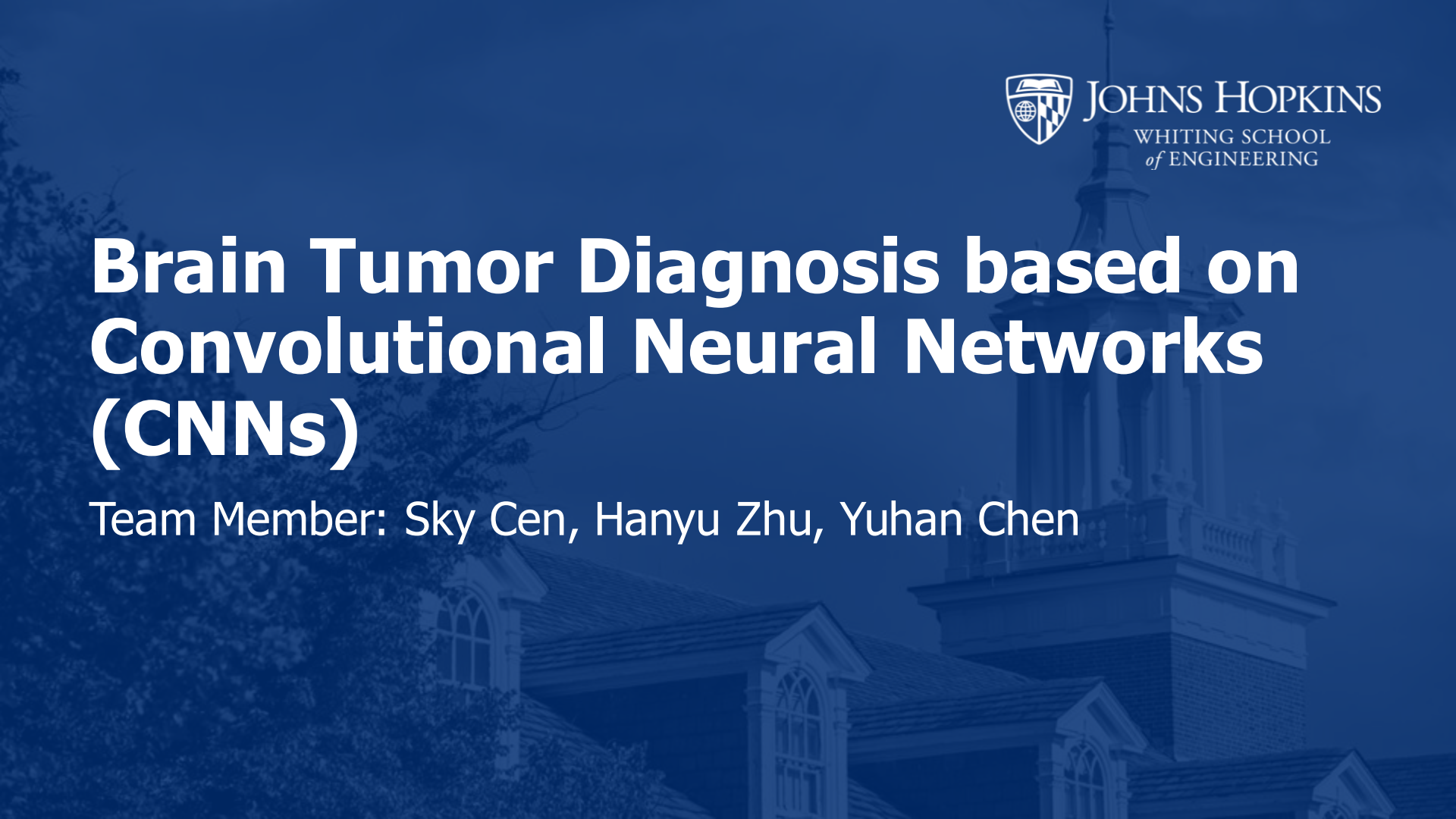


Brain Tumor Diagnosis based on Convolutional Neural Networks (CNNs)

