

A Multi-scale Fusion Deep Learning on Brain Tumor Segmentation

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DS598-DSC, Instructor: Thomas Gardos, Spring 2024



Project goals



1. Segmentation and Classification:

- Accurately segment and classify four distinct classes in the brain scan with tumors

2. Comparative Analysis:

- Compare the UNET model's segmentation performance between single and multiple modality input.

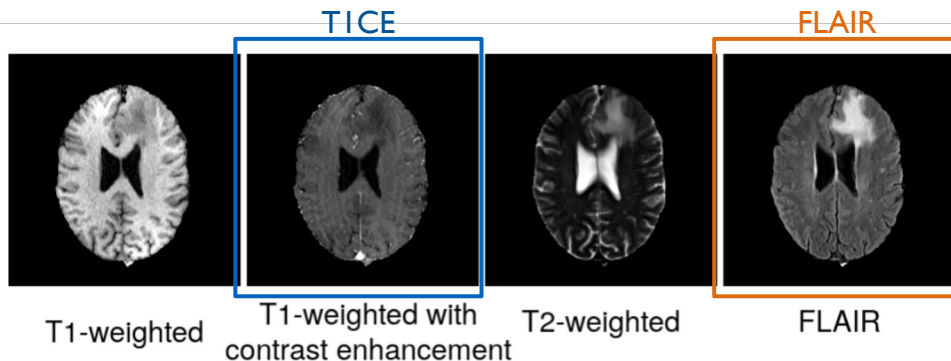
Dataset

Subset of BraTS 2021 (The Brain Tumor Segmentation) challenge

Target label types on each pixel:

1. '0': Not tumor;
2. '1': Necrotic/Core;
3. '2': Edema;
4. '3': Enhancing.

Input image types (modality):

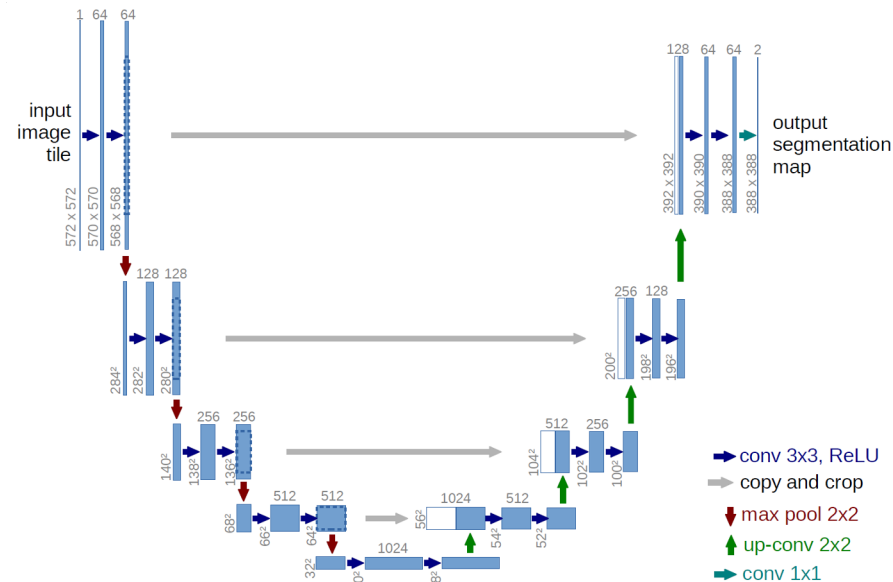
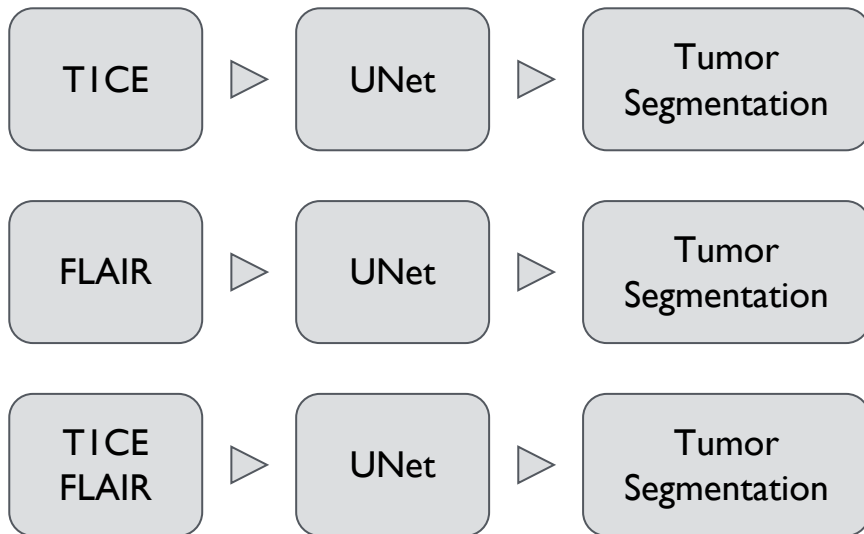


