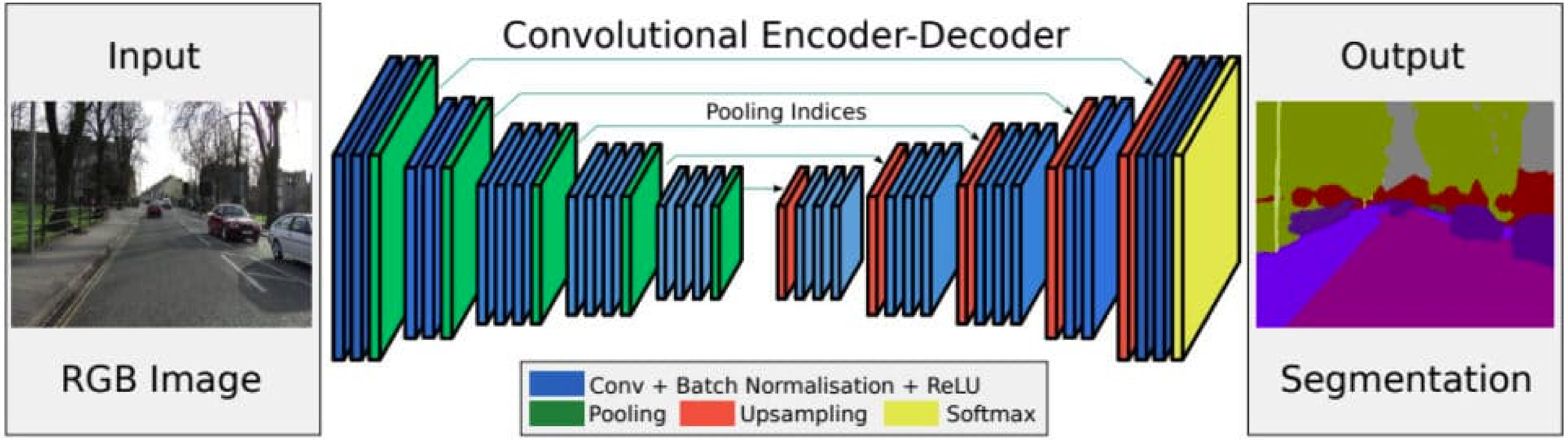
BRIAN MRI SEGEMENTATION

WITH DIFFERRENT ENCODERS

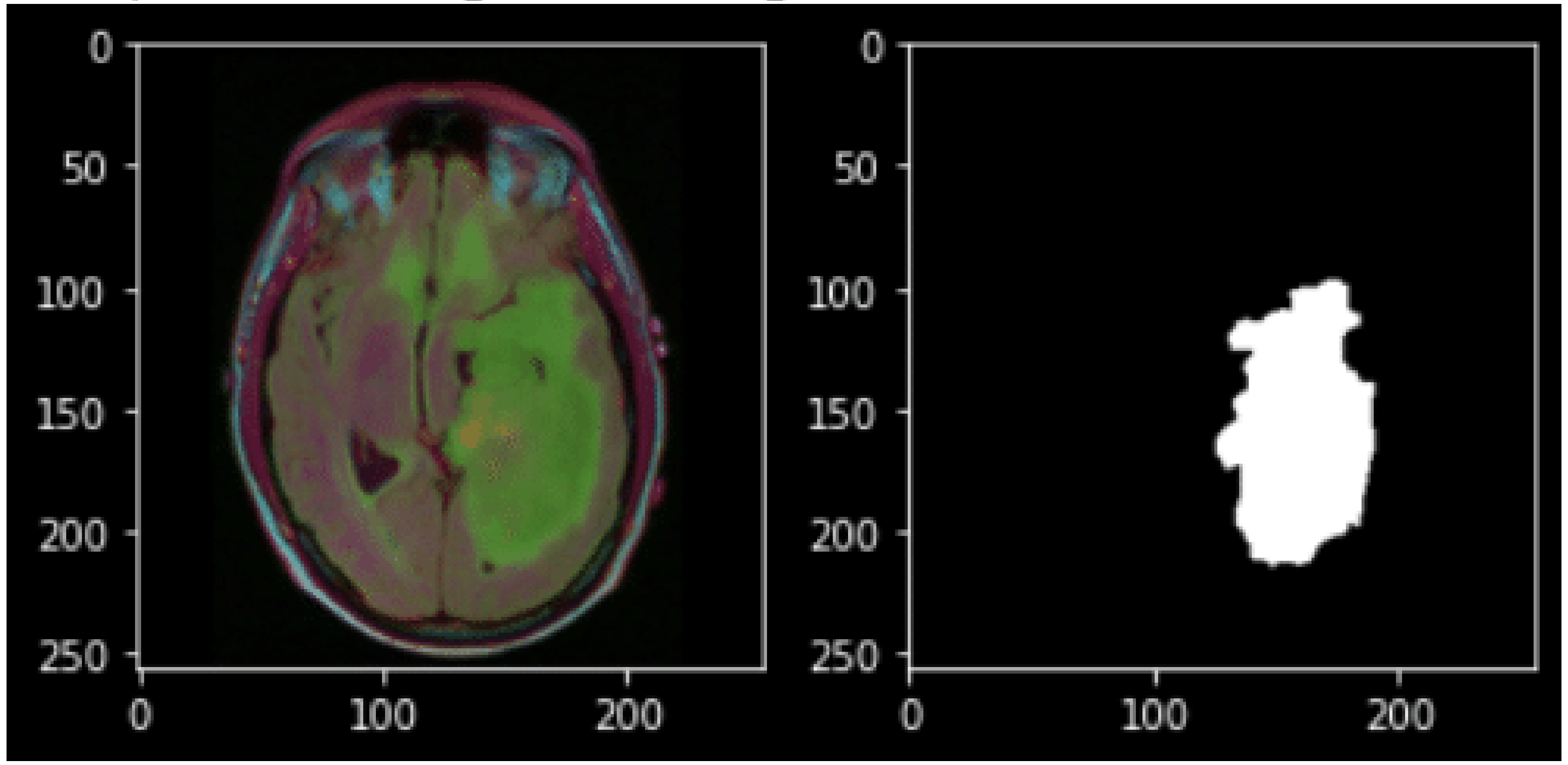
Semantic Segmentation



Assigns a class label to each pixel in an image

Brain MRI Semantic Segmentation

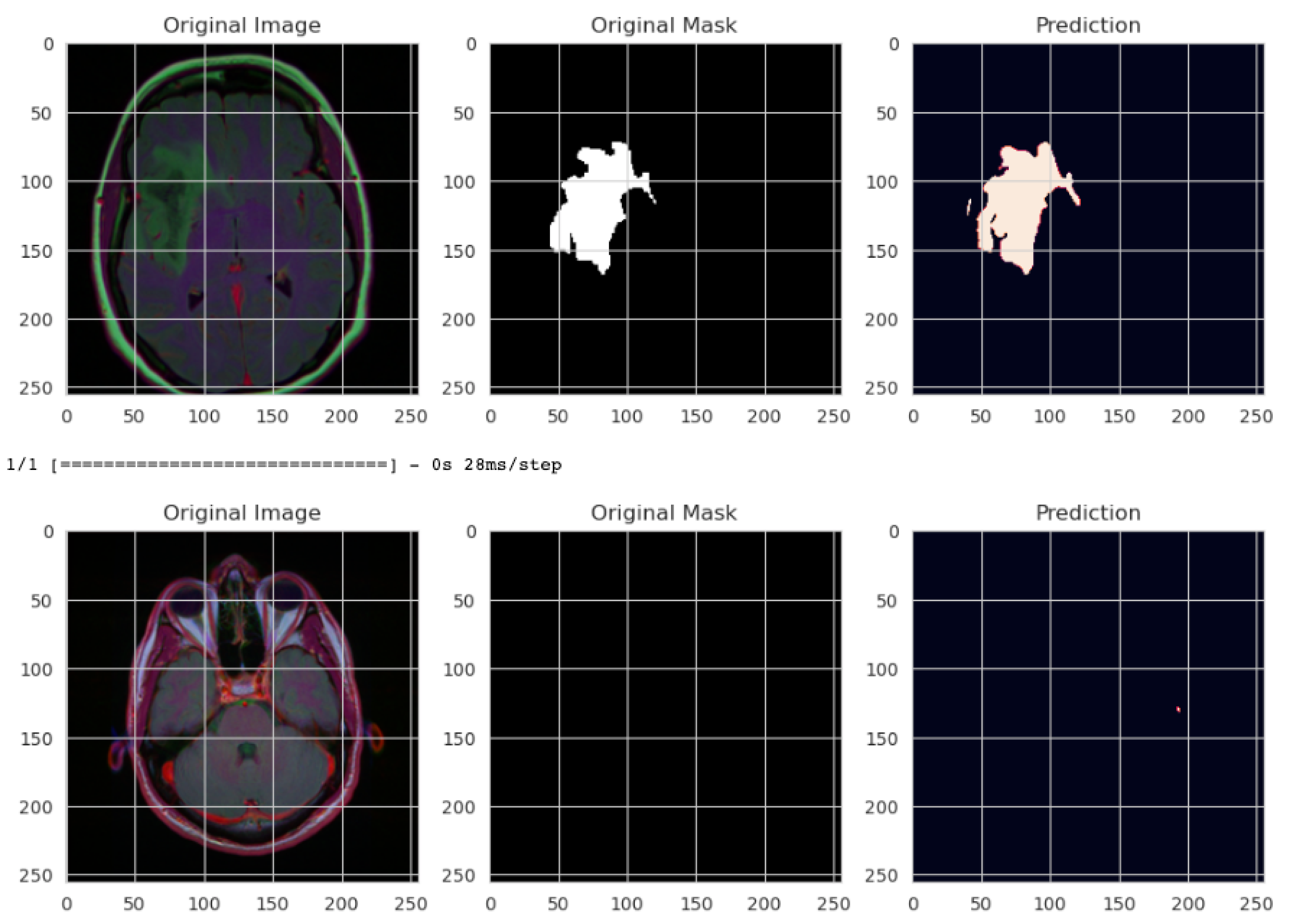
Data source:https://www.kaggle.com/datasets/mateuszbuda/lgg-mri-segmentation



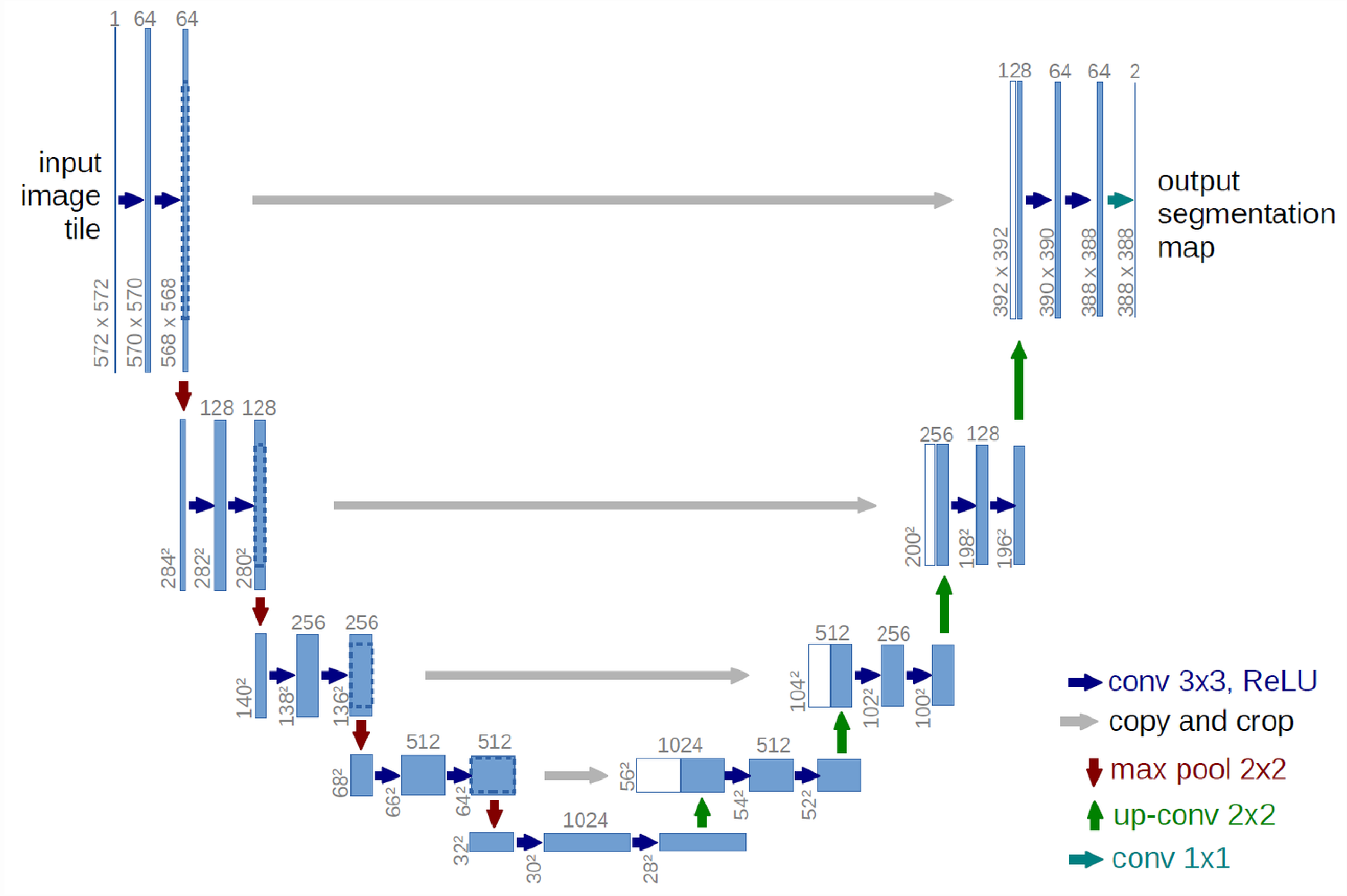
Training set:	**2828**
Validation set:	**393**
Test set:	**708**
Total:	**3929**

