Image Segmentation by modified ResNET18

Dataset description

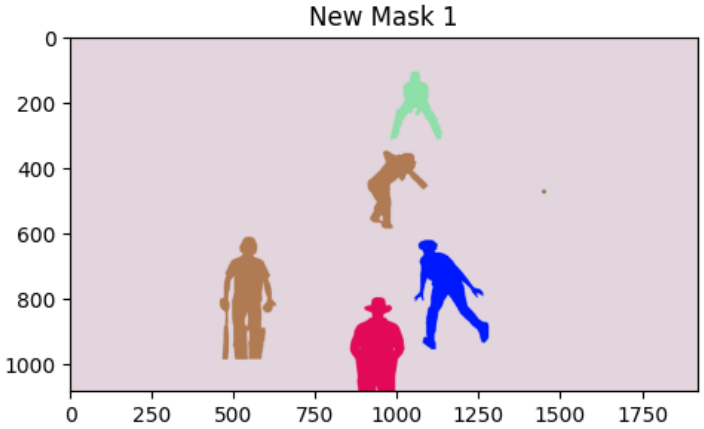
- The data set contains 298 images with their masks. To train the model the dataset is split into train, validate and test groups

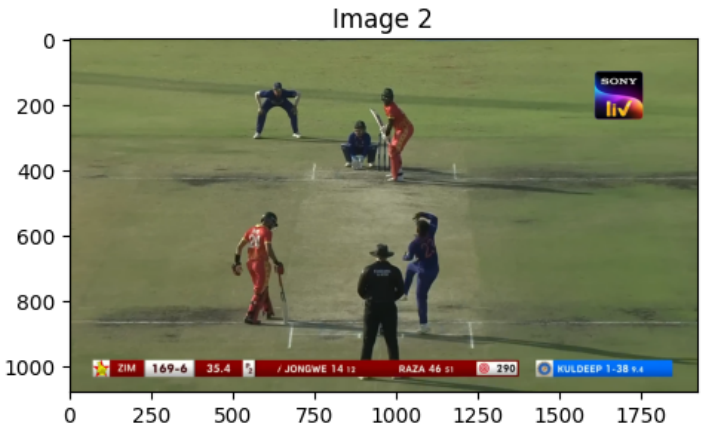
Training Data : 224 images with assigned masks

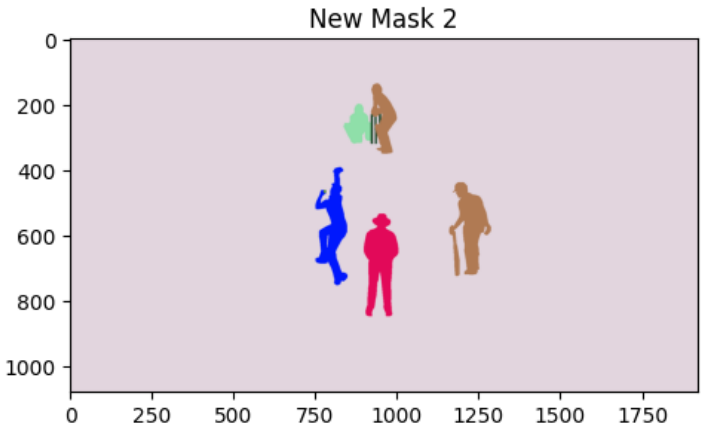
Validation Data: 24 images with assigned masks

Test Data: 50 images with assigned masks

Dataset sample







General Model Architecture

[3X1080X1920] : INPUT HD Image
[512X34X60] : Resnet-18 Image Output(without FC layers)

[256X135X2400] : DECONV1 : 256; 512X3X3 filters at stride 2 and padding 1
[256] : BATCHNORM1

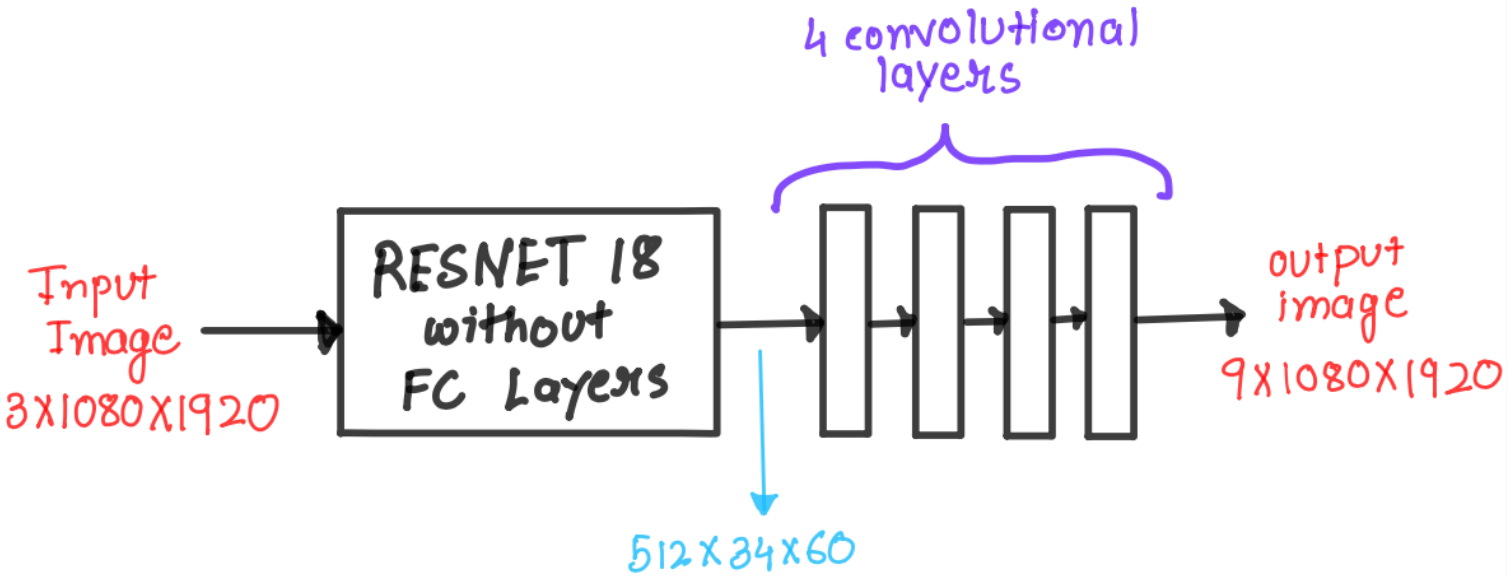
[128X270X480] : DECONV2 : 128; 256X3X3 filters at stride 2 and padding (0,1)
[128] : BATCHNORM2