- Total of 340 data with ground truth
 - Number of Test Data = 10 (Randomly selected)
 - Number of Training data = 264
 - Number of Validation data = 66

Model Description

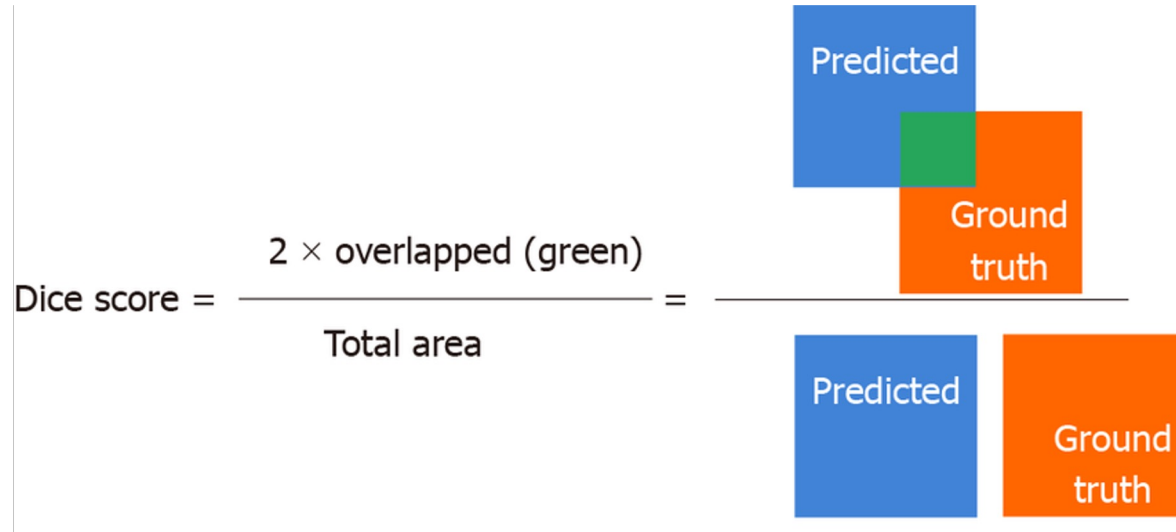
- Classic UNET Model

- In channel = number of modality = 1 or 2
- Out channel = number of classes = 4



Metric

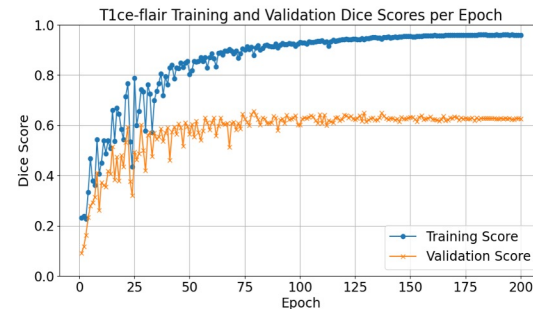
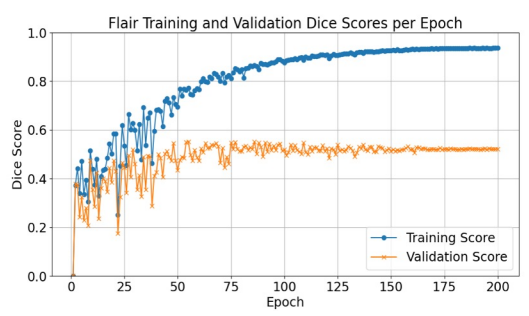
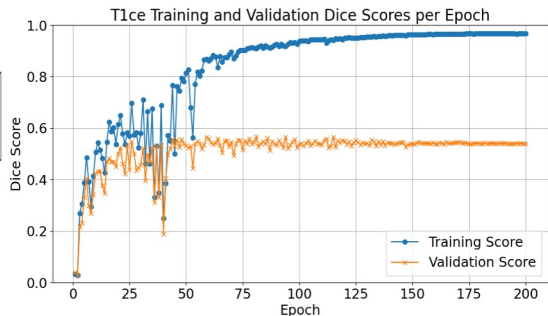
- Dice score: $[0,1]$ measures the similarity between two images



