BIRD SONG CLASSFICATION

Dataset(Speech)

Data set includes only "songs" from 5 species-

- Bewick's Wren
- Northern Cardinal
- American Robin
- Song Sparrow
- Northern Mockingbird

For preprocessing we used Mel log Spectrogram

ResNet(2015)

Introduced the Skip connection idea make creating larger Model possible

The skip connection help to mitigate vanishing gradient problem

The idea of the skip connection to add the output of the input of the block to the out of the block

Limited feature reuse and can overfit

ResNet(2015)

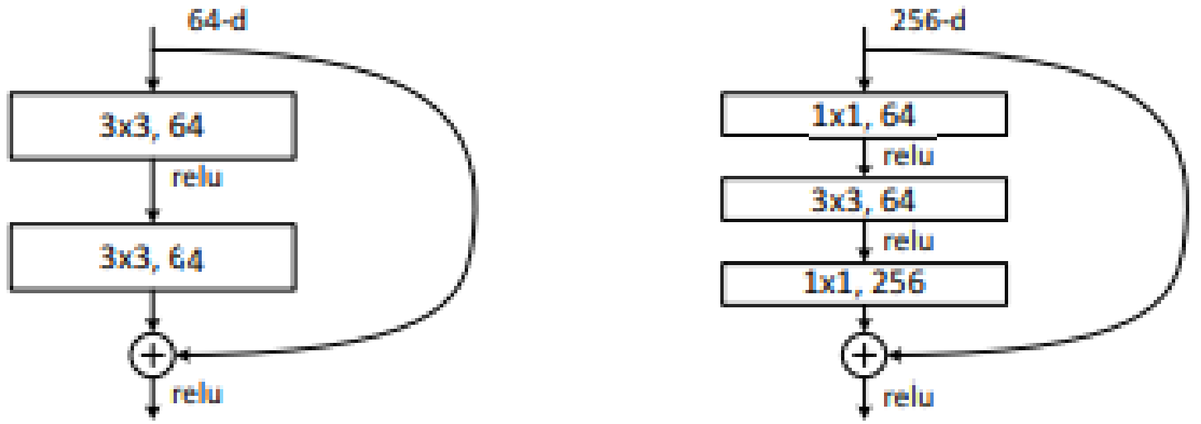


Figure 5. A deeper residual function $\mathcal{F}$ for ImageNet. Left: a building block (on 56×56 feature maps) as in Fig. 3 for ResNet-34. Right: a "bottleneck" building block for ResNet-50/101/152.

XCeption(2017)

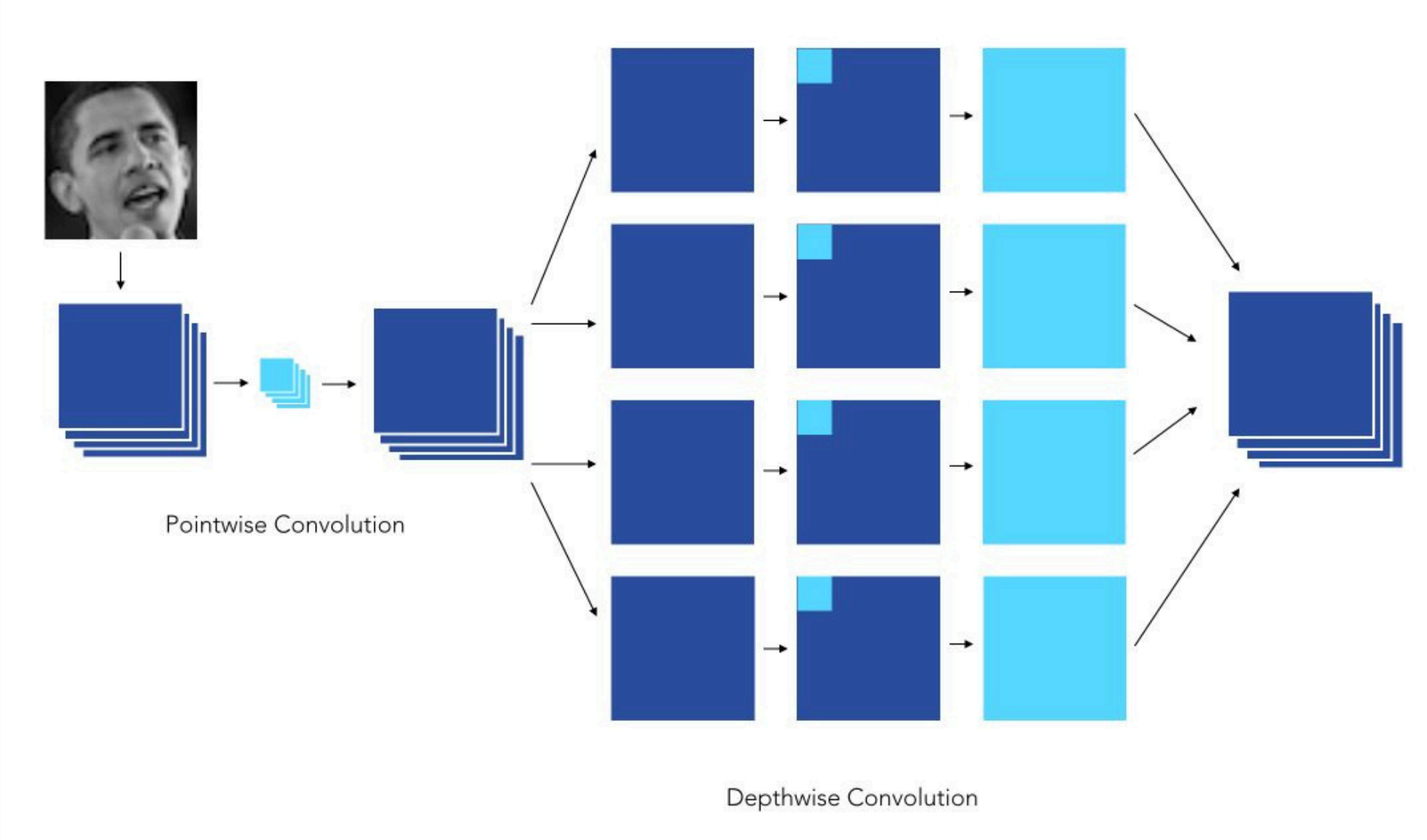
Utilizes depthwise separable convolutions, where spatial and cross-channel correlations are processed independently.

