Skoltech

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NeuroScanAI

Segmentation of Tumor in MRI Brain images

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Project Overview

Introduces a novel approach to automate brain tumor identification from MRI scans.

Project Objectives

•: Existing manual examinations are inefficient and error-prone.
•: To boost diagnostic precision and expedite the treatment planning process.

Project Goals

•: Leveraging state-of-the-art deep learning to streamline and refine diagnosis.
•: Delivering an innovative tool to significantly impact brain tumor management, fostering tailored therapy options.

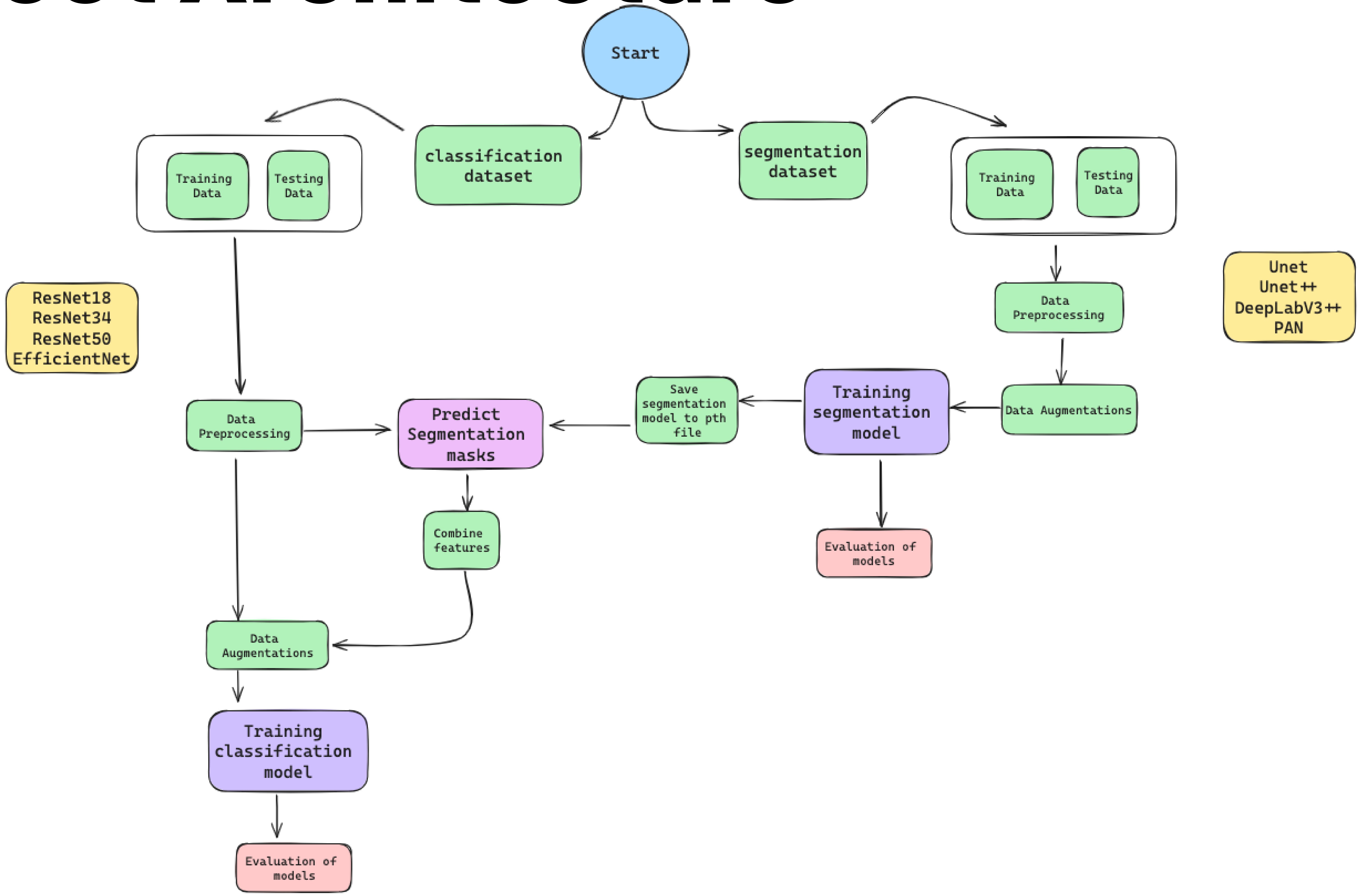
Problem Statement

- What's the best way to automatically spot and classify brain tumors in MRI images?
- Can deep learning improve how fast and accurately we diagnose brain tumors?
- How can our new tool change the way doctors plan and monitor brain tumor treatments?