[64X541X961] : DECONV3 : 64; 128X3X3 filters at stride 2 and padding 1
[64] : BATCHNORM3

[32X1080X1920] : DECONV4 : 32 64X3X3 filters at stride 2 and padding 1
[64] : BATCHNORM3

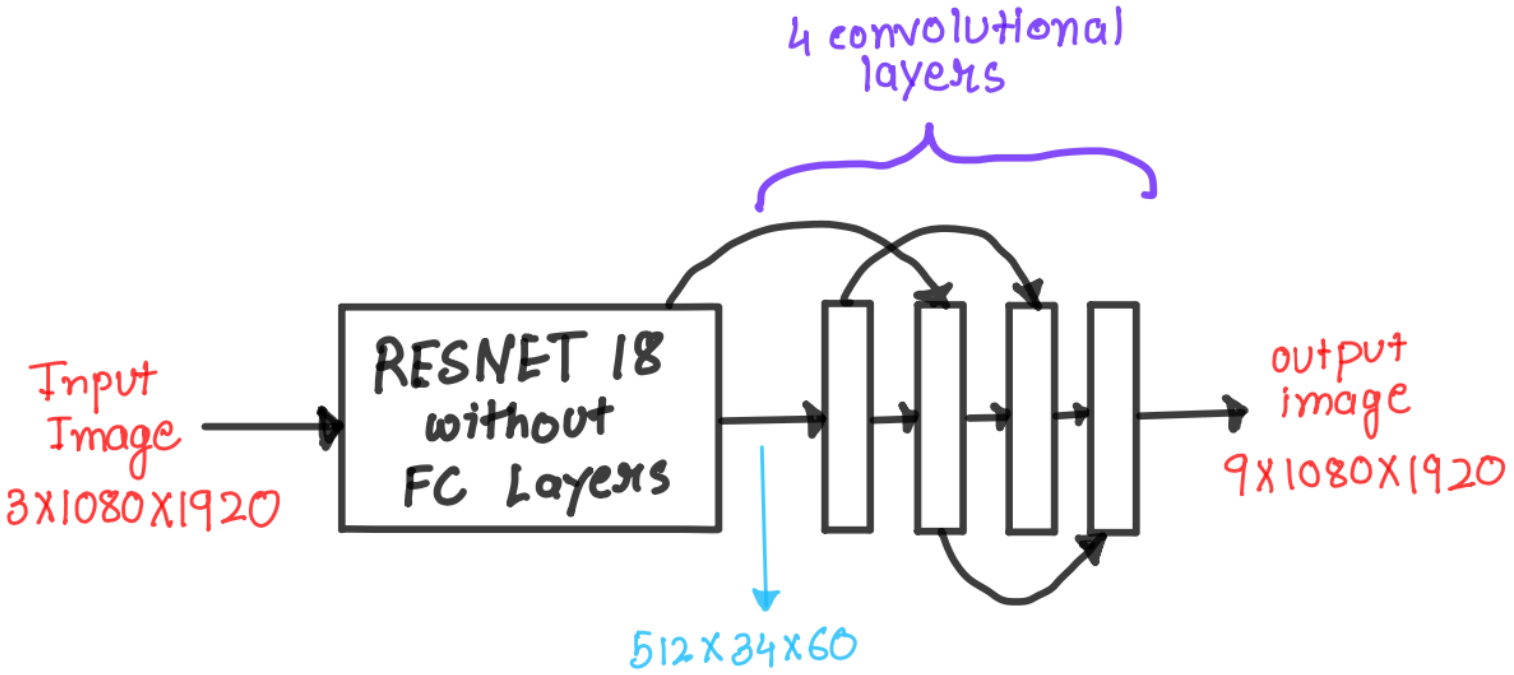
[9X1080X1920] : CLASSIFIER (Final OUTPUT Mask) : 9; 32X3X3 filters at stride 1 padding 0

ResNET without skip connections



"Without skip connections'