This dataset contains brain MR images together with manual FLAIR abnormality segmentation masks.

Brain MRI
Semantic Segmentation



Unet



- A CNN architecture specifically designed for biomedical image segmentation
- Symmetric U-shaped structure with contracting and expanding paths
- Enable precise localization and high-resolution feature mapping

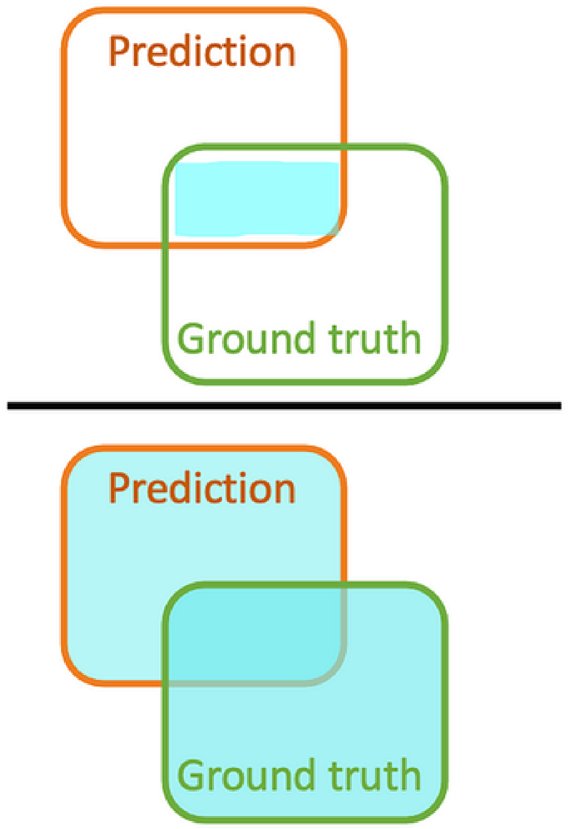
Different encoders

- Generic Unet(no pretained encoders)
- VGG16 (retrain all layer)
- ResNet50 (retrain all layer)
- ResNet50 (freeze first two conv blocks)