Project Methodology

- We study MRI images of the brain to detect tumors using computer algorithms.
- Our method involves training deep learning models on segmentation and classification of these images to recognize tumor patterns.
- We test different algorithms, comparing their accuracy and speed in identifying tumors

Project Architecture



Project Hypothesis

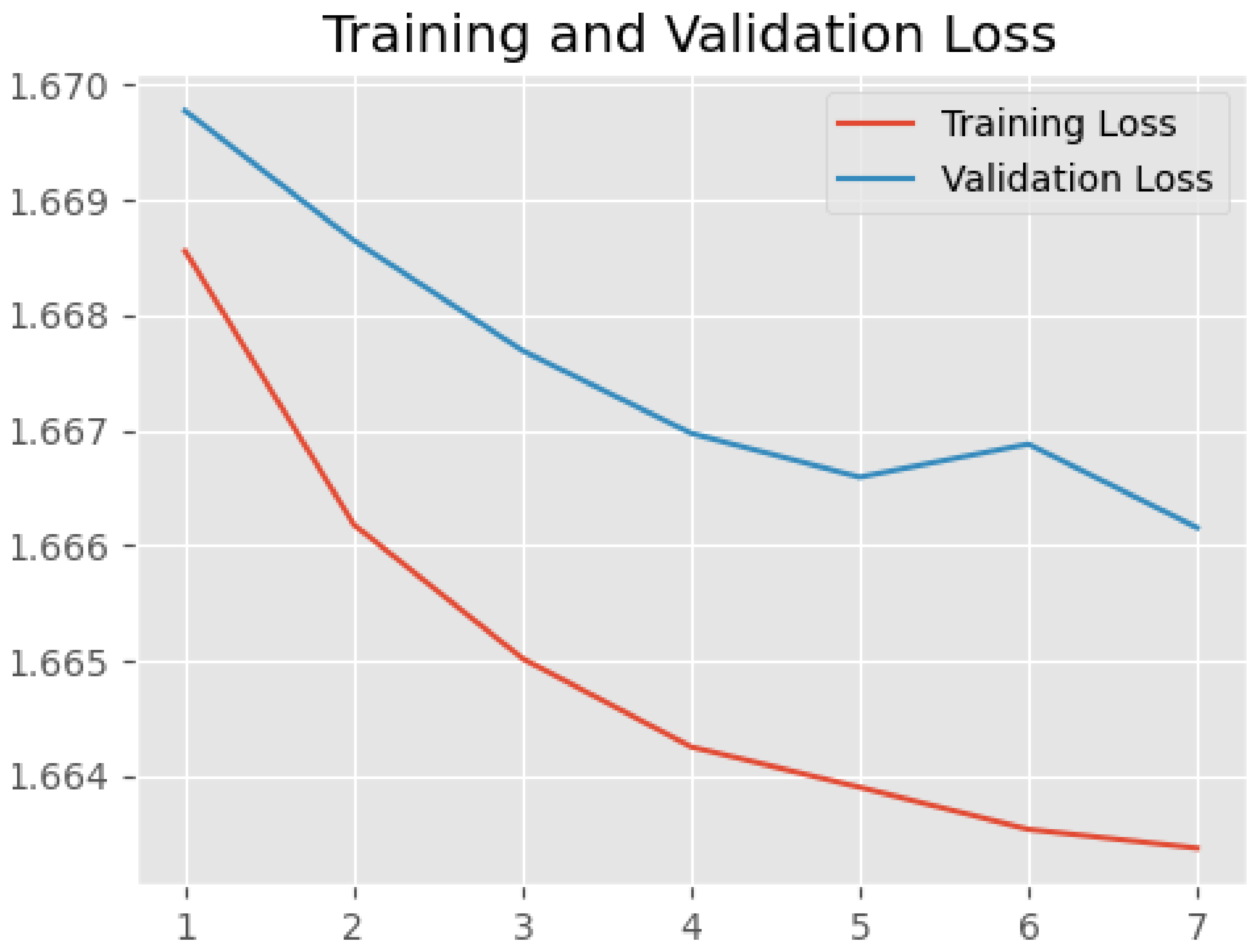
Our hypothesis states that the segmentation supplement **enhances** classifier performance in terms of model accuracy.