Team Member: Sky Cen, Hanyu Zhu, Yuhan Chen

Presentation Outline

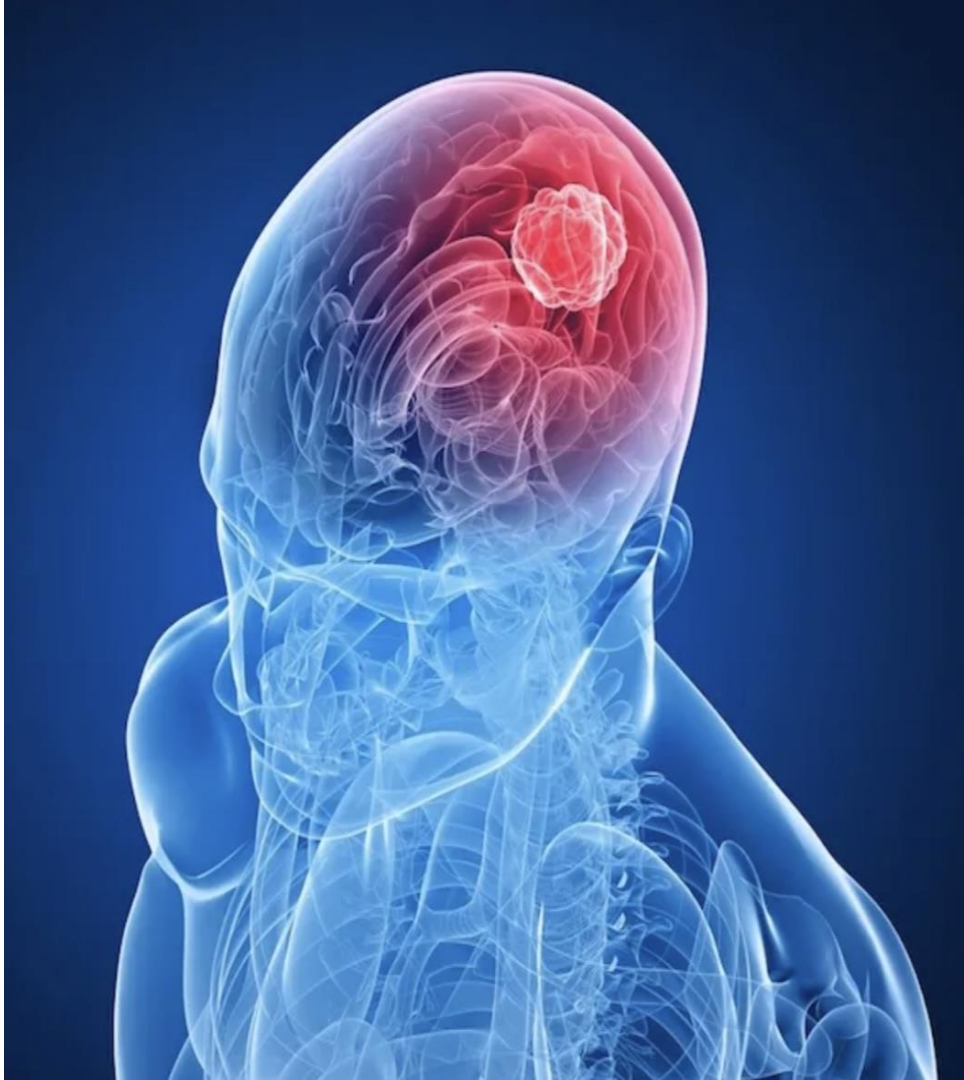
- Background Introduction
- Methodology
- Data Preprocessing and Augmentation
- MRI Classification
- MRI Segmentation
- Summary and Further Improvements
- Real-world Implementation and Extensions