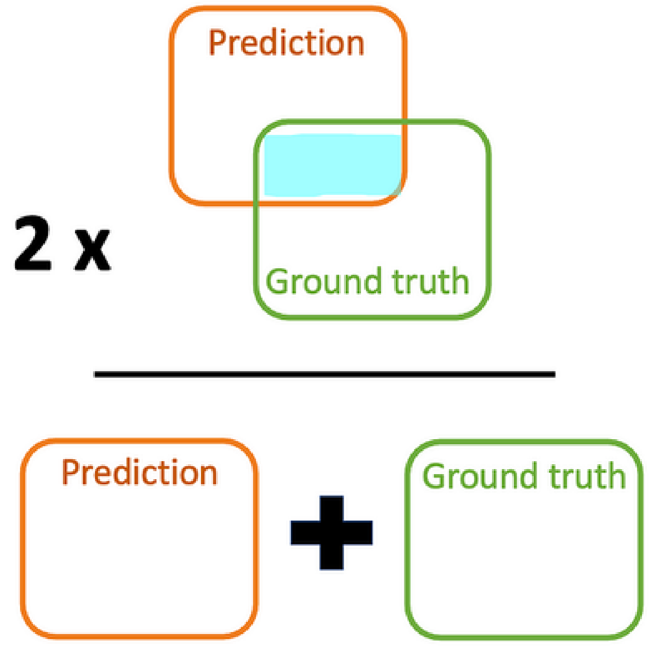
Metrics

- Both metrics have values between 0 and 1, where a score of 1 indicates a perfect match between the predicted and ground truth masks.
- The subtle difference between them is that the dice score tends to veer towards the average performance. Whereas the IOU helps one understand worst case performance.
- In practice, they're often both used.

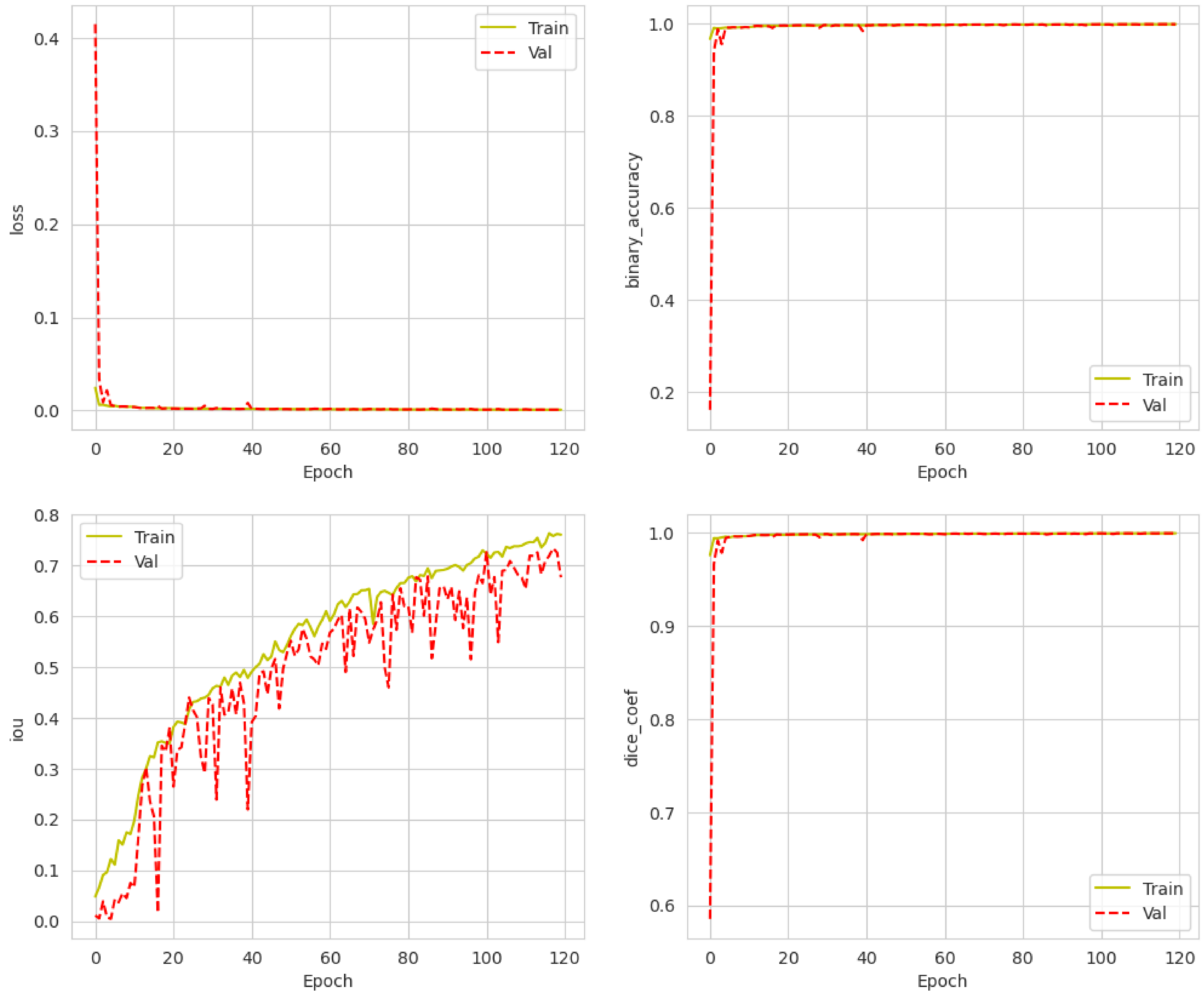
$$\text{IoU} = \frac{\textit{Area of overlap}}{\textit{Area of union}} =$$