ResNET with skip connections



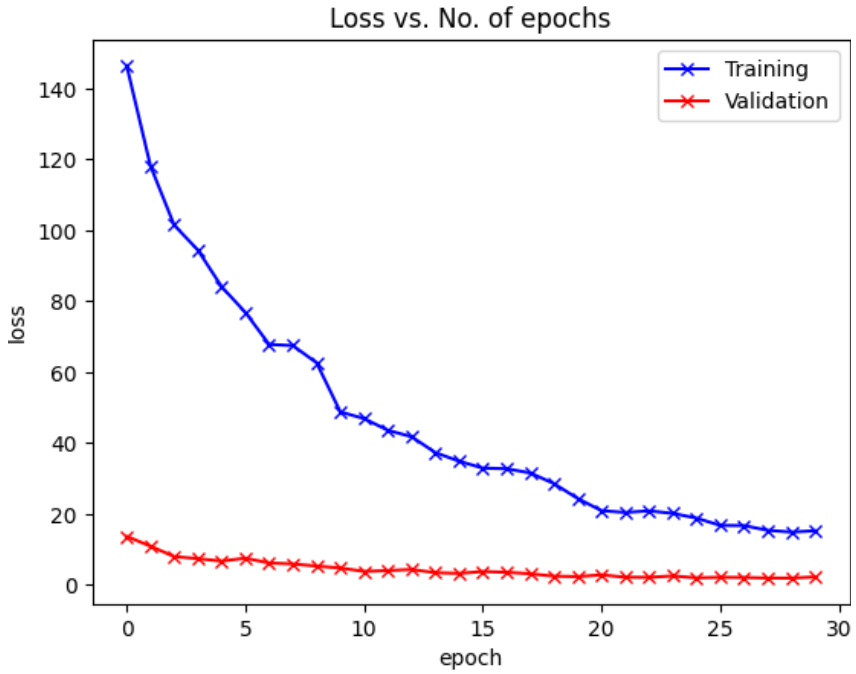
Hyperparameters

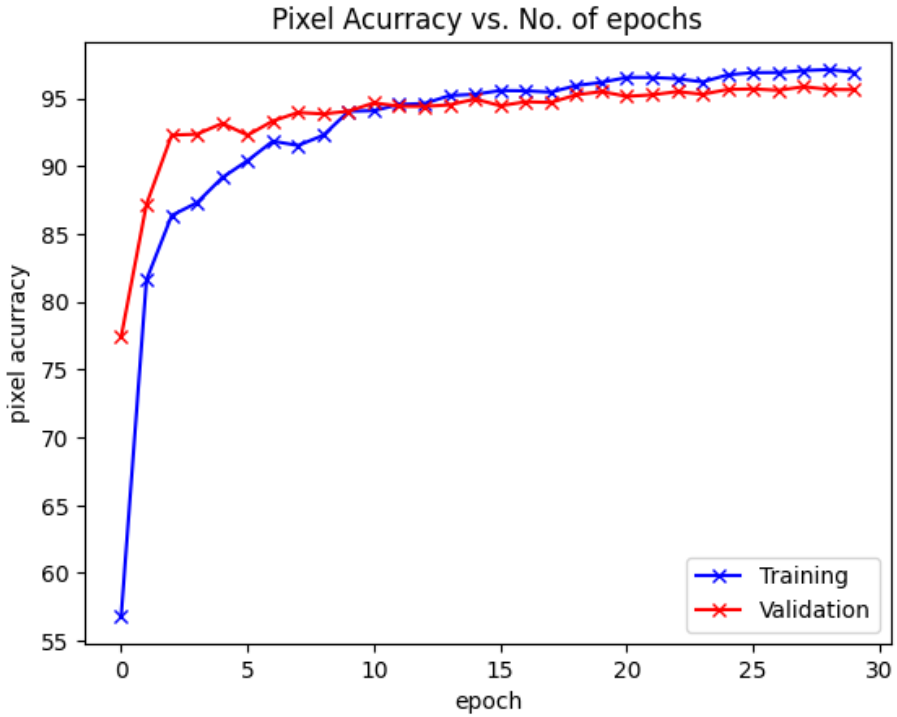
- Number of classes : 9
- Batch Size : 3/5
- Number of Epochs : 30
- Learning Rate : 0.0001

- Loss function: Categorical cross-entropy
- Optimiser : ADAM

Model1 : Without skip connections

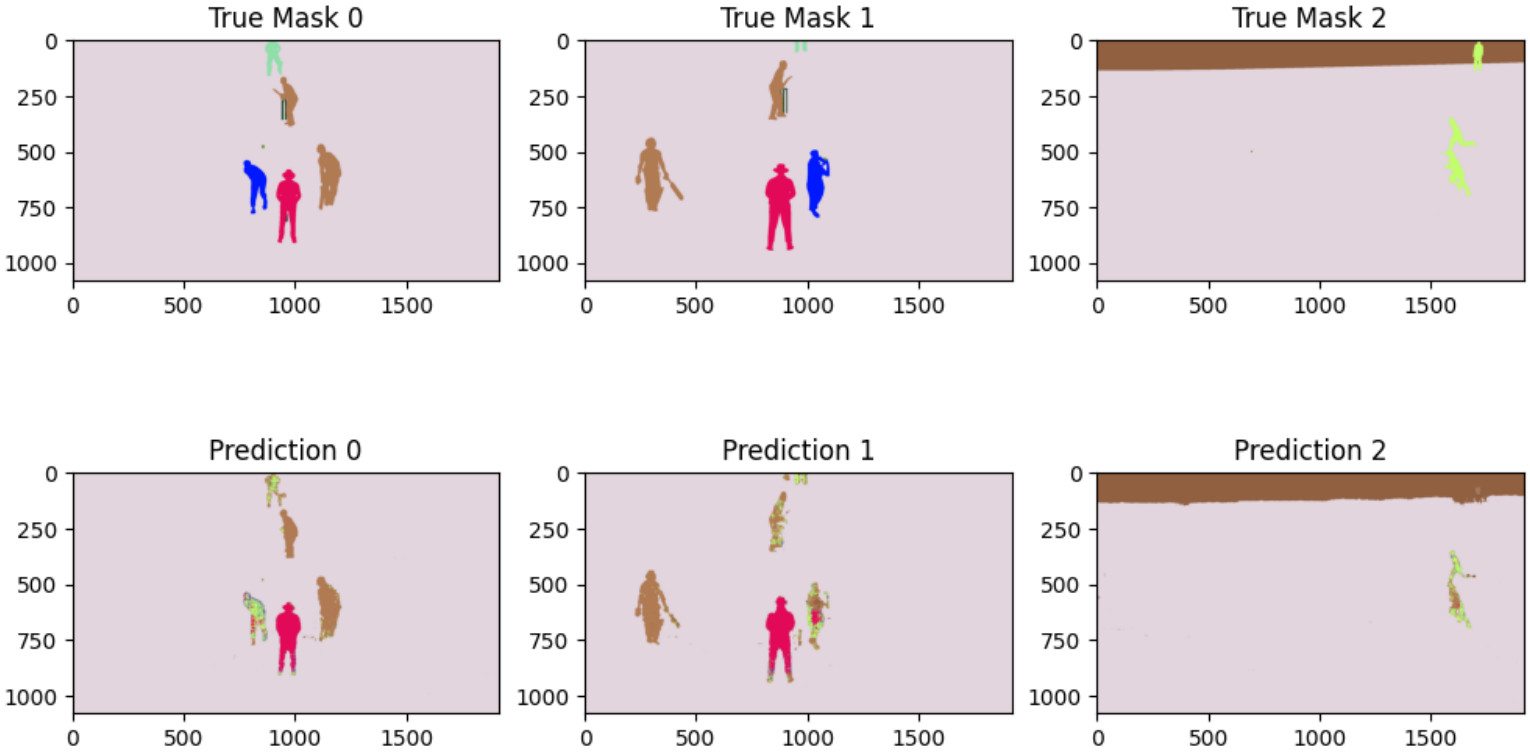
(Loss and Accuracy Plots)