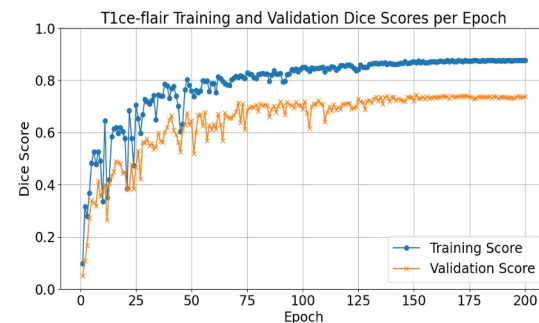
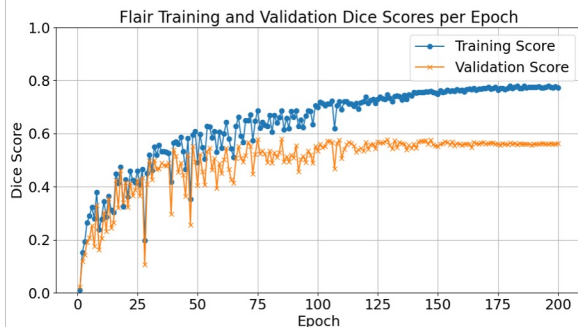
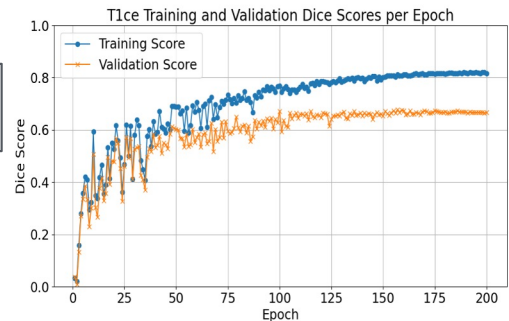
Experimental Results