Background Introduction

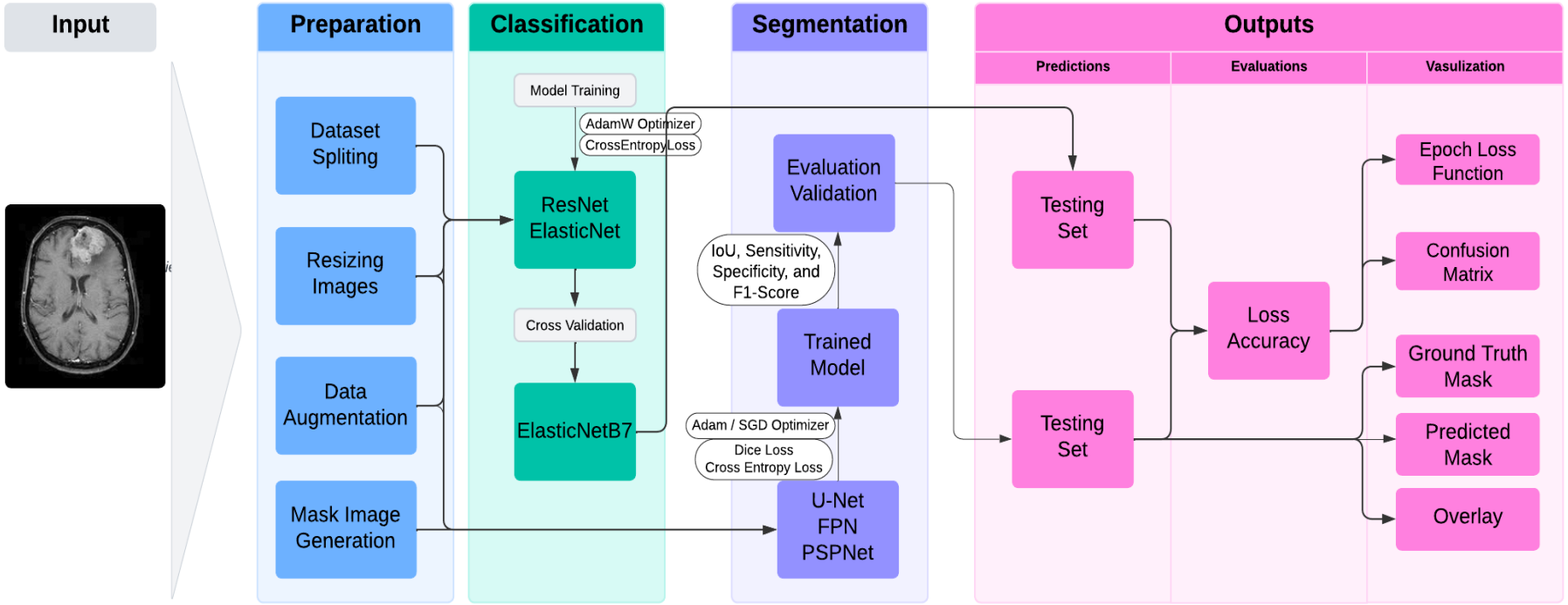
- The manual diagnosis for brain tumor is:
  - **Highly variable & Subjective**
  - **Time-consuming**
  - **Hard to localize**

- Lead to:
  - **Delay in treatment**
  - **Inaccurate information to surgeons**

High Death Rate: 73.8%



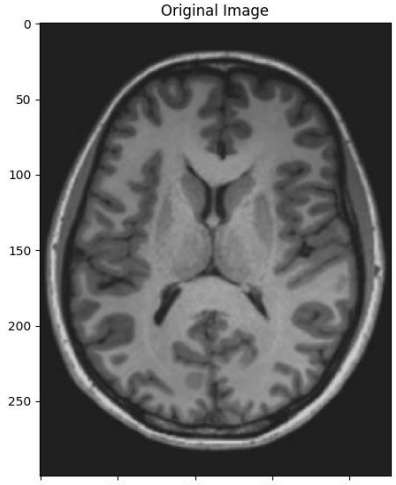
Methodology

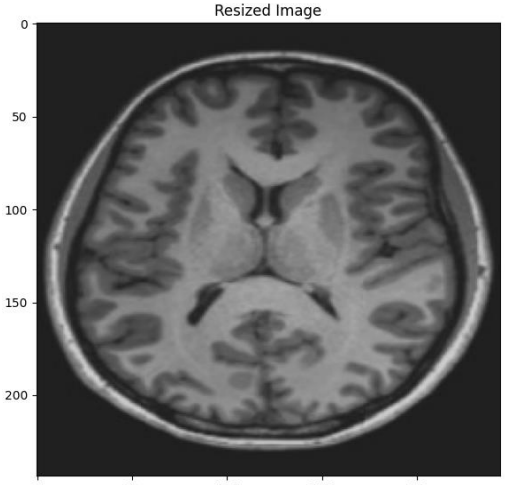


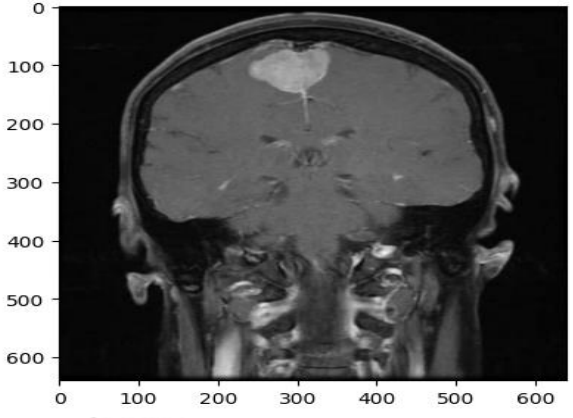
Data Preparation

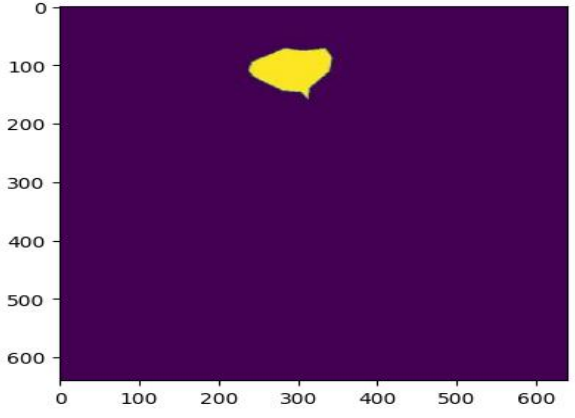
- Dataset Split
- Image Resizing and Labeling
- Data Augmentations
- Mask Image Generation
  - Validation Included