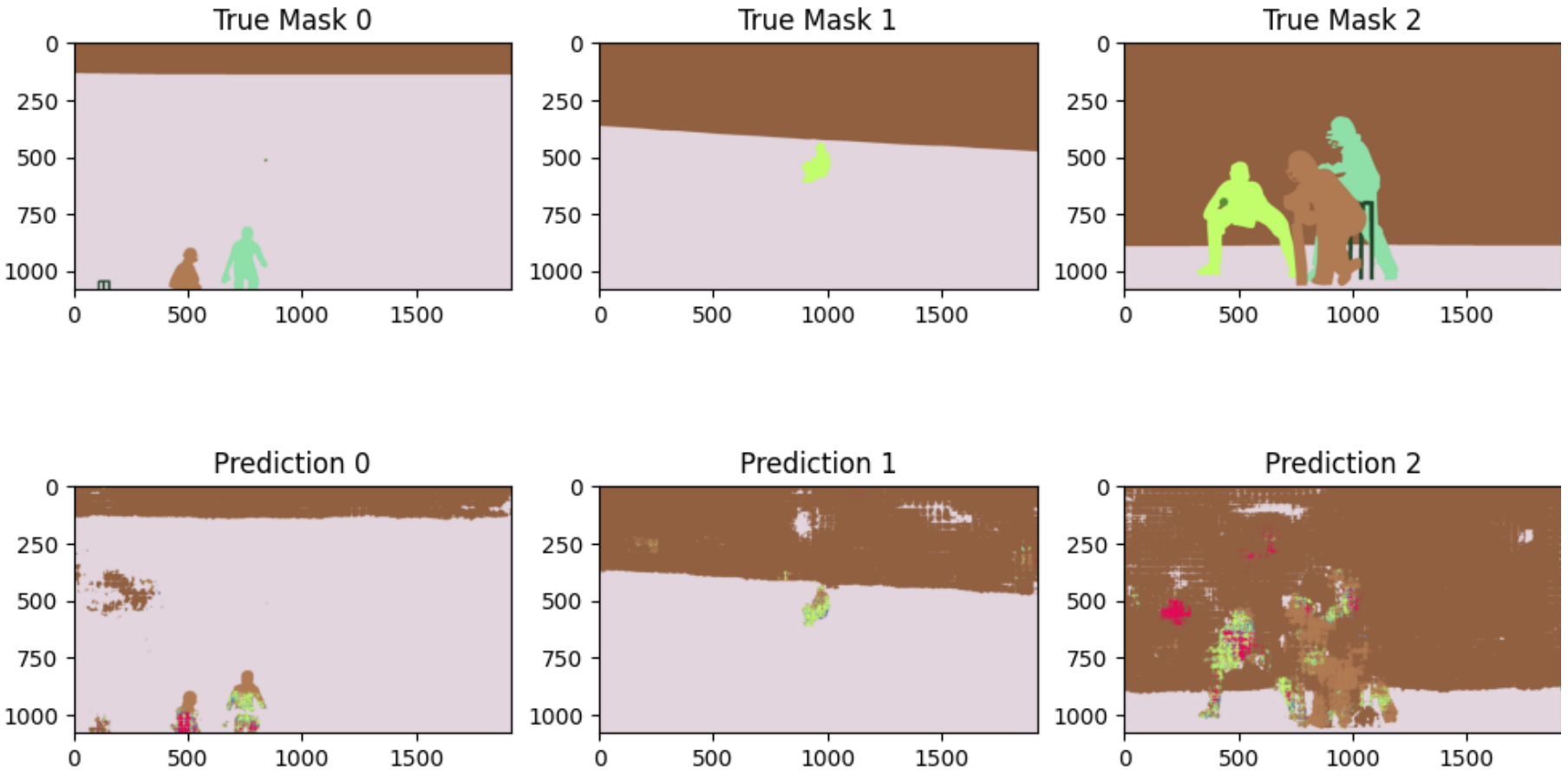


Model1: Predictions

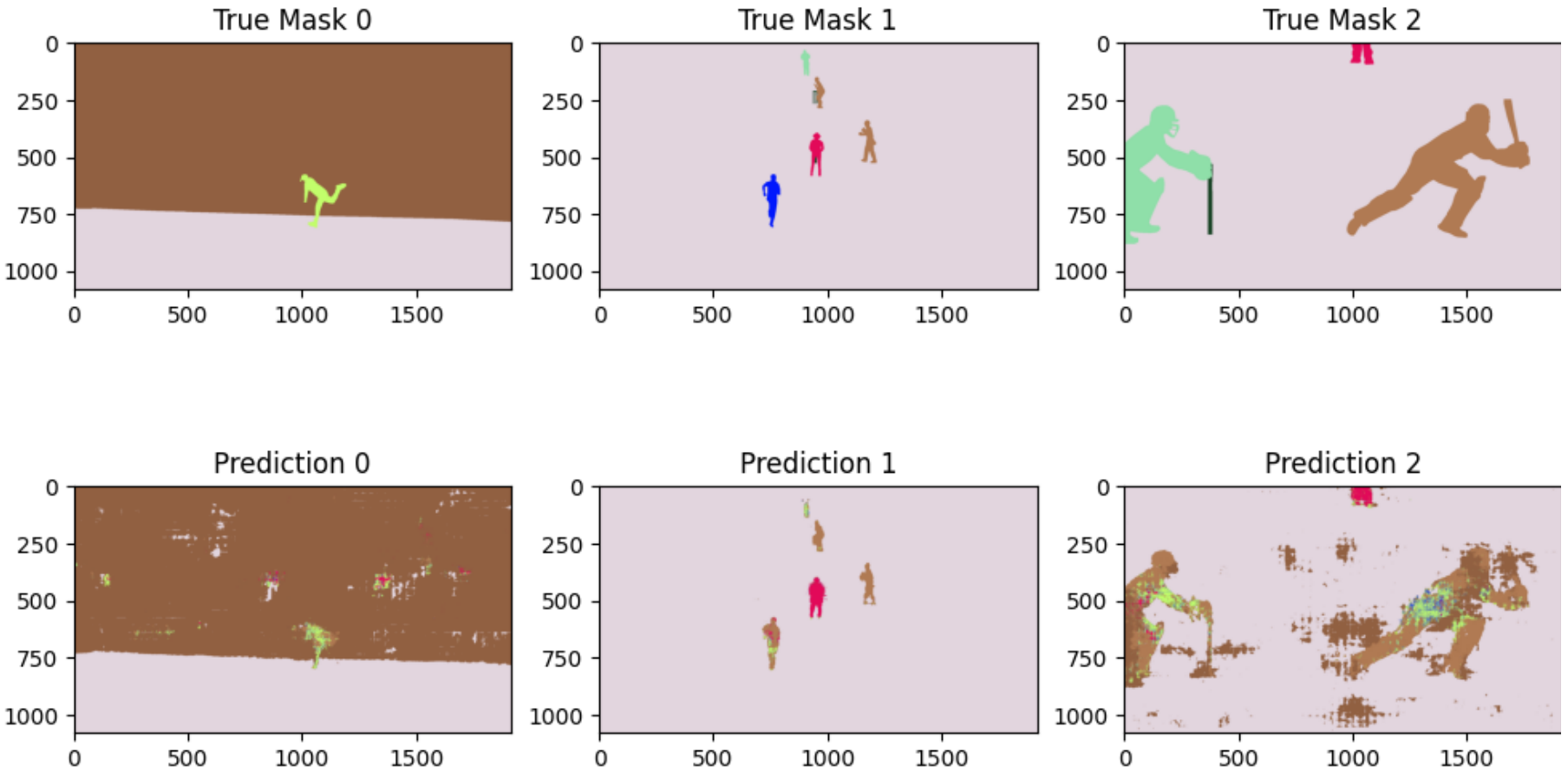
(Comparison of ground truth and model outputs)