W/O Data Augmentation



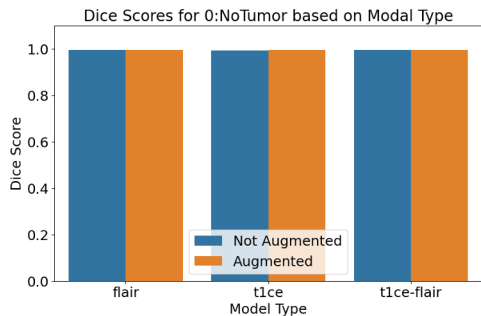
Data Augmented



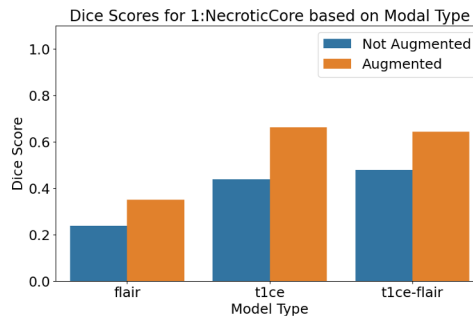
Result and Discussion

- Dice score: $[0, 1]$ measures the similarity between two images

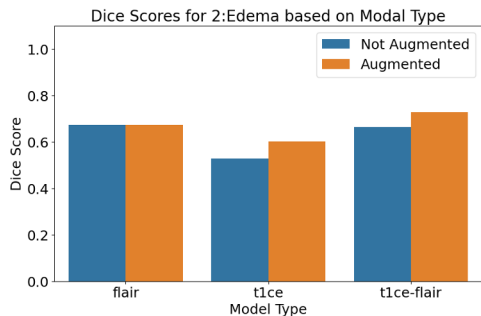
Class 0:
No Tumor



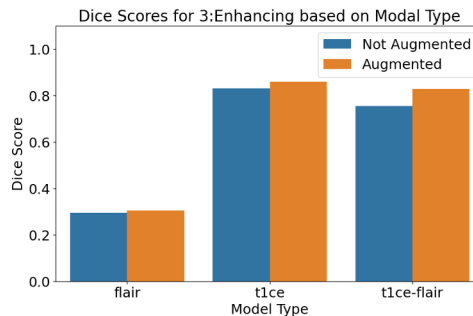
Class 1:
Core



Class 2:
Edema



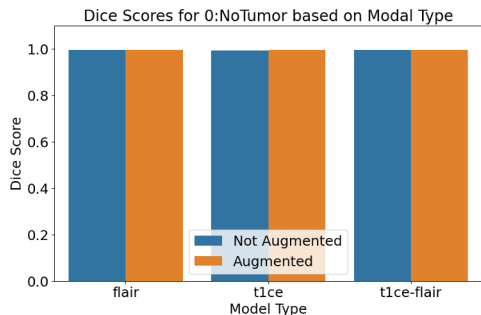
Class 3:
Enhancing Tumor



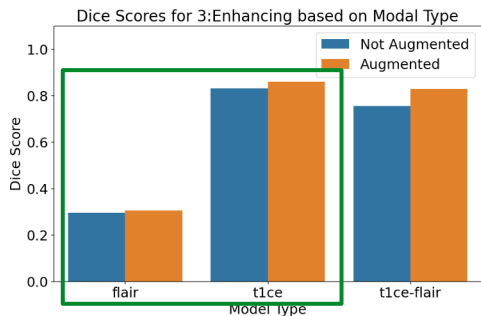
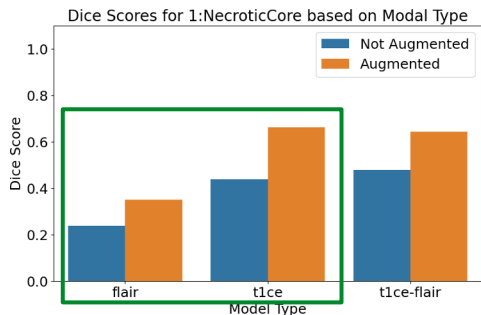
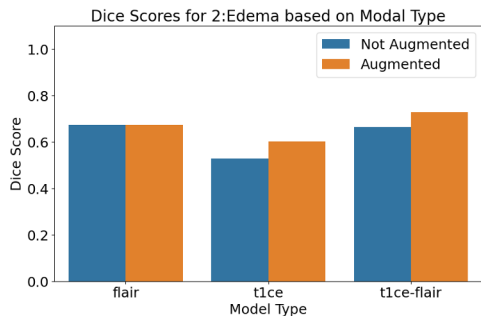
Result and Discussion

- Dice score: $[0, 1]$ measures the similarity between two images

Class 0:
No Tumor



Class 2:
Edema



Class 1:
Core

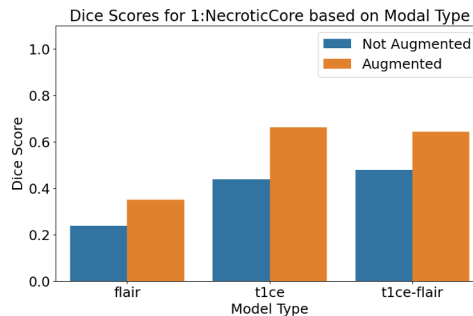
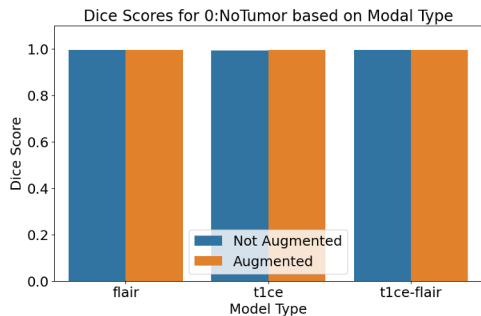
T1CE > FLAIR