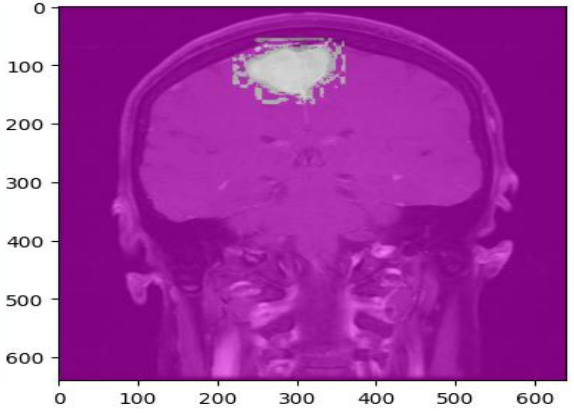
```
Train dataset size: 2294, 0.7028186274509803
Validation dataset size: 576, 0.17647058823529413
Test dataset size: 394, 0.12071078431372549
```





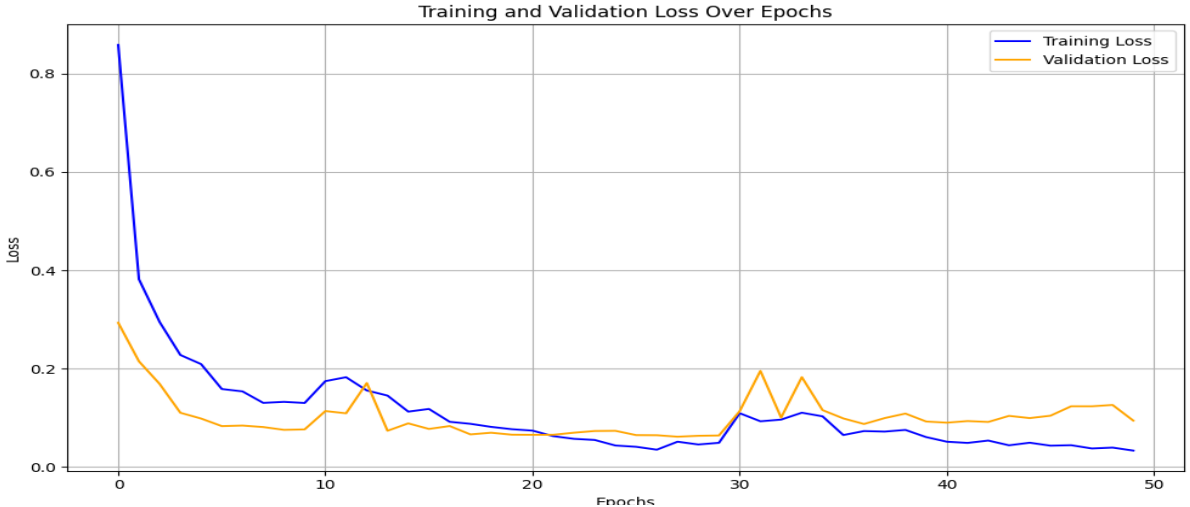






Classification

- Define and Train Model
  - ResNet
  - EfficientNet
- Evaluation and Selection
  - Loss Function: Cross Entropy
  - Accuracy %
  - Coefficient Matrix