$$\text{Dice} = \frac{2\ X\ \textit{Area of overlap}}{\textit{Total area}} =$$

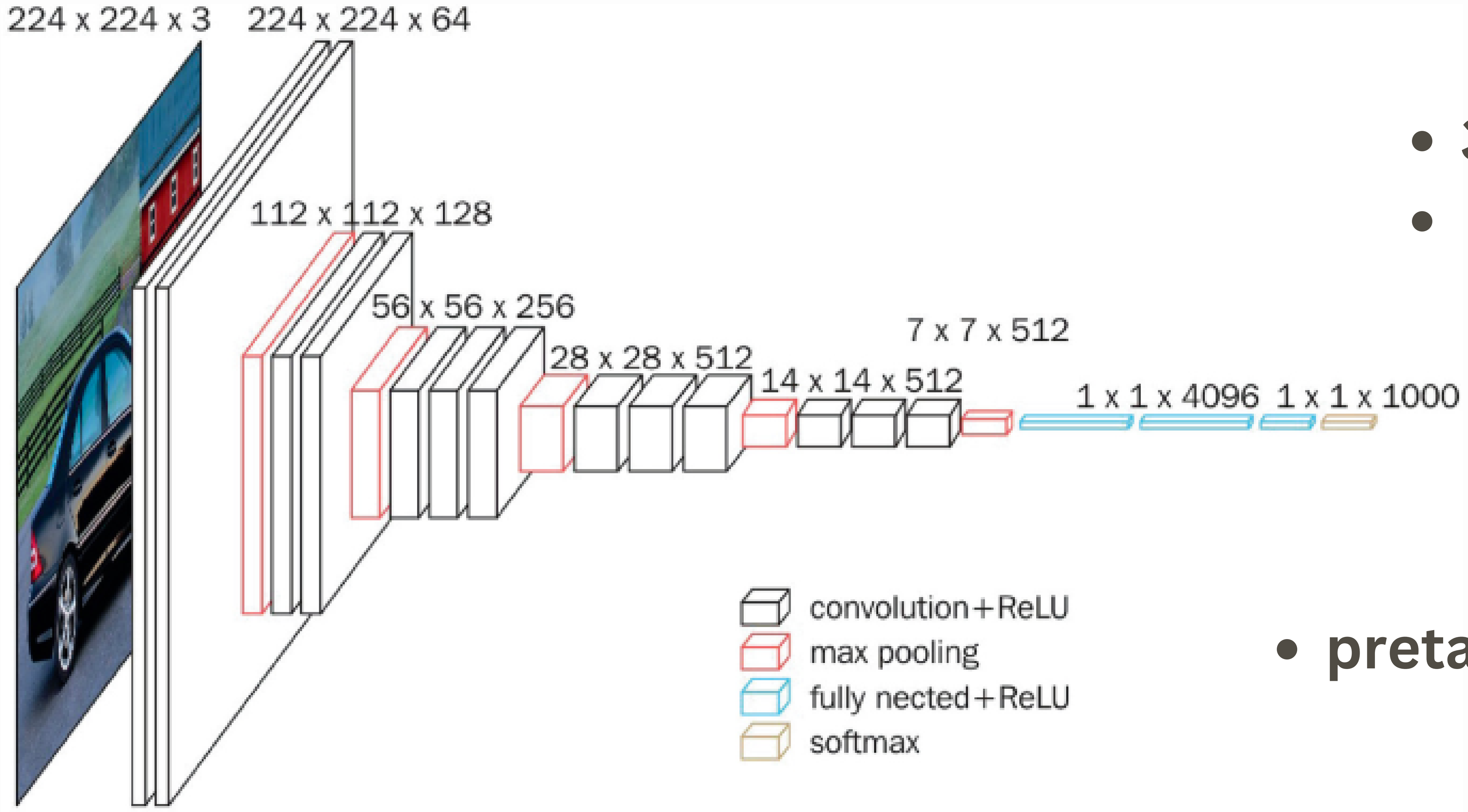


Unet



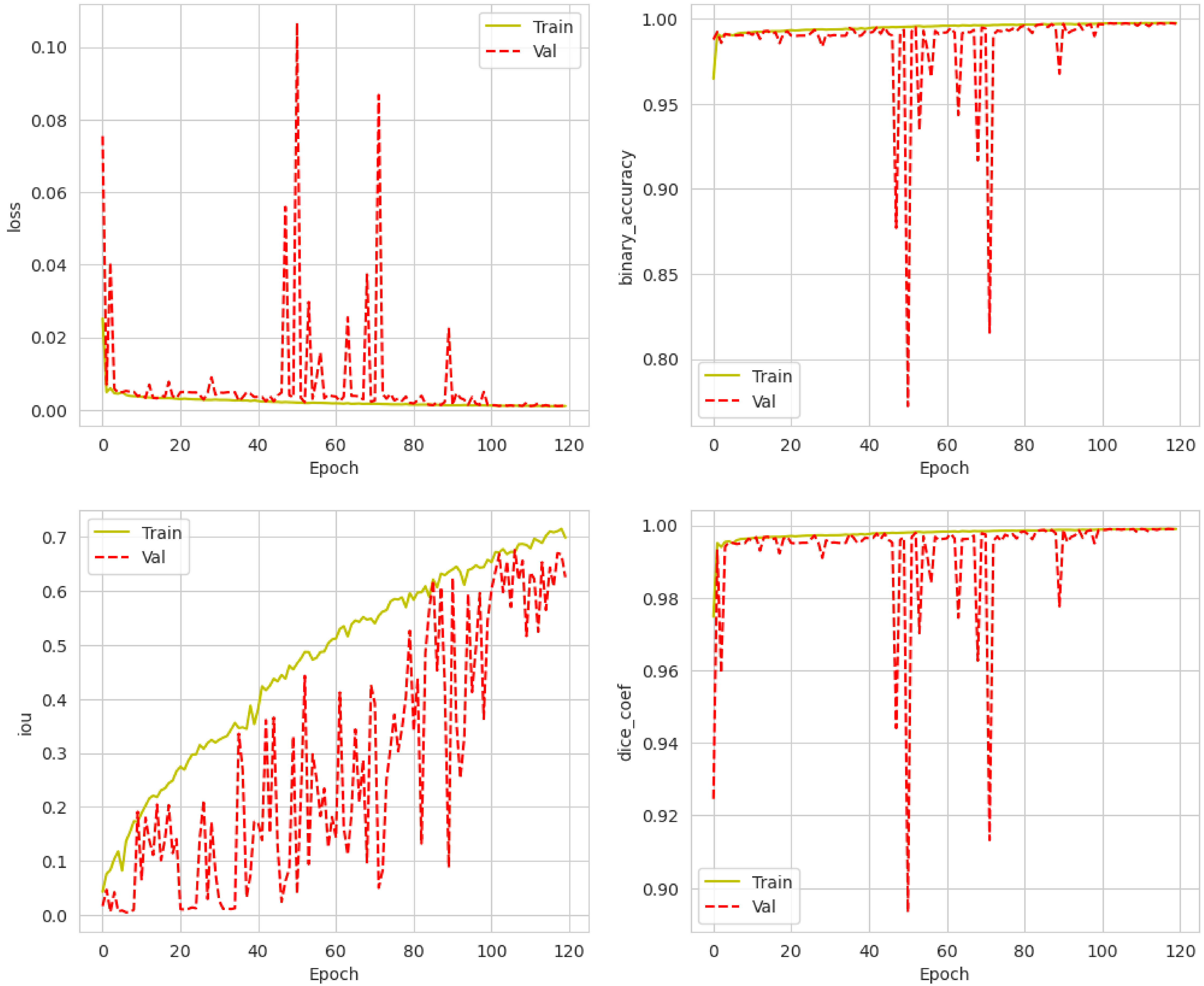
loss
Epoch
Train
Val
binary_accuracy
Epoch
Train
Val
iou
Epoch
Train
Val
dice_coef
Epoch
Train
Val