Continued ...

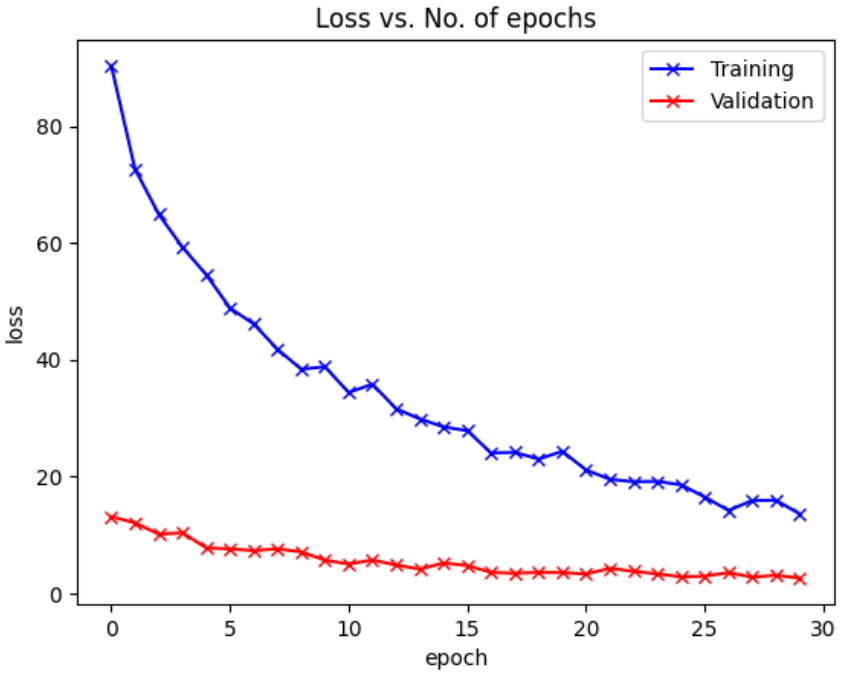

True Mask 0
True Mask 1
True Mask 2
Prediction 0
Prediction 1
Prediction 2
0
250
500
750
1000
0
500
1000
1500