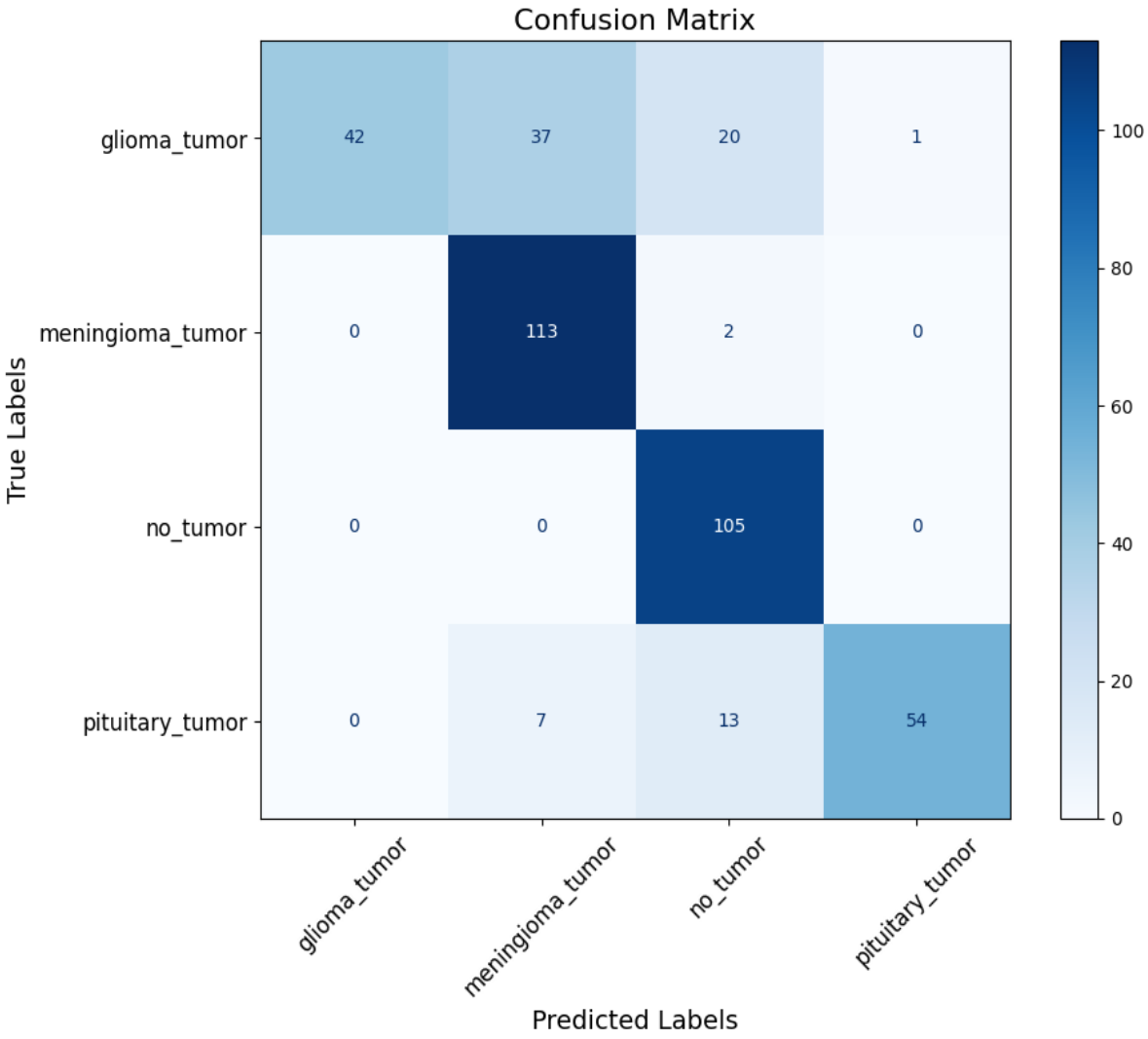
Models Trained:

1. Resnet 34: 73.1% x
2. Resnet 34, data augmentations: 65.23% x
3. Resnet 50: 68.53% x
4. Resnet 50, data augmentations: 71.83% x
5. Resnet 34, normalized: 65.99%
6. Resnet 34, normalized, data augmentations: 67.01%
7. Resnet 50, normalized: 70.05%
8. Resnet 50, normalized, data augmentations: 67.51%
9. Resnet 34, normalized, data augmentations, dropout: 70.05%
10. Resnet 50, normalized, data augmentations, dropout: 67.77%
11. EfficientNetB1, normalized, data augmentations, dropout: 75.13%
12. EfficientNetB2, normalized, data augmentations, dropout: 74.62%
13. EfficientNetB4, normalized, data augmentations, dropout: 73.86%
14. EfficientNetB0, normalized, data augmentations, dropout: 76.90%
15. EfficientNetB7, normalized, data augmentations, dropout, pretrained weights: 79.44%
16. EfficientNetB7, normalized, data augmentations, dropout, pretrained weights, freeze: 53.55%
17. EfficientNetB7, normalized, data augmentations, dropout, pretrained weights: 79.70% ***