VGG 16

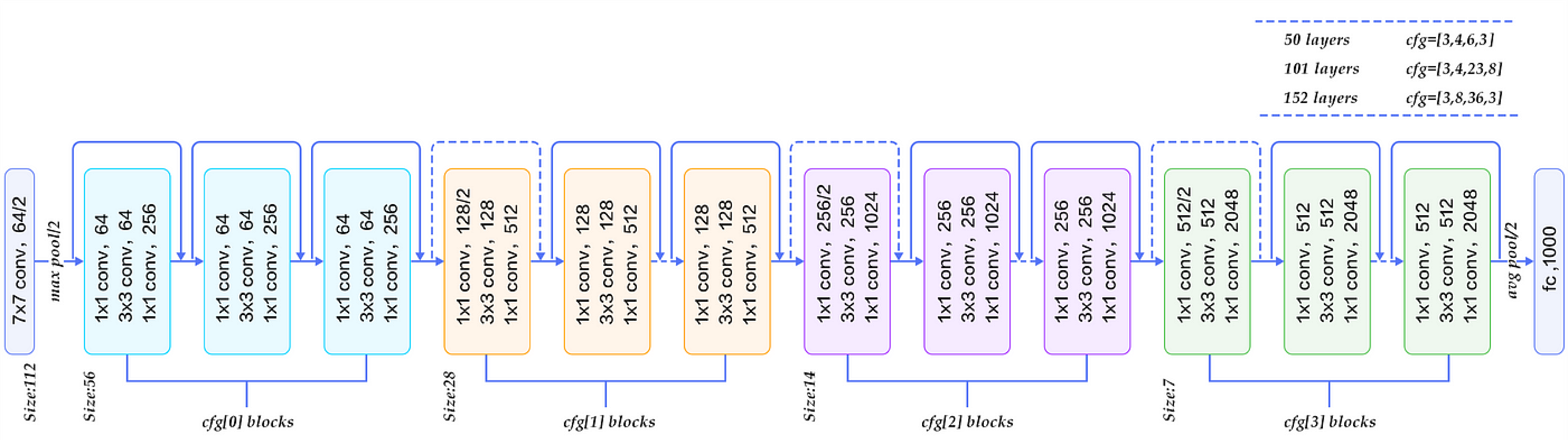


- 3x3 convolutional filters
- Deeper networks
- pretained weights on ImageNet

VGG 16

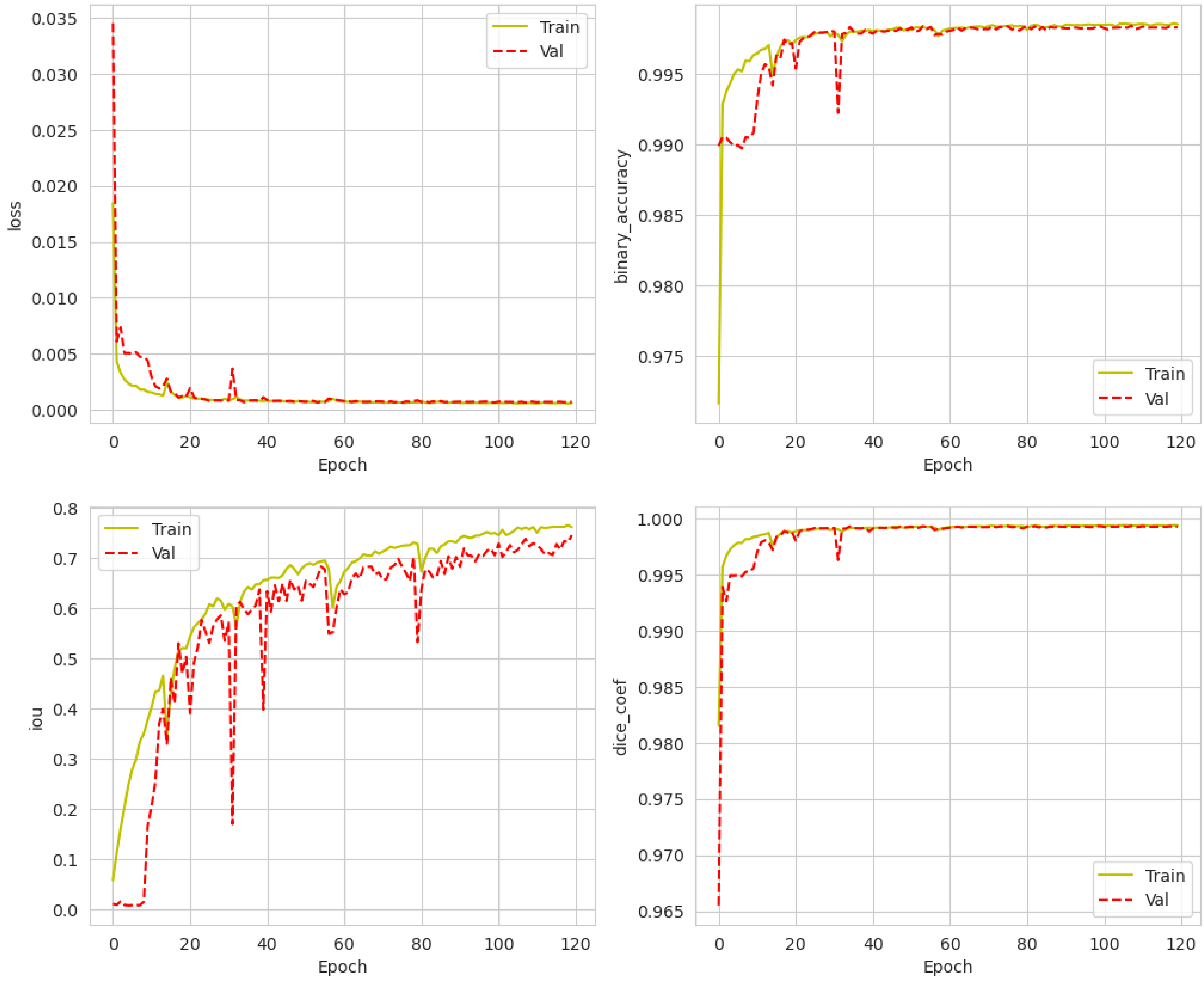


ResNet 50

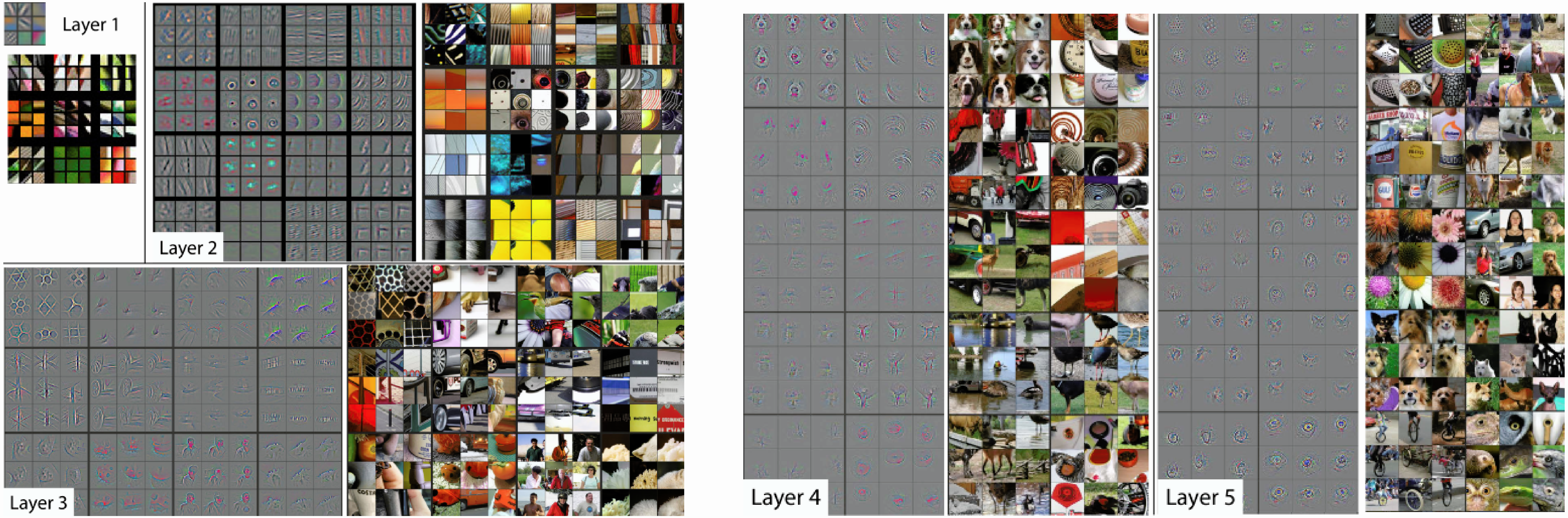


- Has residual connections (also known as skip connections)
- residual connections allow the network to learn residual mappings, bypassing certain layers and enabling the flow of gradients throughout the network.
- Allows for much deeper networks without a decrease in accuracy

