Brain MRI Segmentation using Machine Learning Models

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PROJECT OVERVIEW

The objective of our project is to implement and train a U-Net model for image segmentation. We began by studying the original U-Net paper and building the model from scratch.

To assess its performance, we evaluated segmentation results using standard metrics such as the Dice coefficient and Intersection over Union (IoU), interpreting the outcomes to identify the model's strengths and limitations relative to our baseline. Additionally, we explored variations of the architecture, including nnU-Net and MedSAM, while also experimenting with different learning rate schedulers and data augmentation techniques to improve training and model robustness.

CONCLUSION

Through this project, we successfully improved segmentation accuracy in MRI-based tumor detection, surpassing our baseline model using advanced architectures like U-Net and MedSAM.

By achieving this, we not only met our initial objective but also demonstrated the potential of AI to refine medical imaging techniques and tackle complex challenges in healthcare diagnostics.

DATA & RESULTS

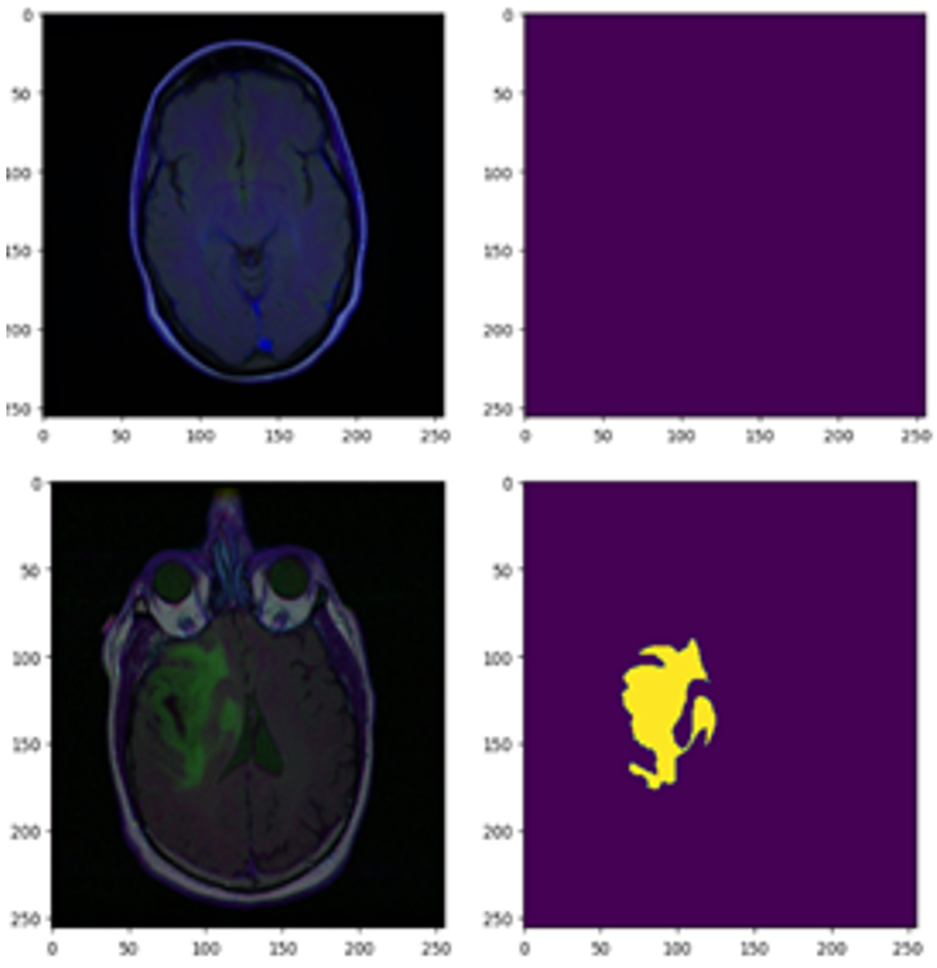
Table of image data

	ID	Image
472	TCGA_DU_6408_19860521_31	lgg-mri-segmentation/kaggle_3m/TCGA_DU_6408_19...
288	TCGA_DU_6405_19851005_23	lgg-mri-segmentation/kaggle_3m/TCGA_DU_6405_19...
3666	TCGA_FG_6691_20020405_29	lgg-mri-segmentation/kaggle_3m/TCGA_FG_6691_20...
851	TCGA_DU_7018_19911220_36	lgg-mri-segmentation/kaggle_3m/TCGA_DU_7018_19...
2796	TCGA_HT_A61B_19991127_11	lgg-mri-segmentation/kaggle_3m/TCGA_HT_A61B_19...