Classification

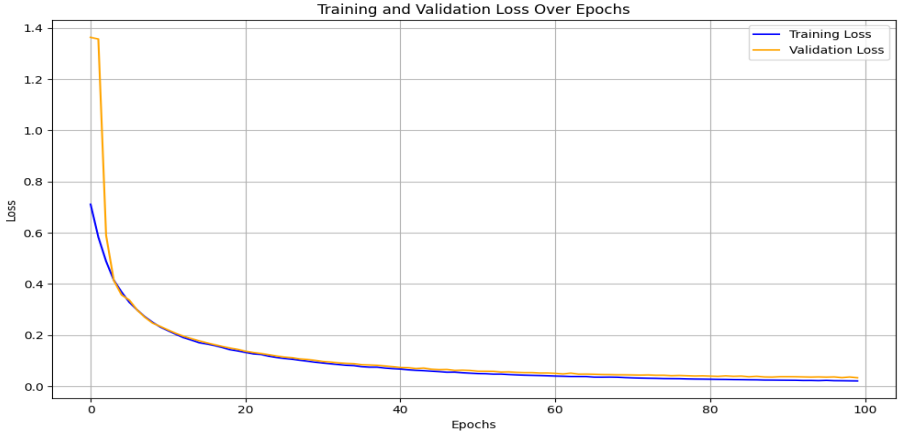
- Prediction
  - Coefficient Matrix

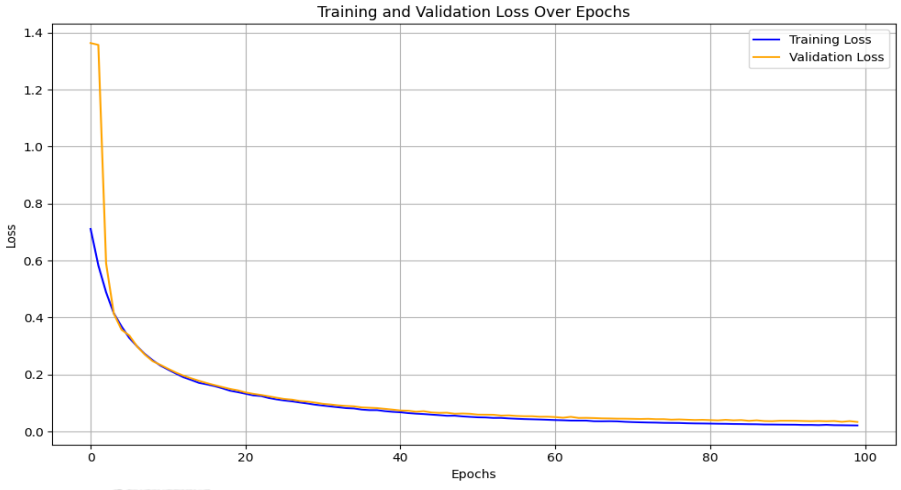
Baseline: approximately **70%**

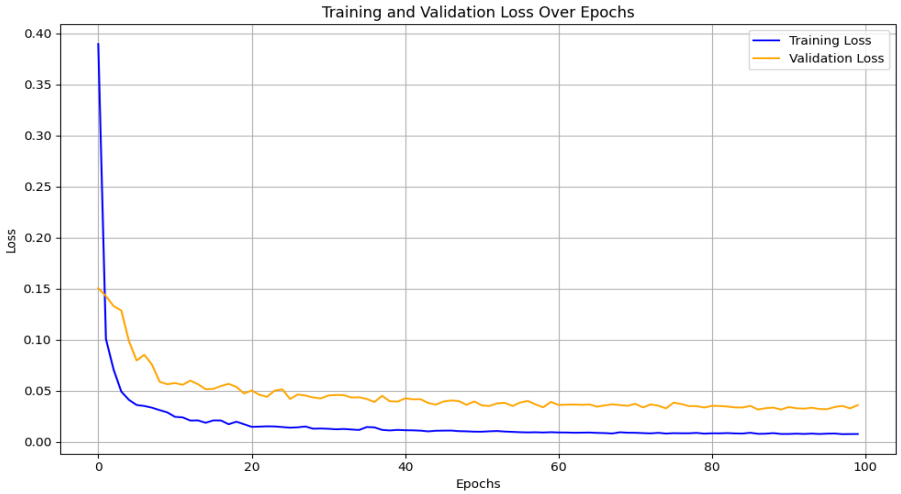


Segmentation

- Define and Training Model
  - U-Net
  - FPN
  - PSPNet
- Model Evaluation and Selection
  - Loss over Epochs
  - Dice Score
- Prediction