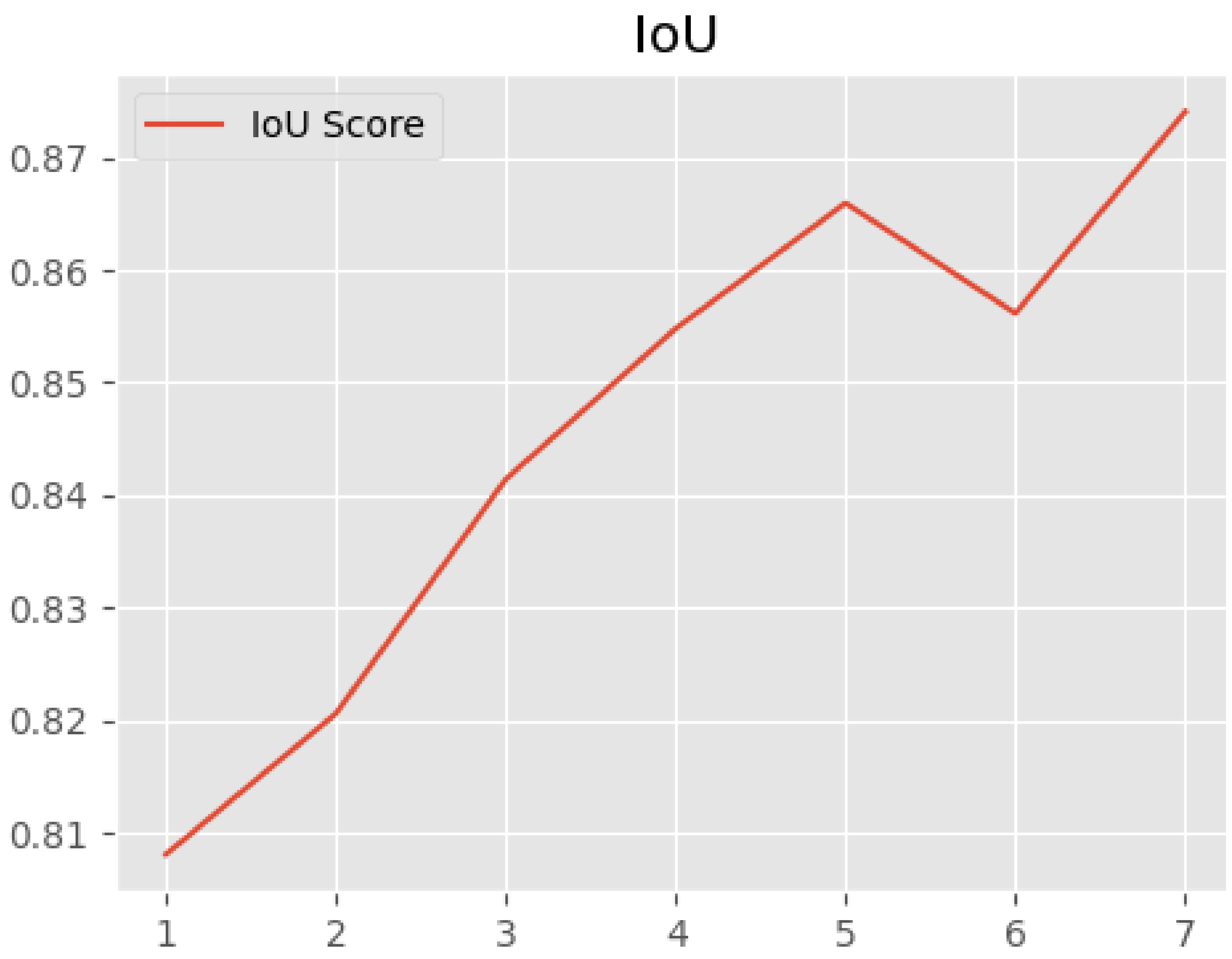
Segmentation

Train segmentation models

Results

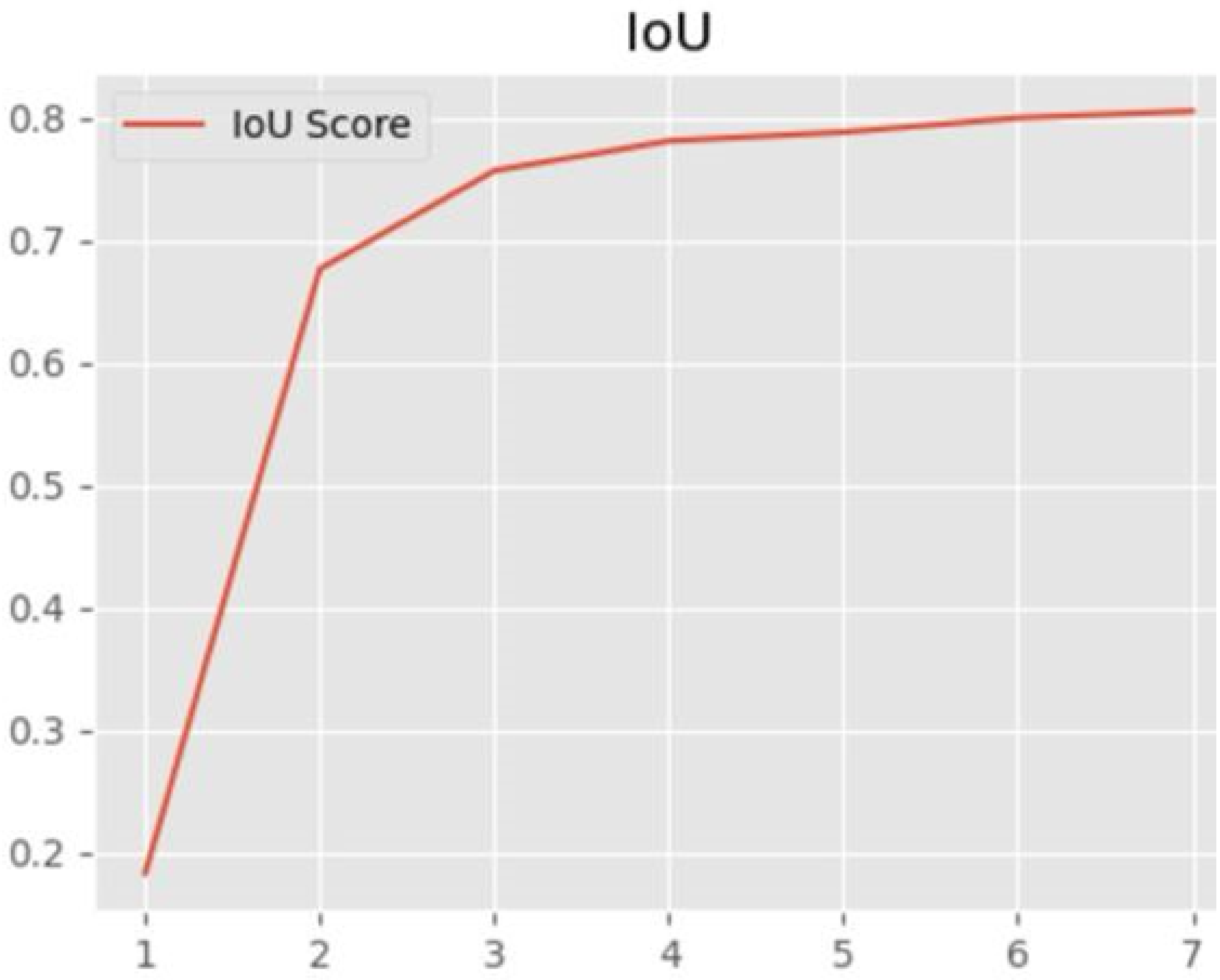