Class 3:
Enhancing Tumor

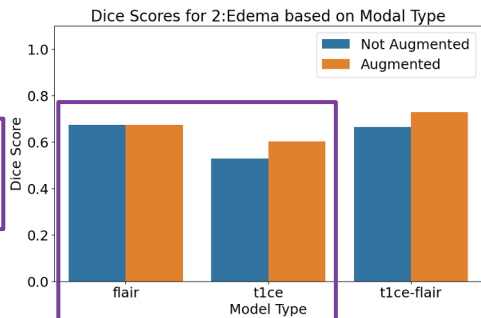
Result and Discussion

- Dice score: $[0, 1]$ measures the similarity between two images

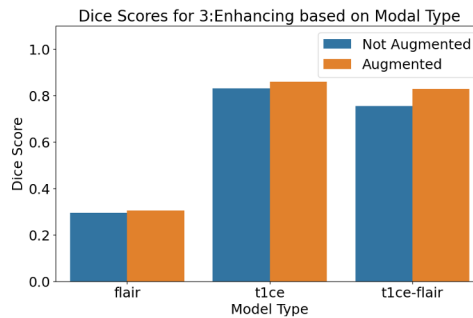
Class 0:
No Tumor



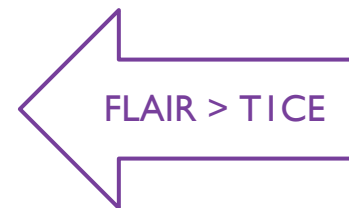
Class 1:
Core



Class 2:
Edema



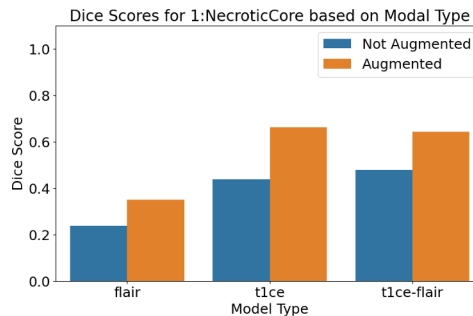
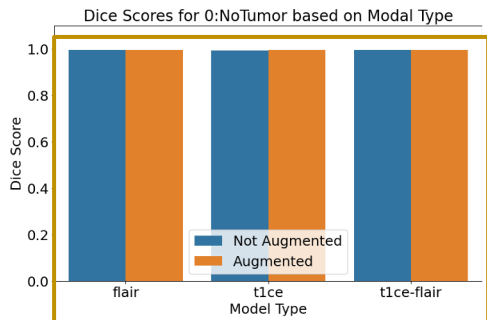
Class 3:
Enhancing Tumor



Result and Discussion

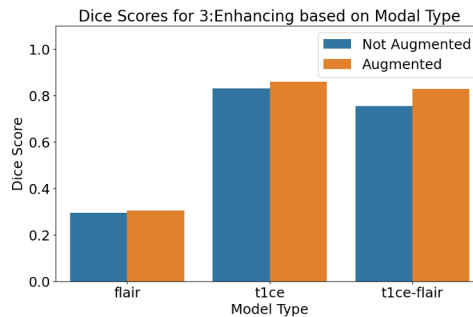
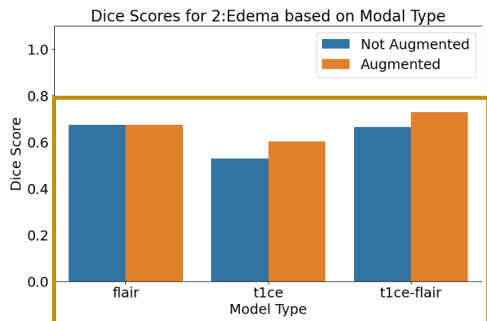
- Dice score: $[0, 1]$ measures the similarity between two images

Class 0:
No Tumor



Class 1:
Core

Class 2:
Edema

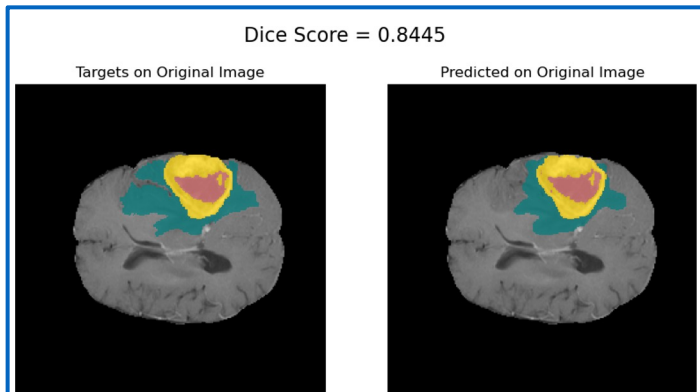


Class 3:
Enhancing Tumor

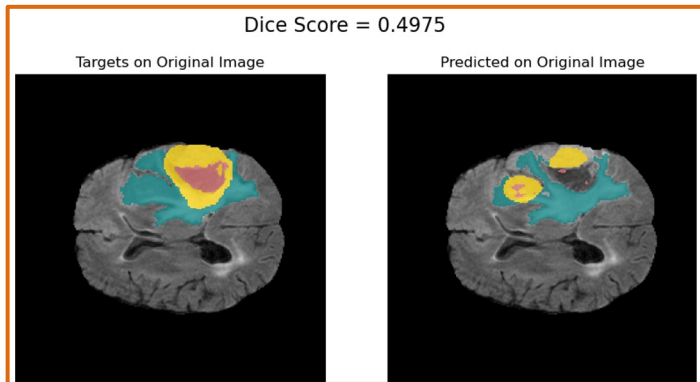


Result and Discussion

T1CE



FLAIR



T1CE-
FLAIR