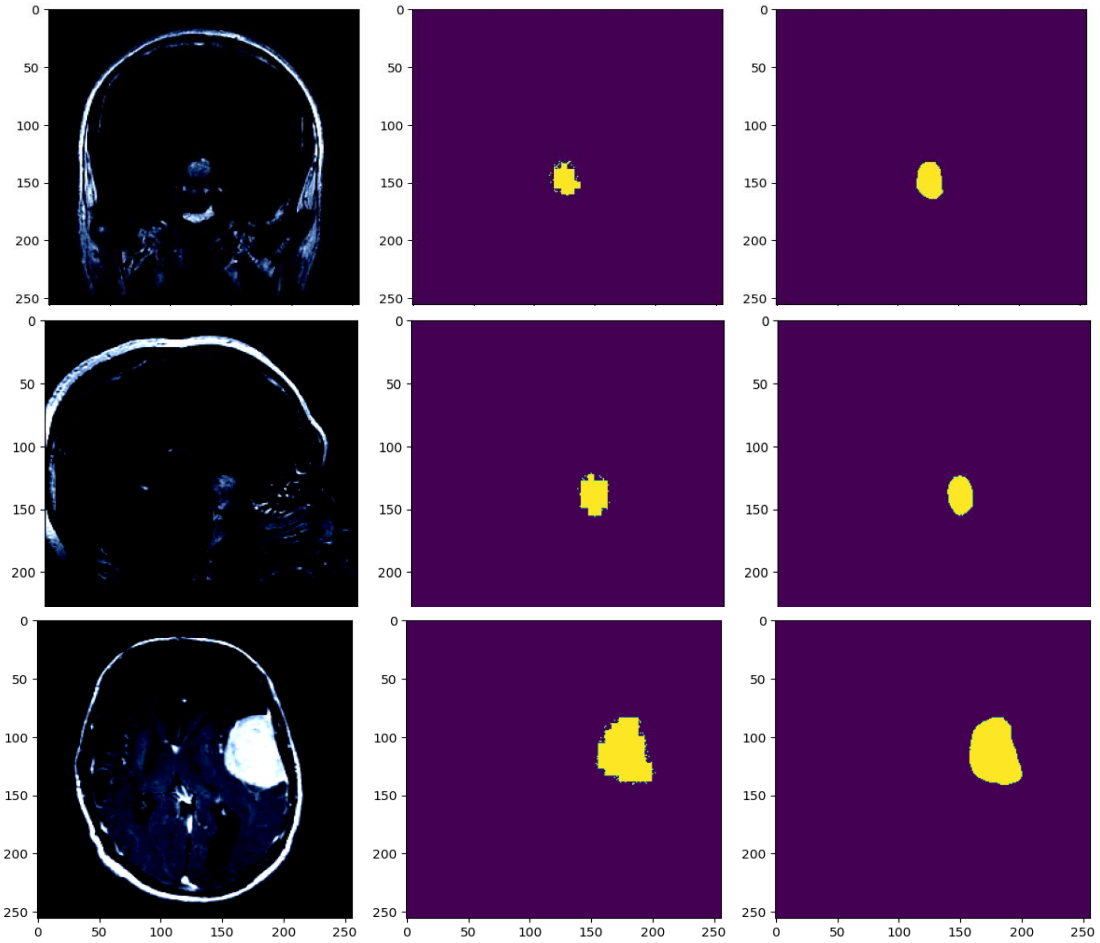


Segmentation

	U-Net	FPN	PSPNet
Dice Score	0.8218	0.7299	0.7969

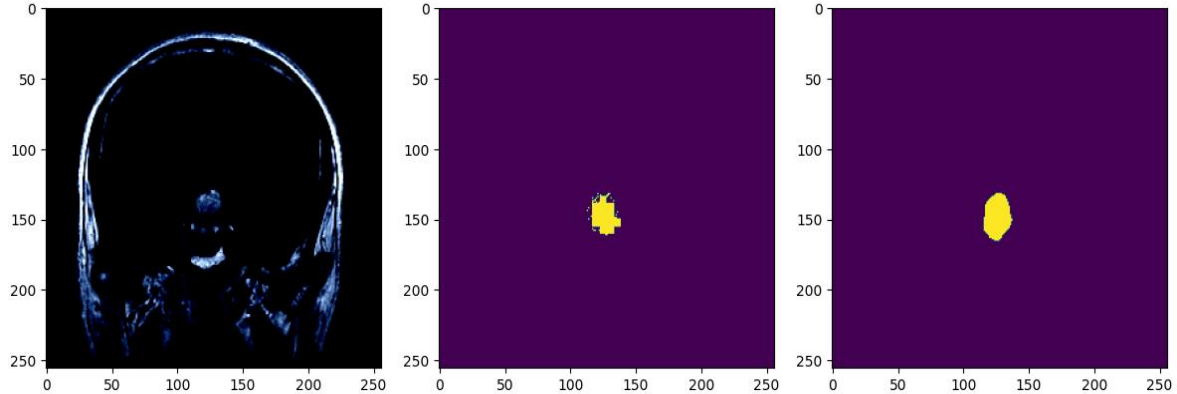
- Define and Training Model
  - U-Net
  - FPN
  - PSPNet
- Model Evaluation and Selection
  - Loss over Epochs
  - Dice Score
- Prediction
  - Visualization