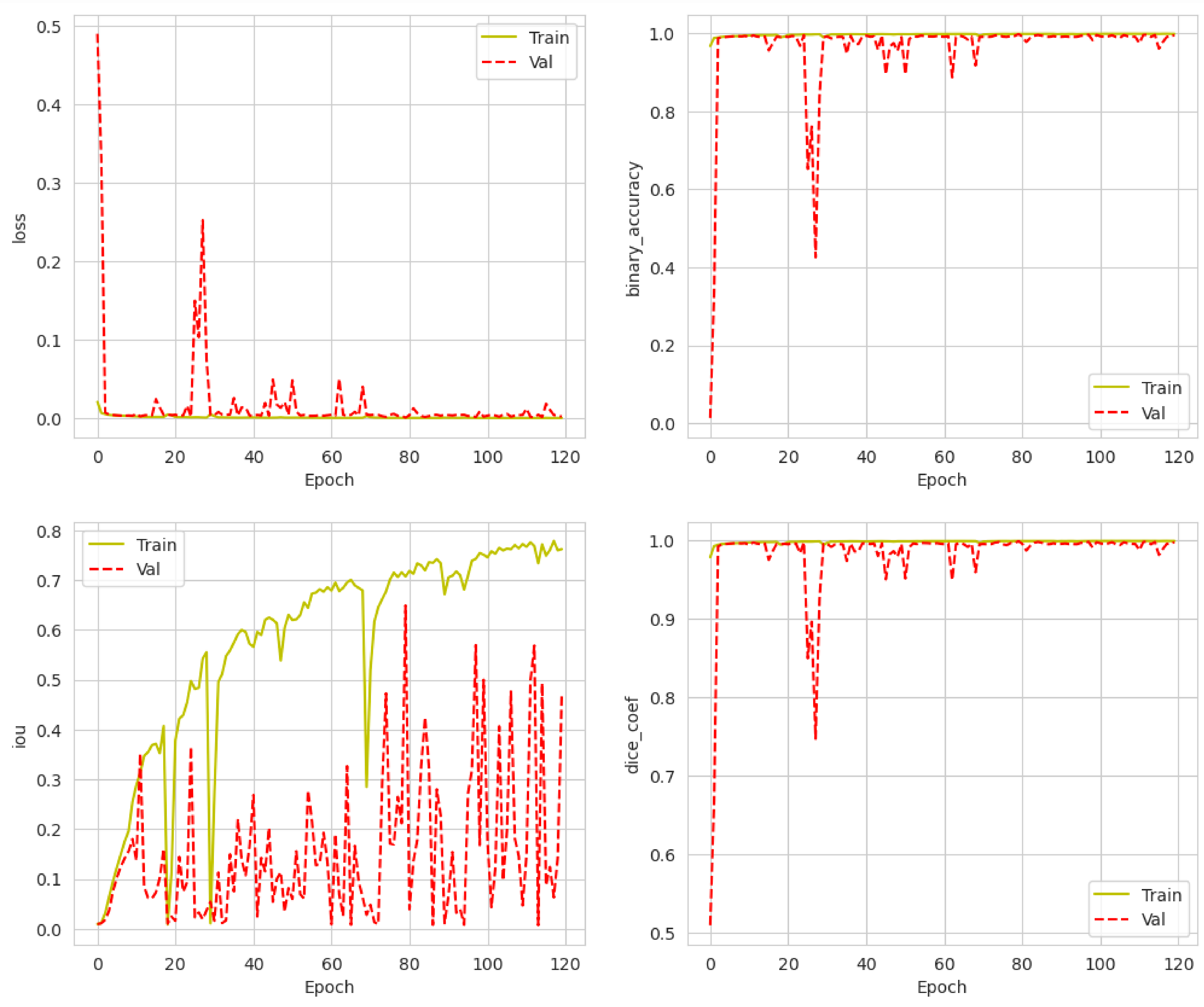
ResNet50 fine tuning



Feature Maps

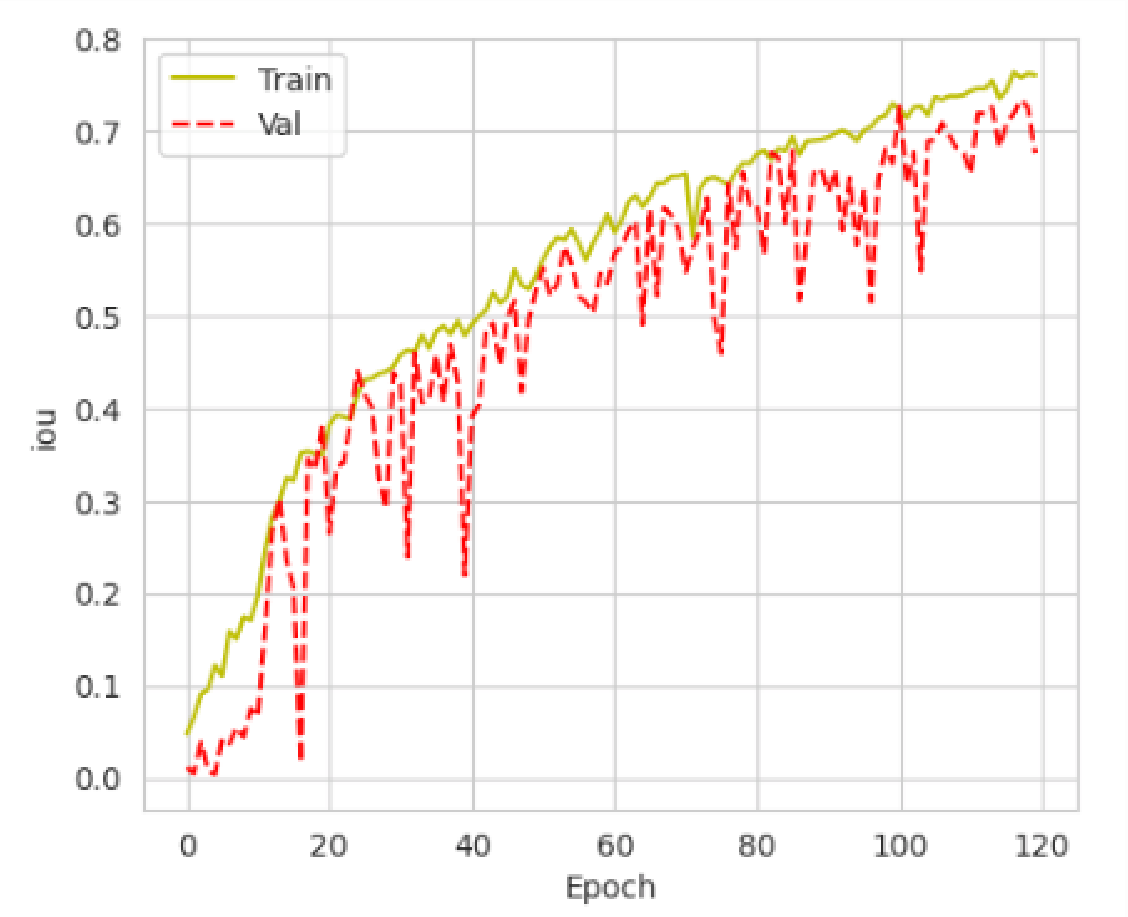


ResNet50 frezee first two conv blocks

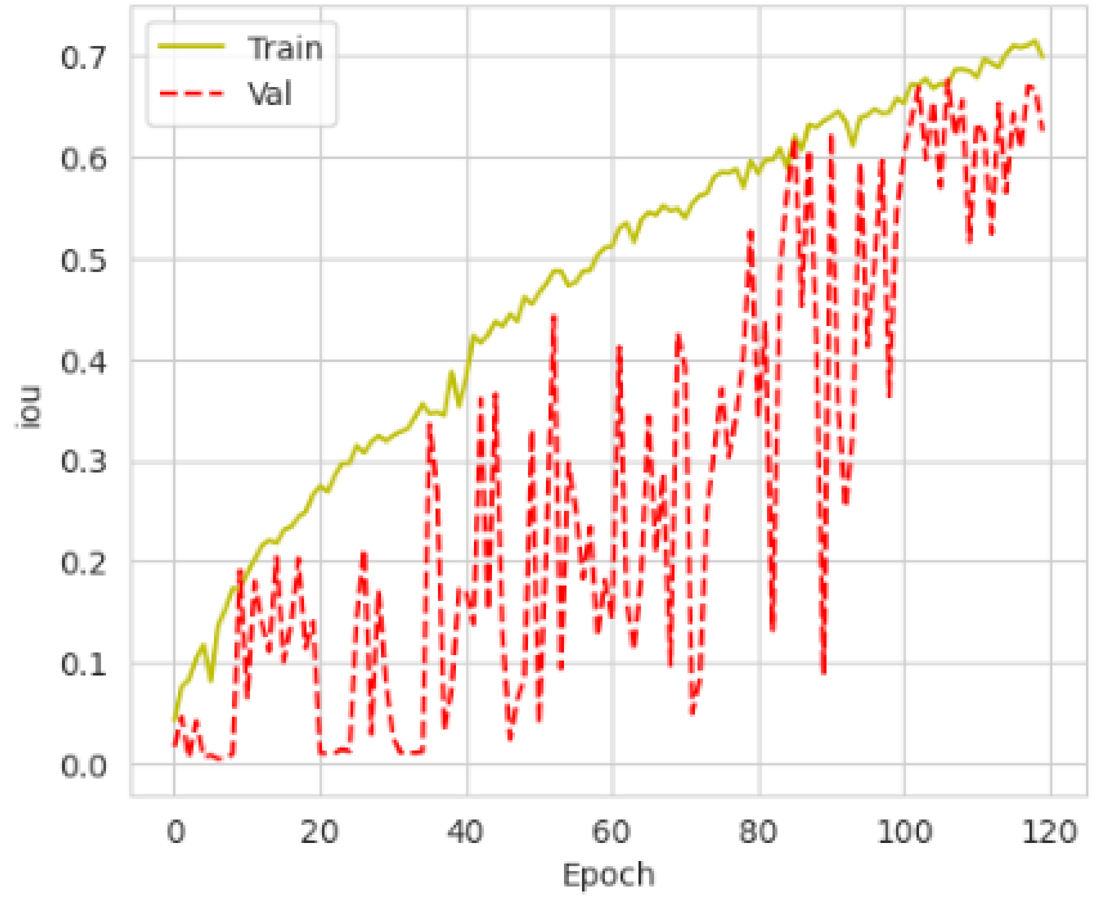


IoU Comparision

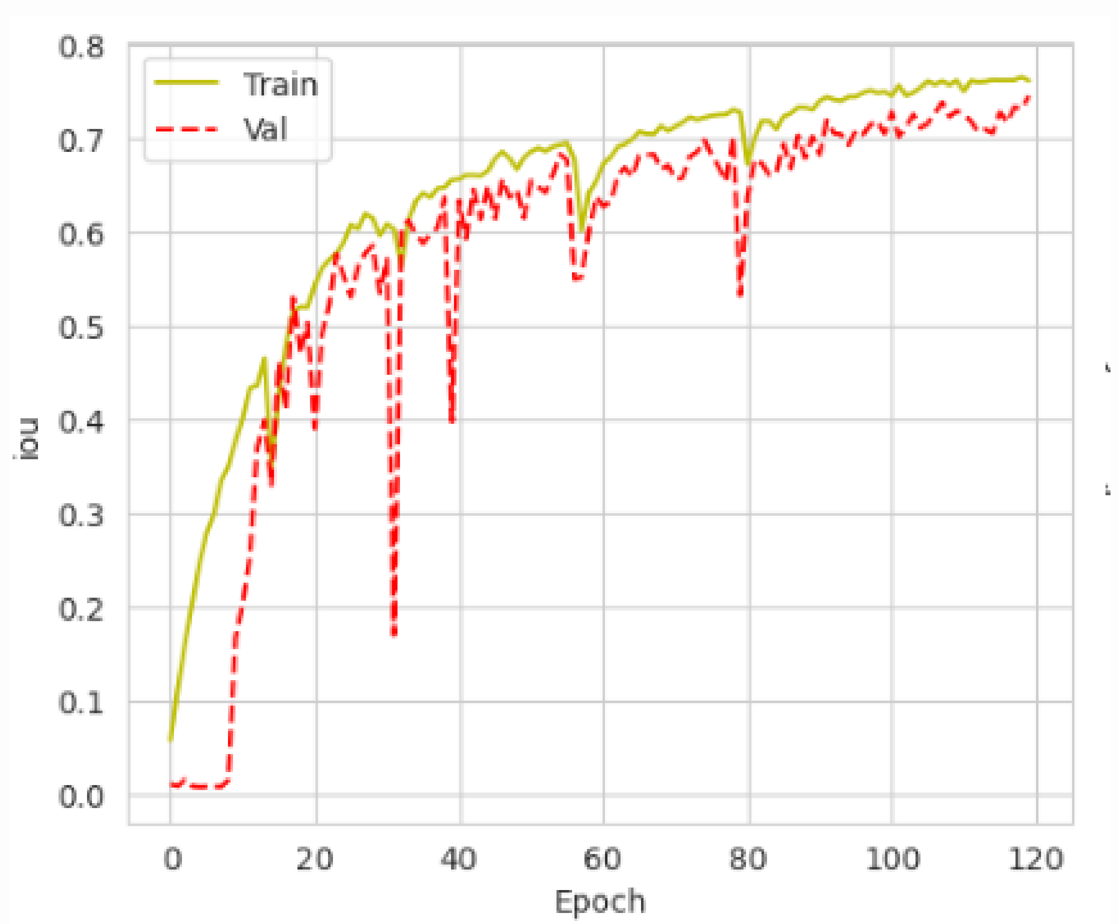
Unet



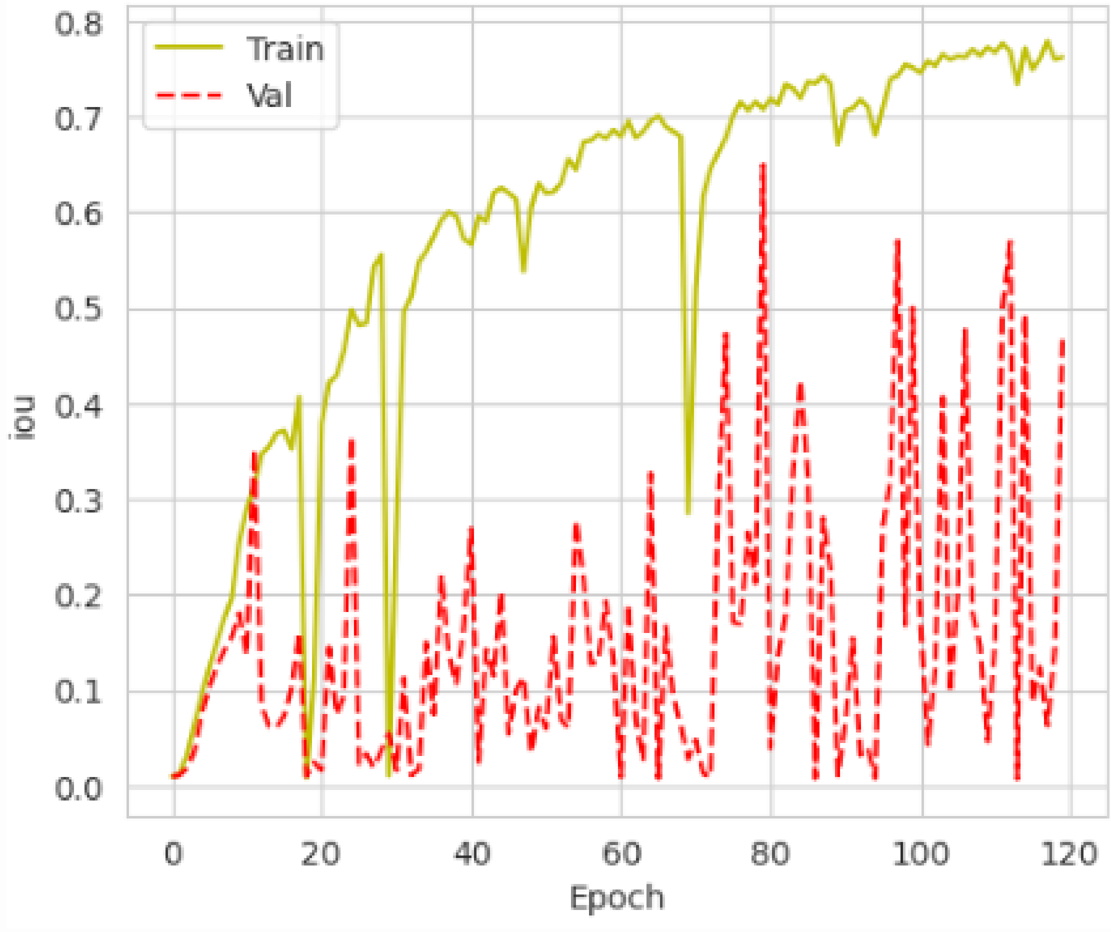
VGG



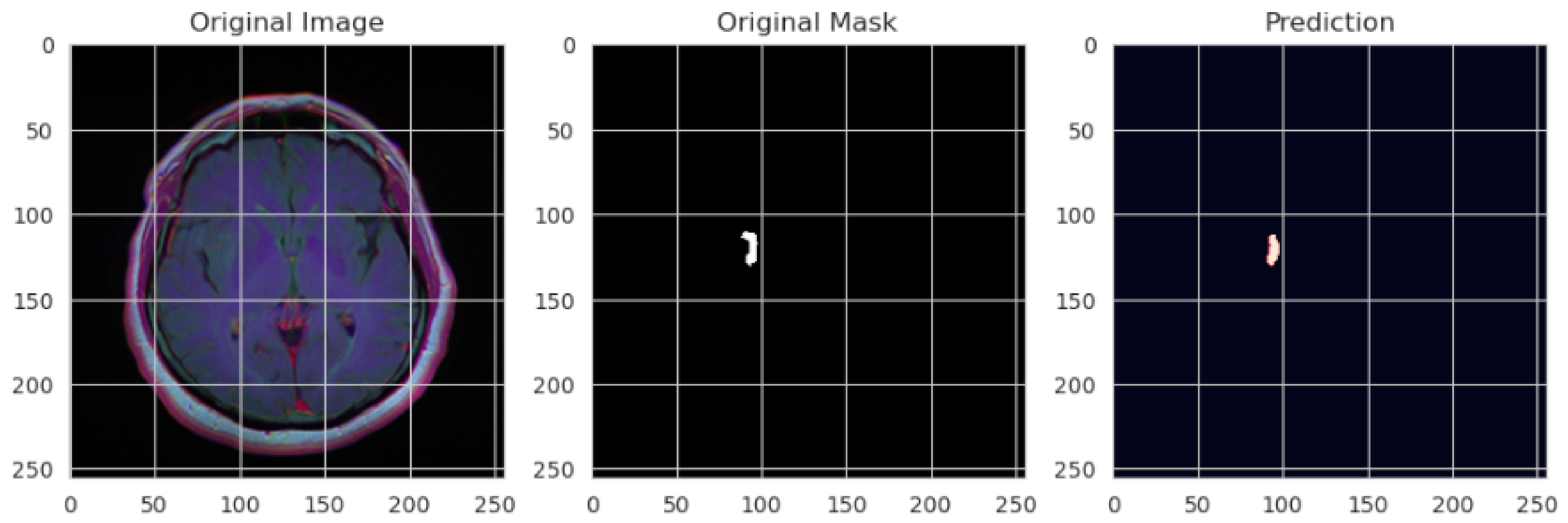
ResNet50 finetuning



ResNet50 freeze



Mask Visualization