This improves computational efficiency and enhances feature extraction.

Xception is a deep learning architecture that builds on the Inception model by introducing a more efficient way of handling convolutions.

Less Effective for Small Datasets

XCeption(2017)



DenseNet(2018)

Improvement in skip connections idea
not just add the input of block to the output of the block no. It’s concatenate the input features to the output features make it more powerful in gradient flow

But also introduce a problem in computation due to dense feature concatenation

DenseNet(2018)

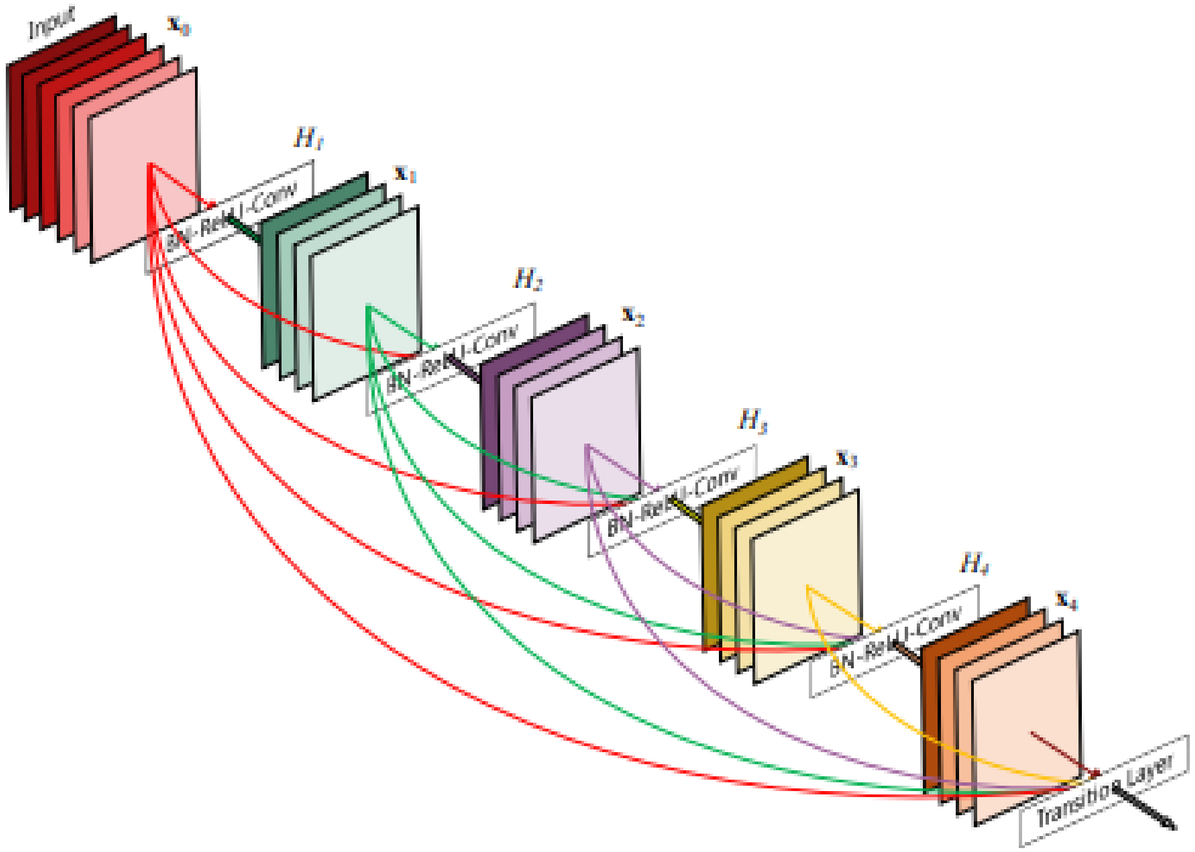


Figure 1: A 5-layer dense block with a growth rate of $k = 4$. Each layer takes all preceding feature-maps as input.

Results

ResNet-18

Accuracy: 0.8083
Precision: 0.8418
Recall: 0.8083
F1 Score: 0.8080
ROC AUC: 0.9708

ResNet-50

Accuracy: 0.8488
Precision: 0.8602
Recall: 0.8488
F1 Score: 0.8486
ROC AUC: 0.9747

XCeption-36

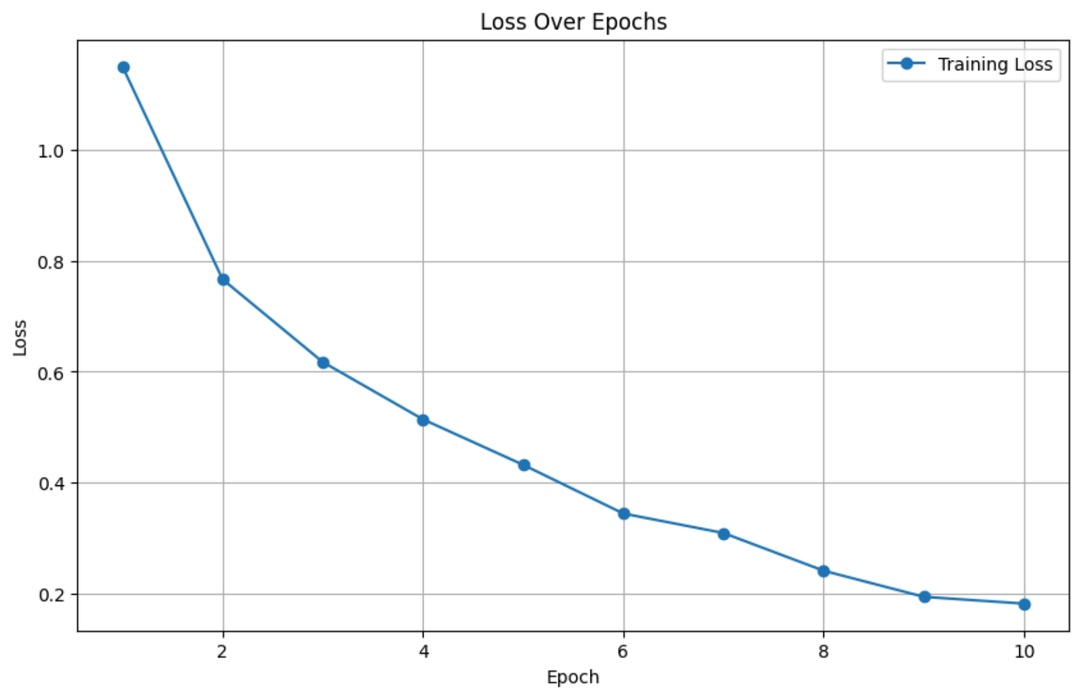
Accuracy: 0.8949
Precision: 0.9124
Recall: 0.8949
F1 Score: 0.8971
ROC AUC: 0.9904