Segmentation



- Define and Training Model
  - U-Net
  - FPN
  - PSPNet
- Model Evaluation and Selection
  - Loss over Epochs
  - Dice Score
- Prediction
  - Visualization
    - U-Net

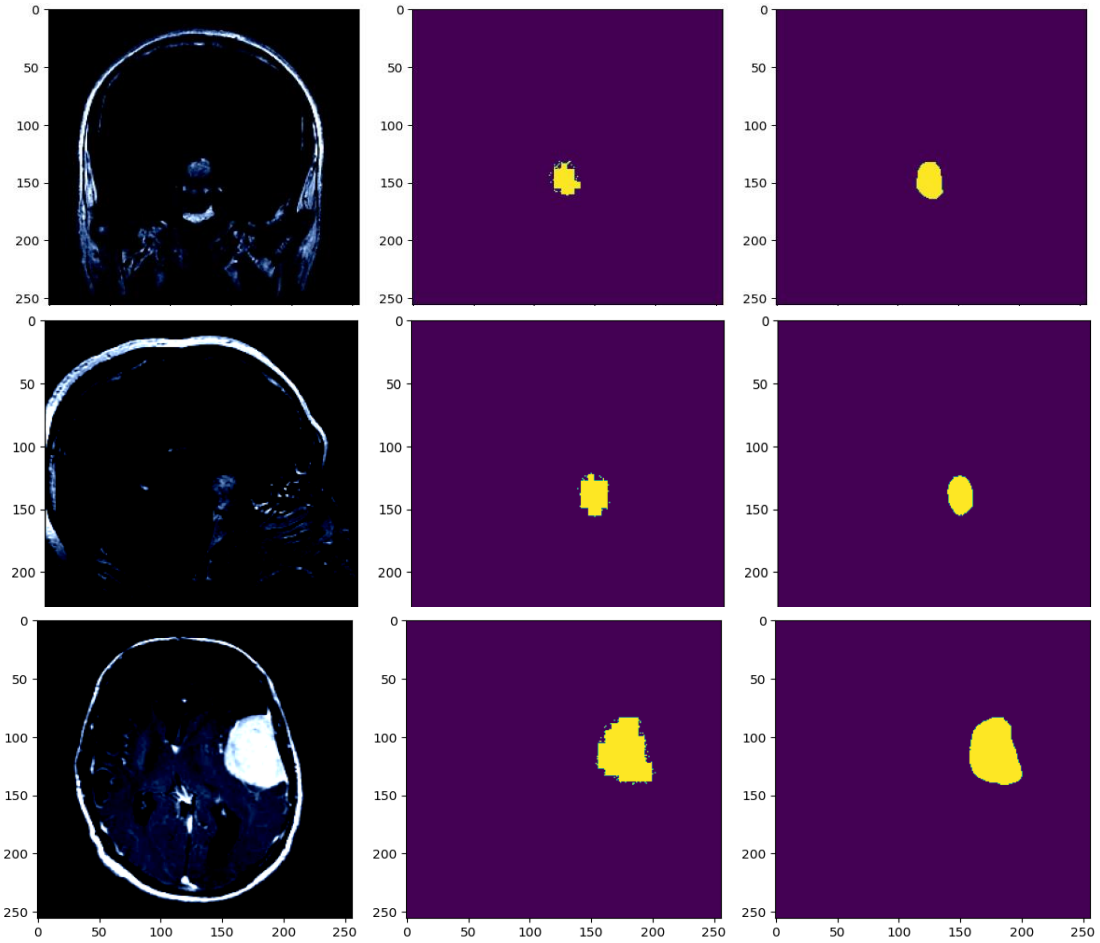
Segmentation



- Define and Training Model
  - U-Net
  - FPN
  - PSPNet
- Model Evaluation and Selection
  - Loss over Epochs
  - Dice Score
- Prediction
  - Visualization

    - FPN

Segmentation



- Define and Training Model
  - U-Net
  - FPN
  - PSPNet
- Model Evaluation and Selection
  - Loss over Epochs
  - Dice Score
- Prediction
  - Visualization
    - PSPNet

Challenges

- **Dataset Imbalance**
- **Hyperparameter Tuning**
- **Dataset Size**

Future Improvements