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1/1 [==============================] - 0s 29ms/step
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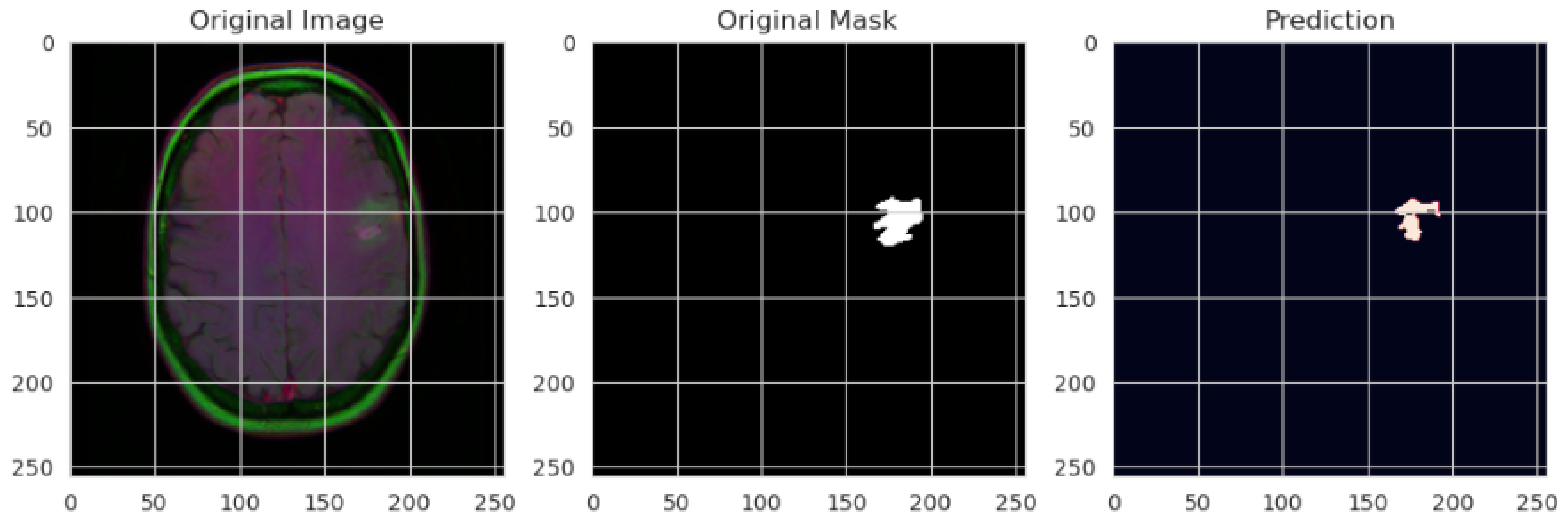

Conclusion

- Unet and ResNet50 (retrain all layer) gave better results
- ResNet50 (retrain all layer) converge faster then Unest, so the pretrained weights helped
- ResNet50 (freeze first two conv blocks) gave the worst results, so the pretrained weights that was trained on ImageNet classification task didn't work well on medical image segmentation.

What's next

- Increse training epoches of Unet and ResNet50 (retrain all layer) to improve the results
- Try cyclical leanring rate to fasten training and improve model performance
- Find pretrained models that were trained on medical images, then use the pretrained weights to do transfer learning