DeepLabV3+





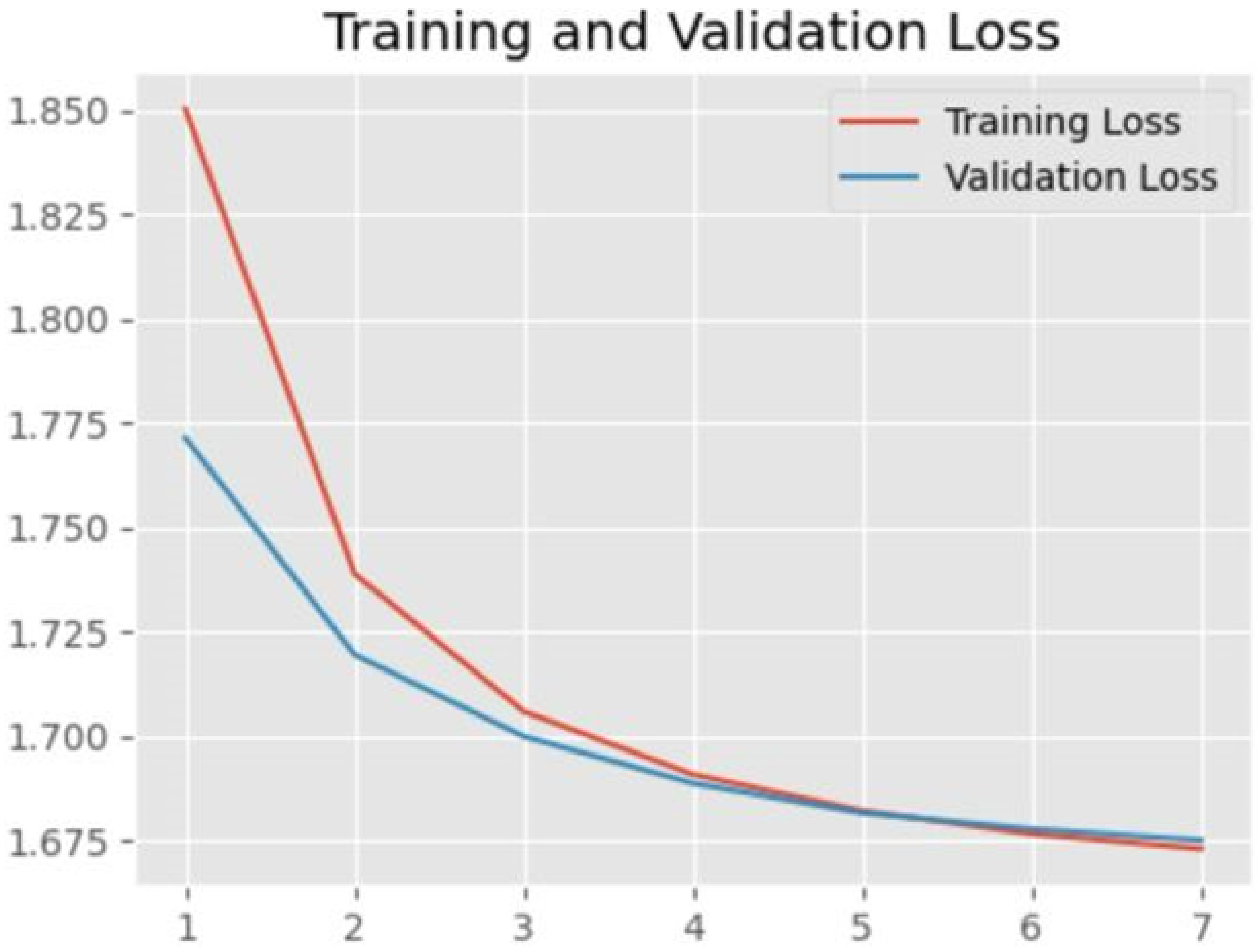
Results

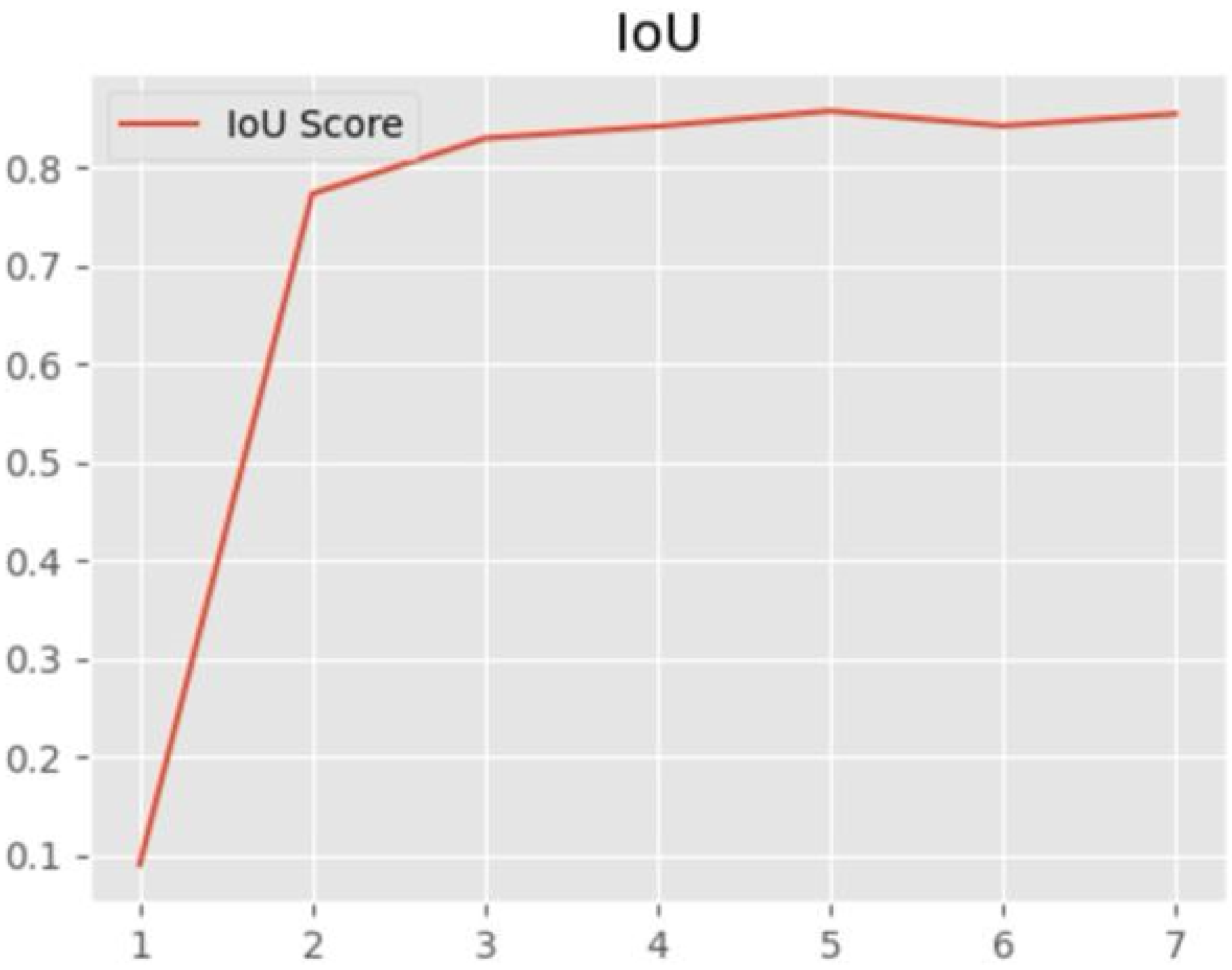
UNET



Results

Unet++

