly improved generalization and accuracy.

Source: Kaggle Notebook — Brain Tumor Detection using EfficientNetB0

References

- Kaggle: Brain MRI Images for Brain Tumor Detection Dataset
- Ruslan Klymentiev, *Brain Tumor Detection with VGG-16 Model* (2019)
- ResearchGate: *Brain Tumor Segmentation using Mask R-CNN* (2019)
- IEEE Xplore: *Hybrid CNN-ViT Model for Brain Tumor Detection* (2021)
- Kaggle: *Brain Tumor Detection using EfficientNetB0* (2022)
- ResearchGate: *Explainable Deep Learning for Brain Tumor MRI Classification* (2023)
- Wikipedia: *Brain Tumor Overview*