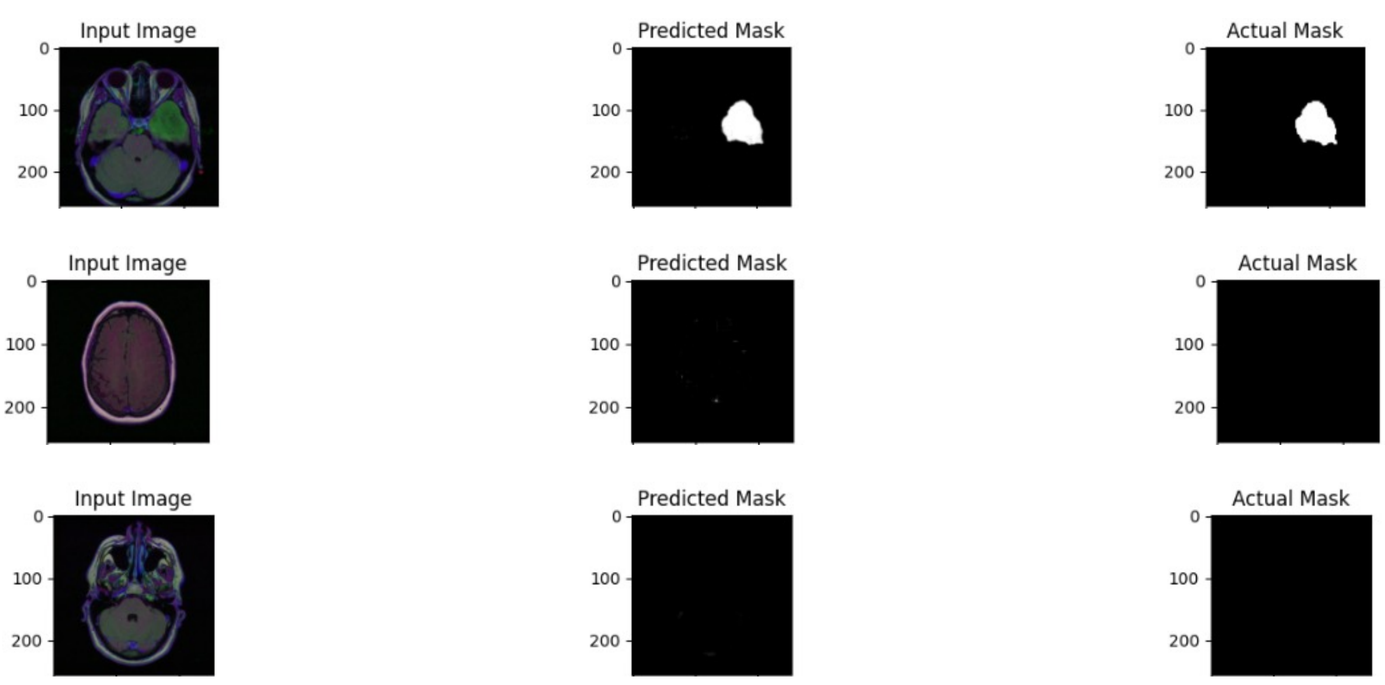
0 no tumor 1 tumor

	Mask	Diagnosis
lgg-mri-segmentation/kaggle_3m/TCGA_DU_6408_19...		1
lgg-mri-segmentation/kaggle_3m/TCGA_DU_6405_19...		0
lgg-mri-segmentation/kaggle_3m/TCGA_FG_6691_20...		1
lgg-mri-segmentation/kaggle_3m/TCGA_DU_7018_19...		0
lgg-mri-segmentation/kaggle_3m/TCGA_HT_A61B_19...		0

Tumor mask in python



Example run of unet model



Iou and dice score metrics

```
(tensor(0.7890, device='cuda:0'), tensor(0.8818, device='cuda:0'))
(tensor(0.8538, device='cuda:0'), tensor(0.9210, device='cuda:0'))
```

TECHNOLOGIES

kaggle · NVIDIA CUDA · python · Ubuntu

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