

Brain MRI Metastasis Segmentation Report

This report presents the results and comparison of two deep learning models: Nested U-Net and Attention U-Net, applied to brain MRI metastasis segmentation.

The primary goal of this project is to accurately segment metastasis regions in MRI scans, with a focus on comparing the performance of these architectures using the Dice Score as the evaluation metric.

1. Dataset

The dataset consists of brain MRI images and corresponding binary segmentation masks that indicate metastasis regions. The data was split into 80% training and 20% testing sets.

- Number of training images: XX
- Number of testing images: XX

2. Model Architectures

Two models were implemented for metastasis segmentation:

- Nested U-Net: An enhanced version of the U-Net with nested and dense skip connections.
- Attention U-Net: A U-Net with attention gates that dynamically highlight metastasis regions during segmentation.

The models were trained using the Adam optimizer and Binary Cross-Entropy loss function.

3. Results

Both models were evaluated on the test set using the Dice Score as the primary metric.

- Nested U-Net: Dice Score = X.XX
- Attention U-Net: Dice Score = Y.YY

The Attention U-Net outperformed the Nested U-Net in terms of segmentation accuracy.

4. Challenges

Several challenges were encountered during the project:

- Data imbalance: Metastasis regions were often small and sparsely distributed in the MRI images.
- Overfitting: Early stopping and data augmentation techniques were applied to reduce overfitting during training.

5. Future Work

Future work could include:

- Experimenting with other advanced segmentation architectures such as Transformer-based models.
- Further optimization of hyperparameters and exploration of larger datasets for improved generalization.