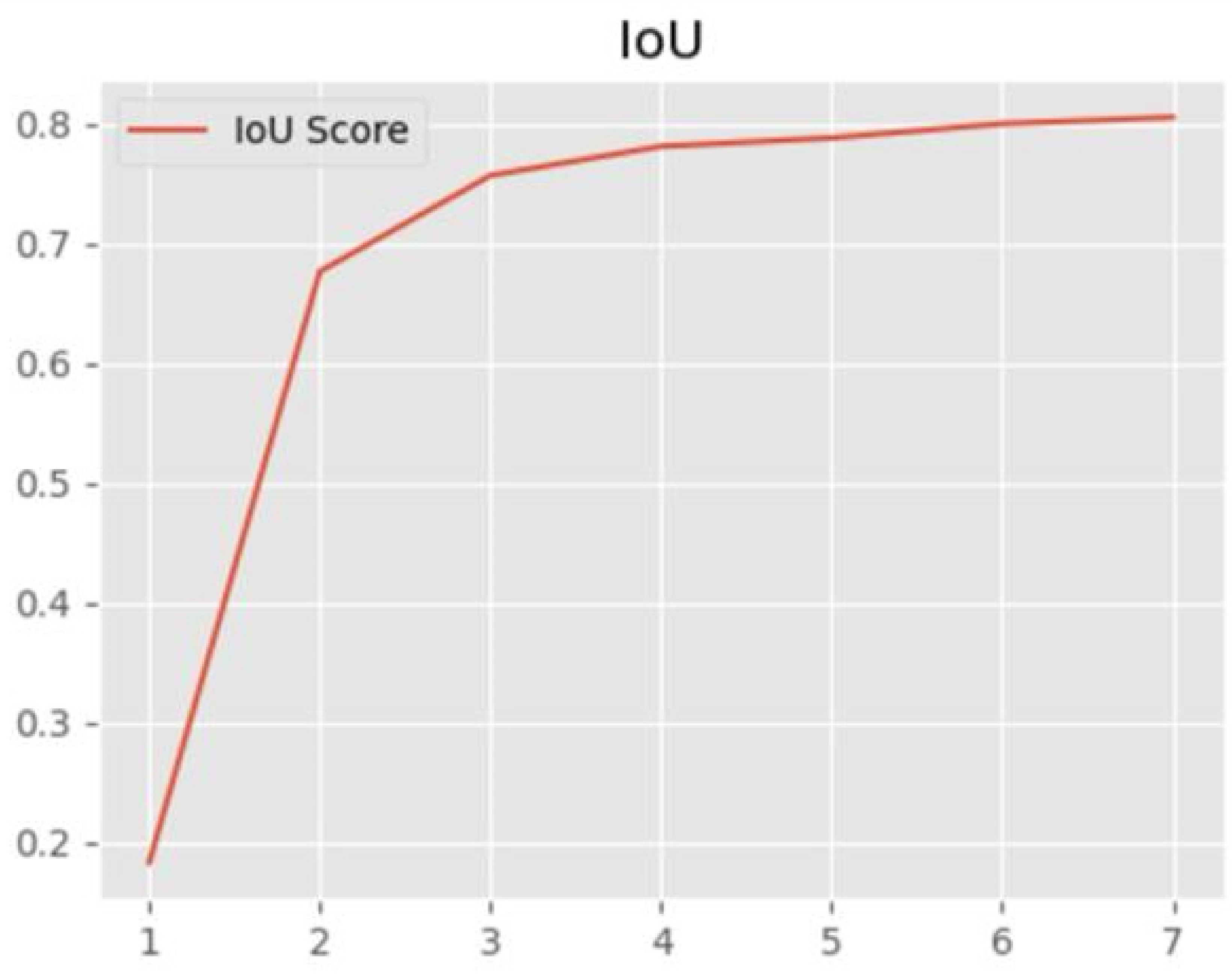




Results

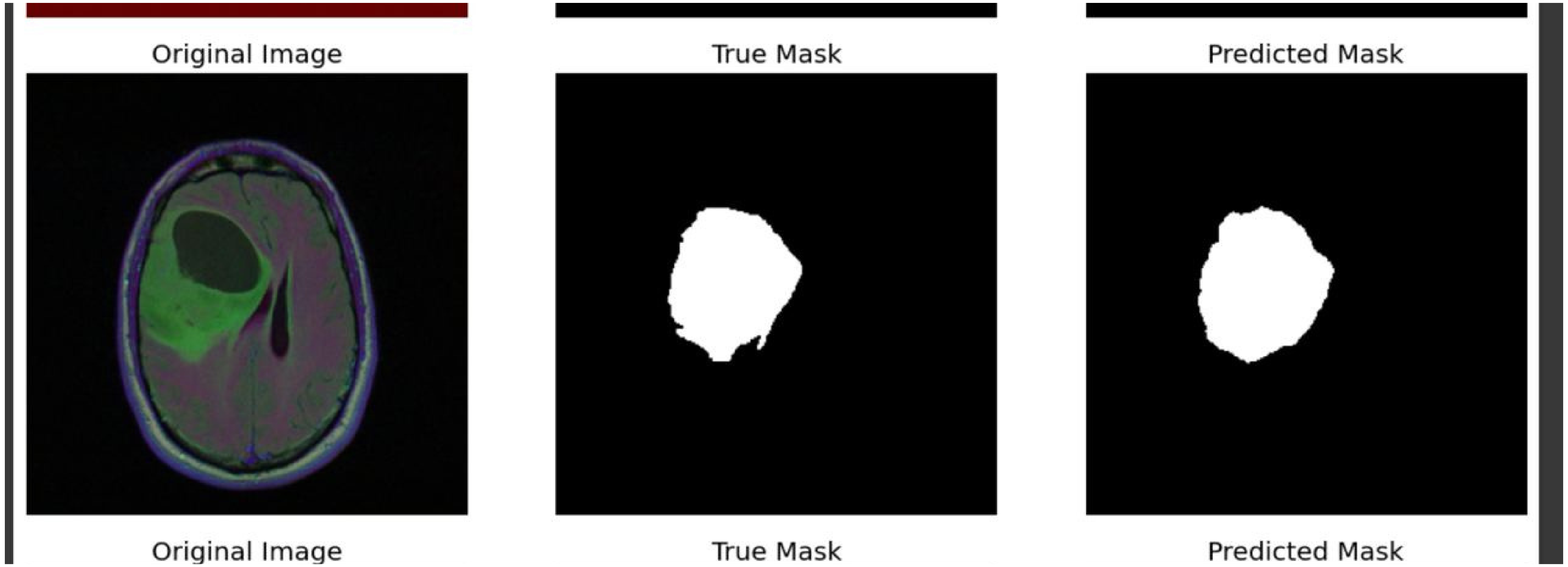
PAN


Training and Validation Loss
Training Loss
Validation Loss
1.78
1.76
1.74
1.72
1.70
1.68
1.66
1
2
3
4
5
6
7


IoU
IoU Score
0.8
0.7
0.6
0.5
0.4
0.3
0.2
1
2
3
4
5
6
7

Model Results

	Train loss	Valid Loss	IOU
DeepLabV3+	1.6634	1.6662	0.8741
UNET	1.6691	1.6712	0.8517
UNET++	1.6730	1.6750	0.8268
PAN	1.6656	1.6683	0.7970