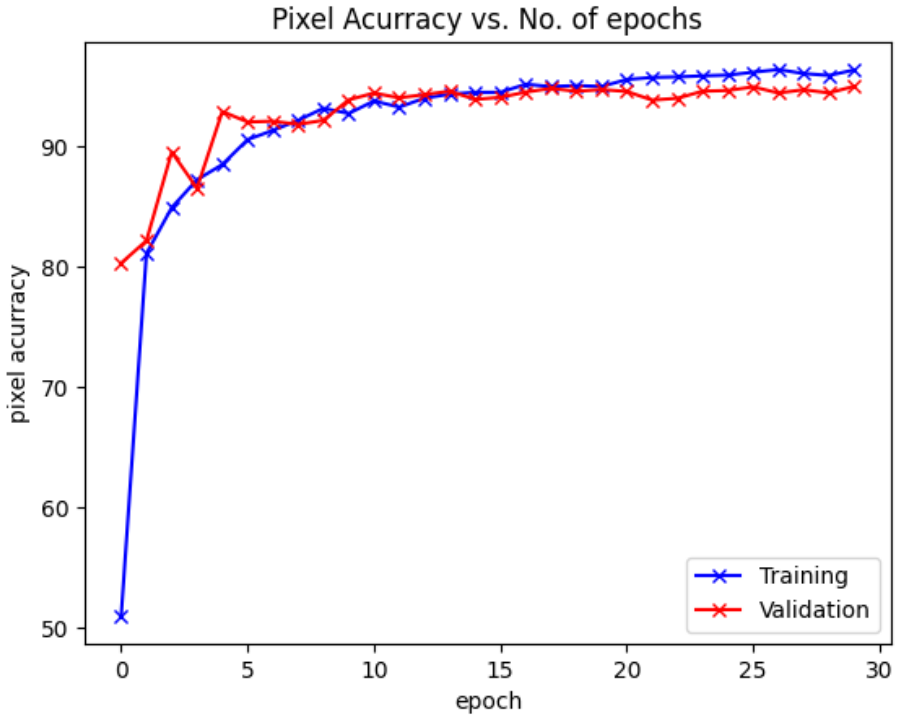
Continued ...


True Mask 0
True Mask 1
True Mask 2
Prediction 0
Prediction 1
Prediction 2
0
250
500
750
1000
0
500
1000
1500

Model2 : With skip connections

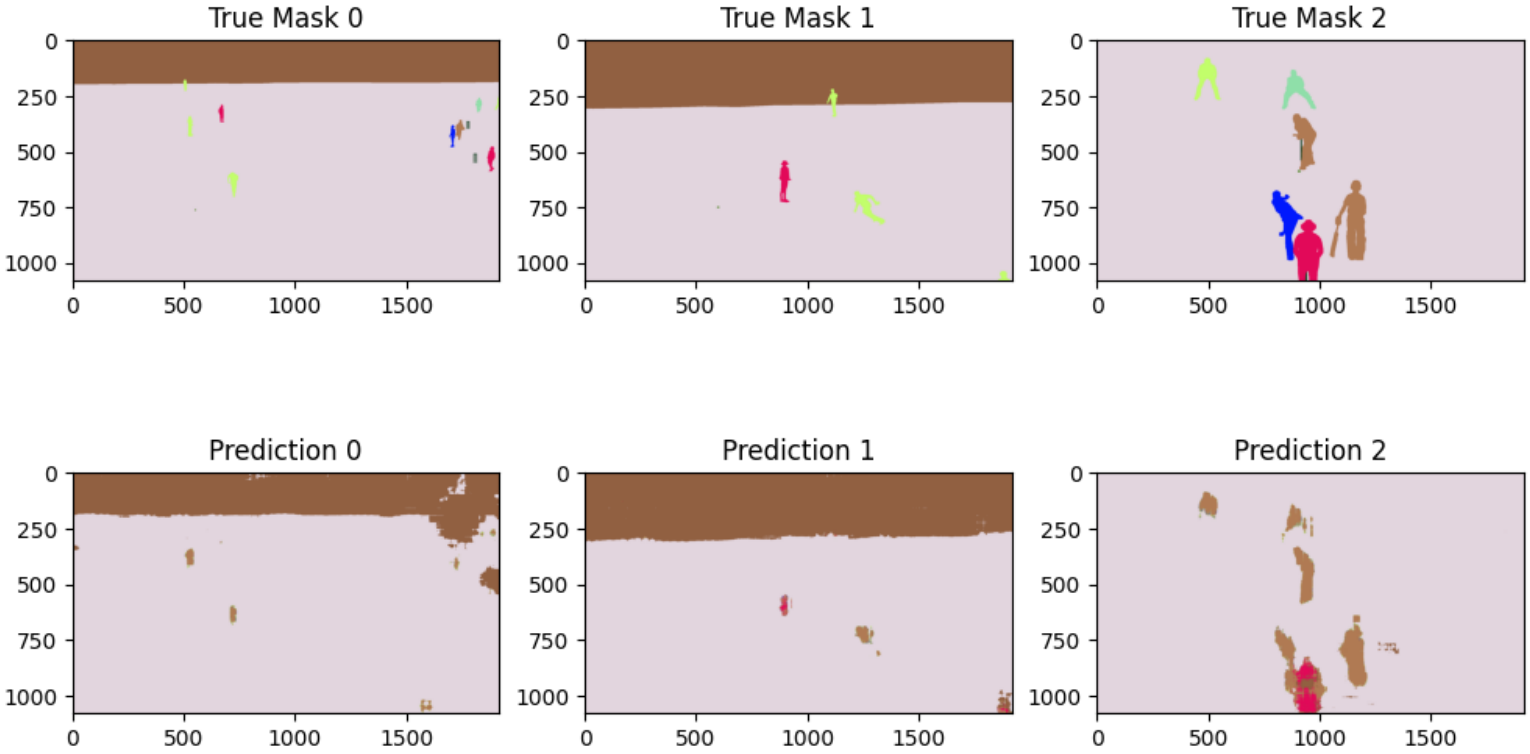
(Loss and Accuracy Plots)





Model2: Predictions

(Comparison of ground truth and model outputs)



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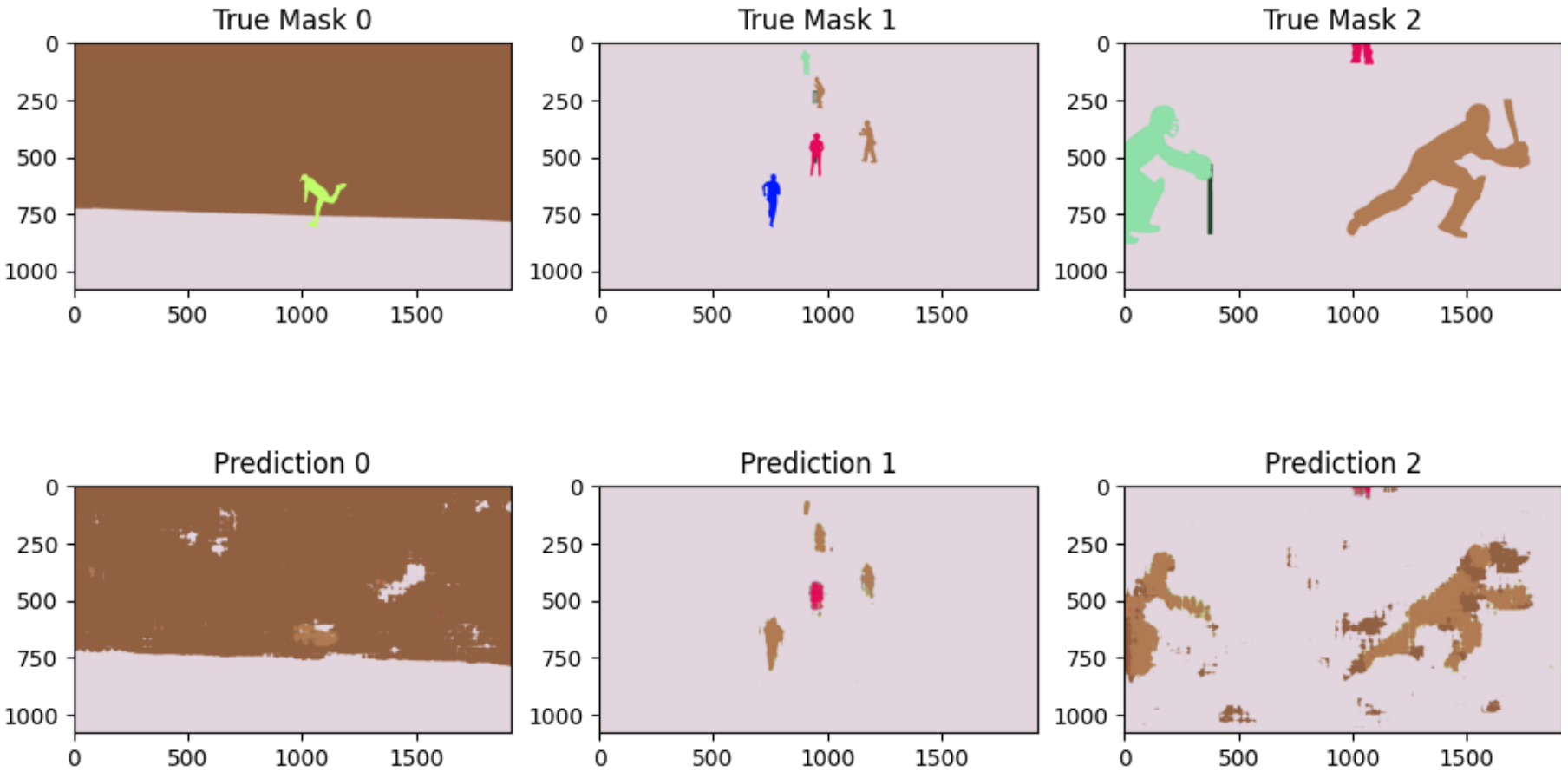
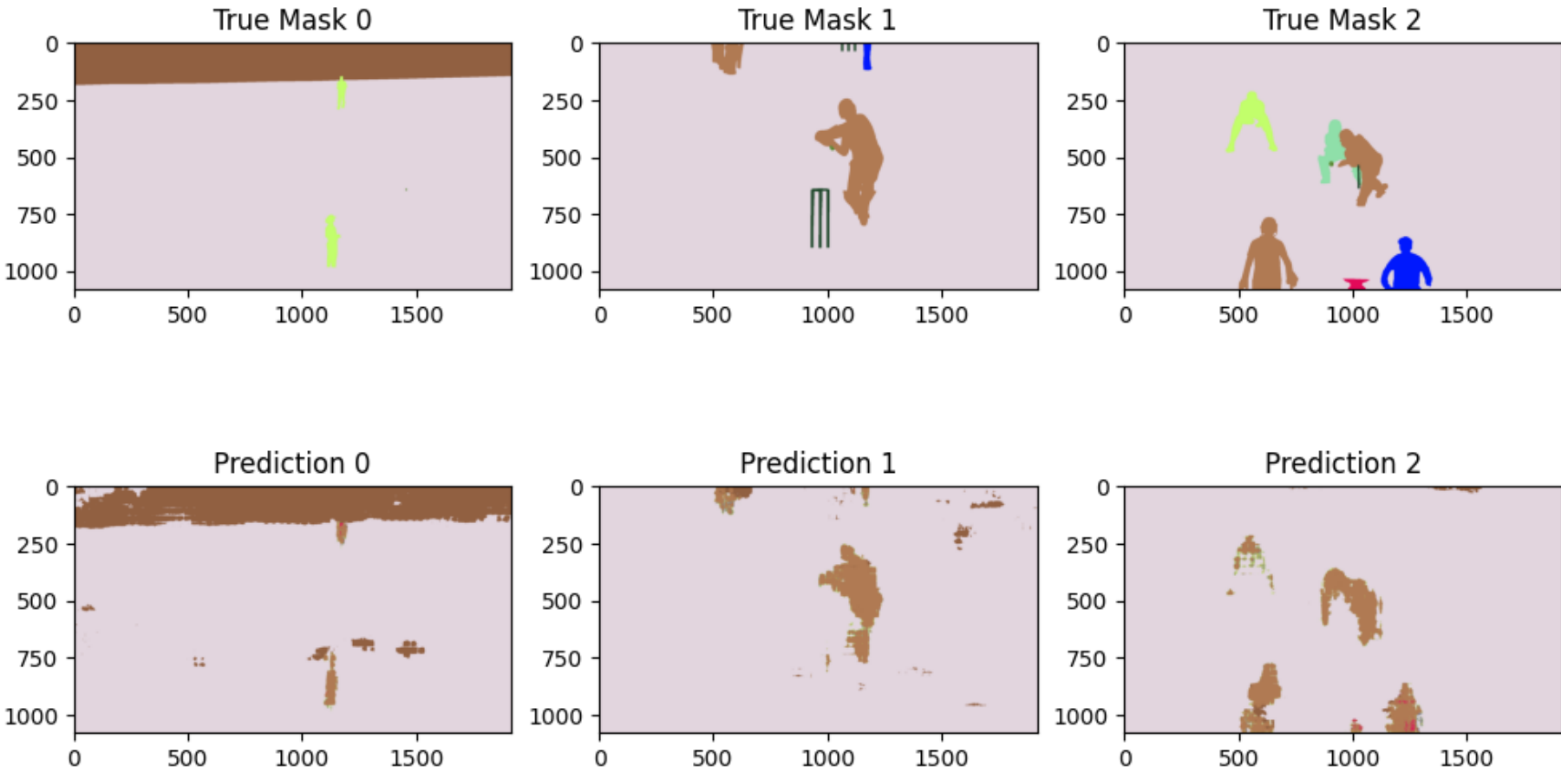