Original Image
True Mask
Predicted Mask
Original Image
True Mask
Predicted Mask

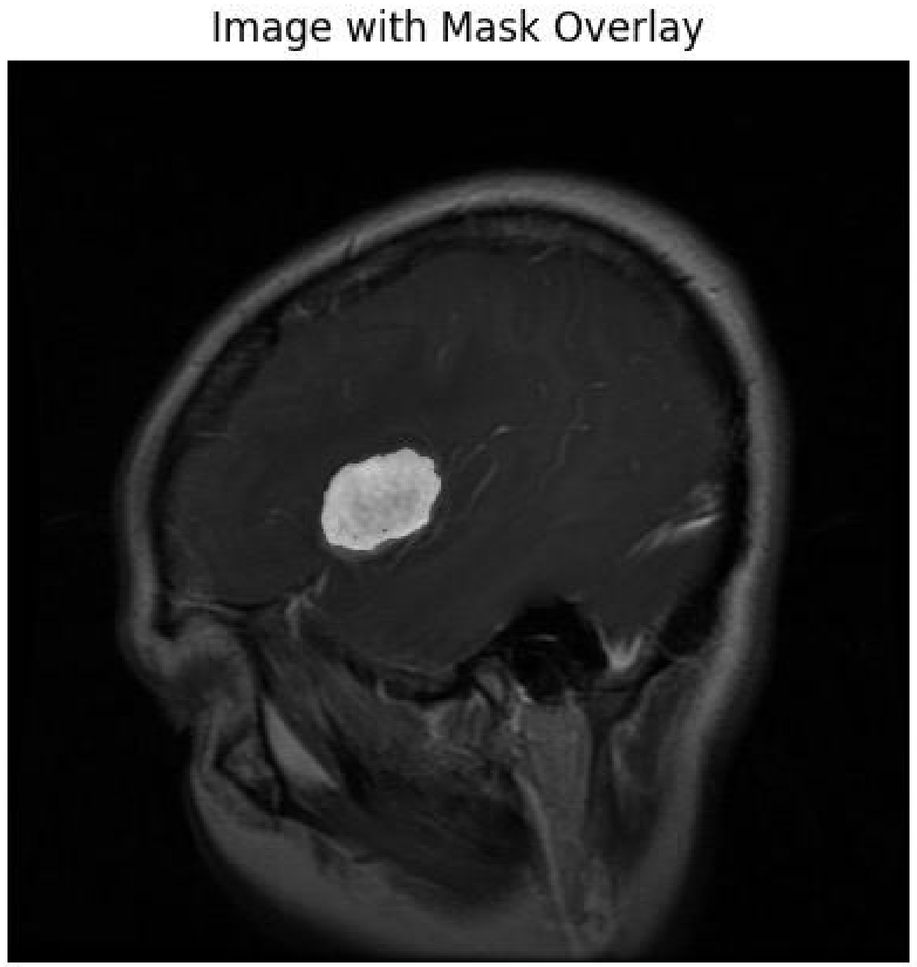


Image with Mask Overlay

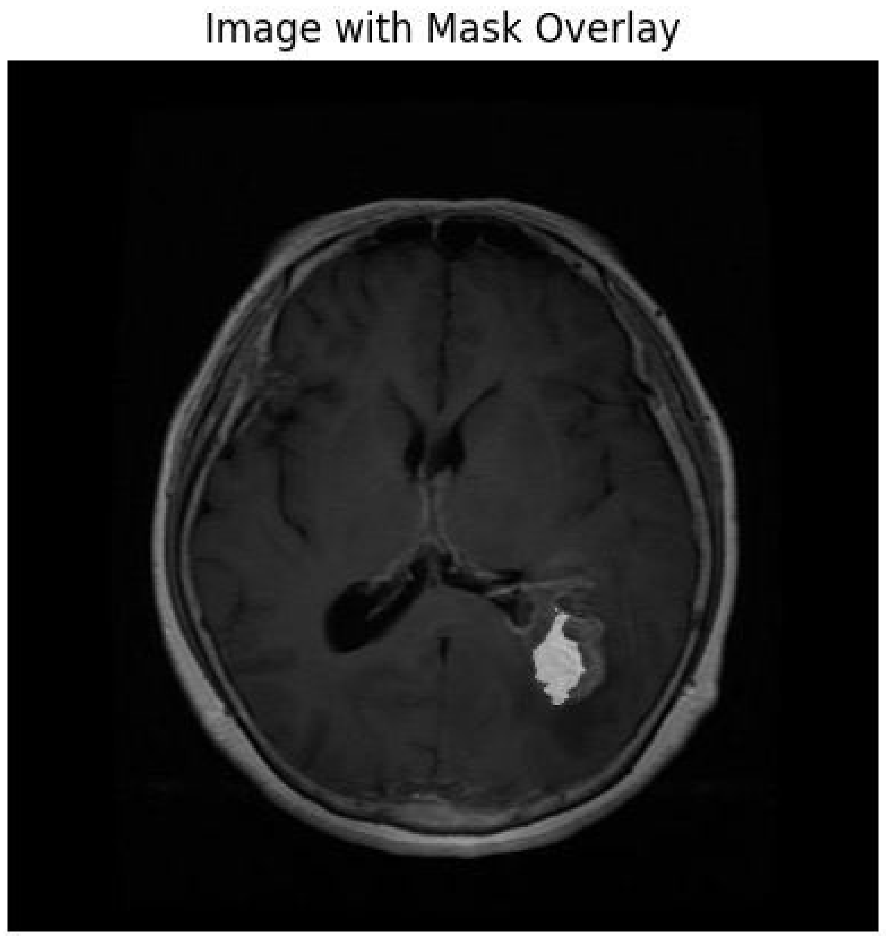


Image with Mask Overlay

Classification

1. Train classifier on the original dataset
2. Train classifier on the masked dataset

Results

Classification on the original MRI data with different models

	Train loss	Train accuracy	Valid Loss	Validation Accuracy
ResNet18	0.095	0.97	0.655	0.84
ResNet34	0.412	0.84	0.538	0.81
ResNet50	0.128	0.96	0.837	0.85
EfficientNet	0.370	0.87	0.390	0.85

Results

Classification on the masked dataset. Masks are predicted with pretrained DeepLabV3+

	Train loss	Train accuracy	Valid Loss	Validation Accuracy
EfficientNet	0.167	0.95	0.663	0.79

Q/A

- Q: what was your task?(to develop a system that can segment tumor areas in brain scans and classify the type of tumor if it exists)
- Q: what have you done (replication of the existing methods and combining them, hyperparametrs)
  trained segmentation models using architectures like U-Net, U-Net++, PAN, and DeepLabV3+. Then used this models to make predictions on the classification dataset and trained a classification model to identify the types of tumors.
- Q: what dataset did you use?(LGG Segmentation Dataset, Brain-Tumor-Classification-DataSet)
- Q: which metrics you evaluate results?(segmentation: CombinedLoss and the Intersection over Union (IOU) score, classification: cross-entropy loss and accuracy)
- Q: what was your work load?
- Q: How much have you done?(trained 4 segmentation and 4 classification models, found good hyperparameters for segmentation training)

Thank you for participating!