True Mask 0
True Mask 1
True Mask 2
Prediction 0
Prediction 1
Prediction 2
0
250
500
750
1000
0
500
1000
1500

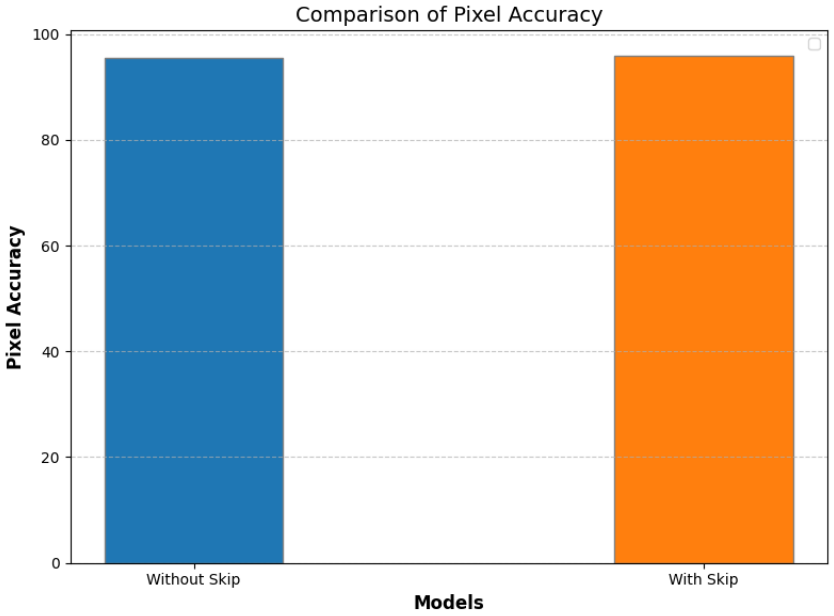
Continued ...

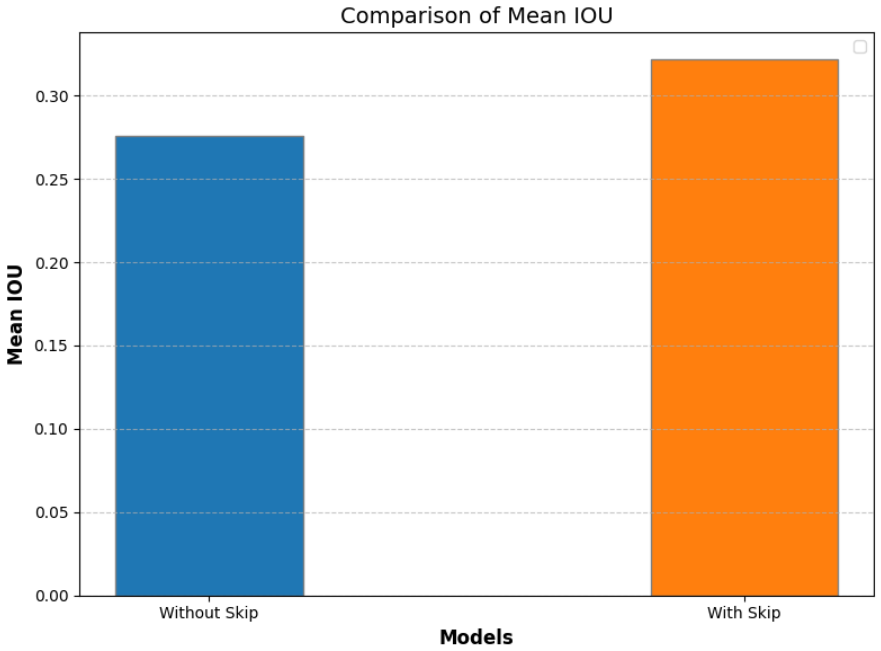

True Mask 0
True Mask 1
True Mask 2
Prediction 0
Prediction 1
Prediction 2
0
250
500
750
1000
0
500
1000
1500

Evaluation
(Comparison of both models)

Architecture	Pixel wise Accuracy	Mean IOU
Without Skip Connections	95.39%	0.2756
With Skip Connnections	95.86%	0.3217

Evaluation
(Comparison of both models)





Takeaways

- The Performance of model is improved upon using skip connections
- The training time can be significantly reduced by freezing the pre-trained layers of RESNET18 and only training new added layers.