DenseNet-121

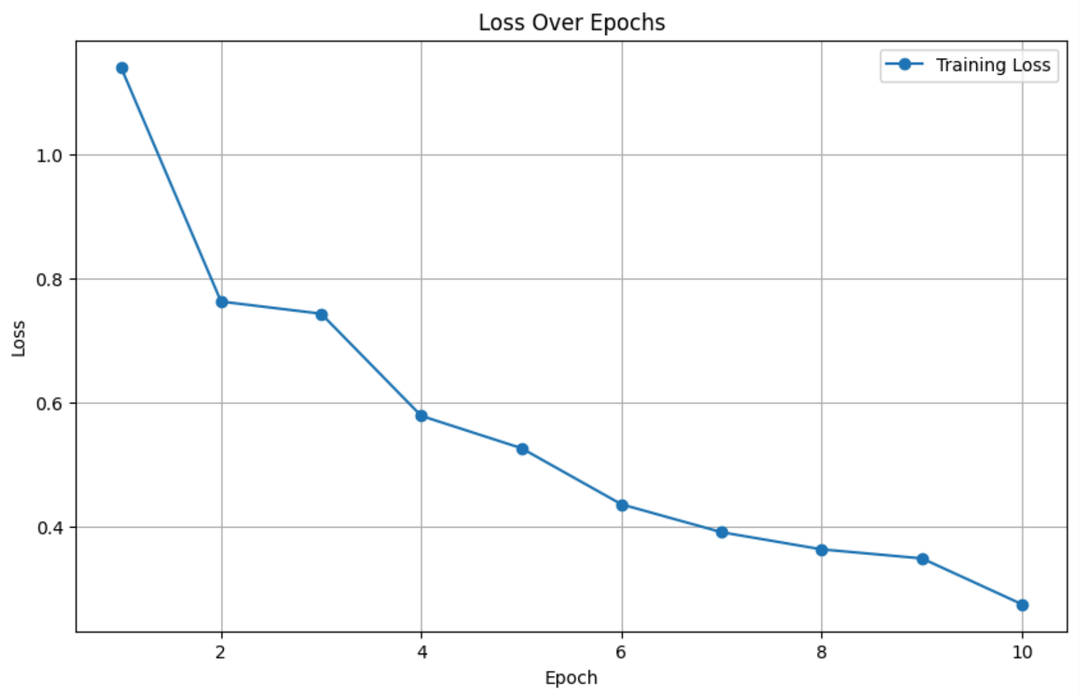
Accuracy: 0.8065
Precision: 0.8371
Recall: 0.8065
F1 Score: 0.8029
ROC AUC: 0.9761

Loss Curve

ResNet-18

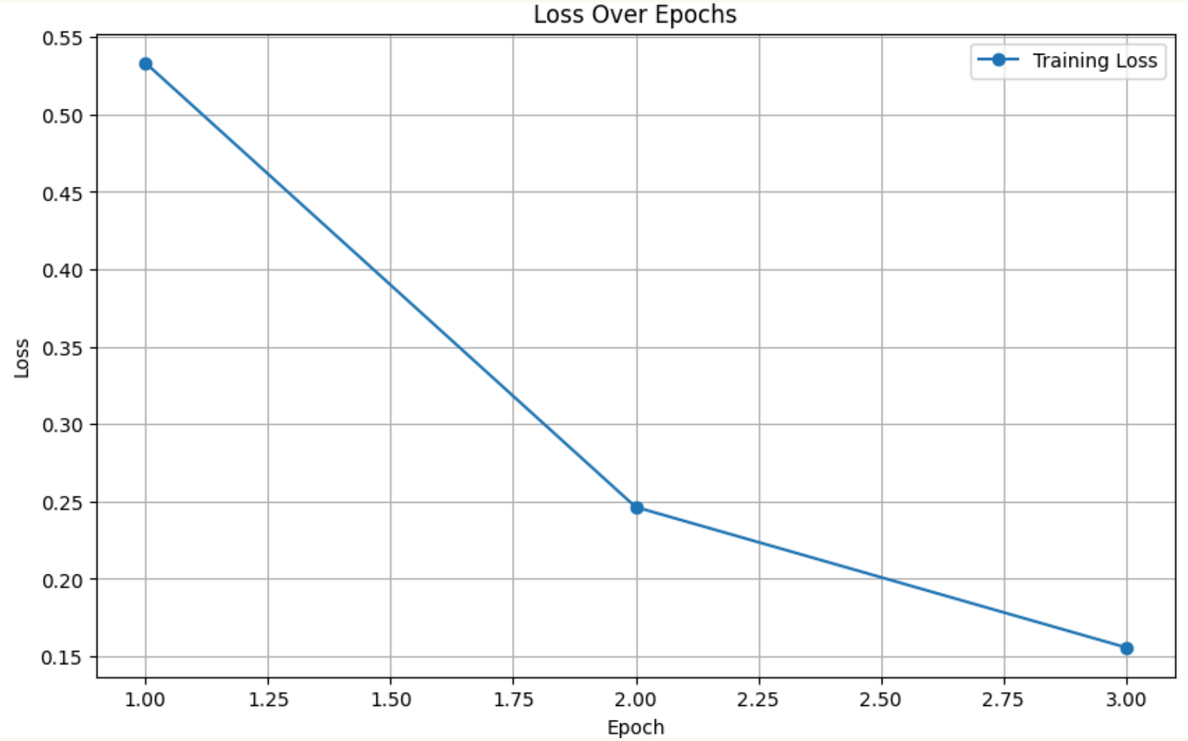


ResNet-50

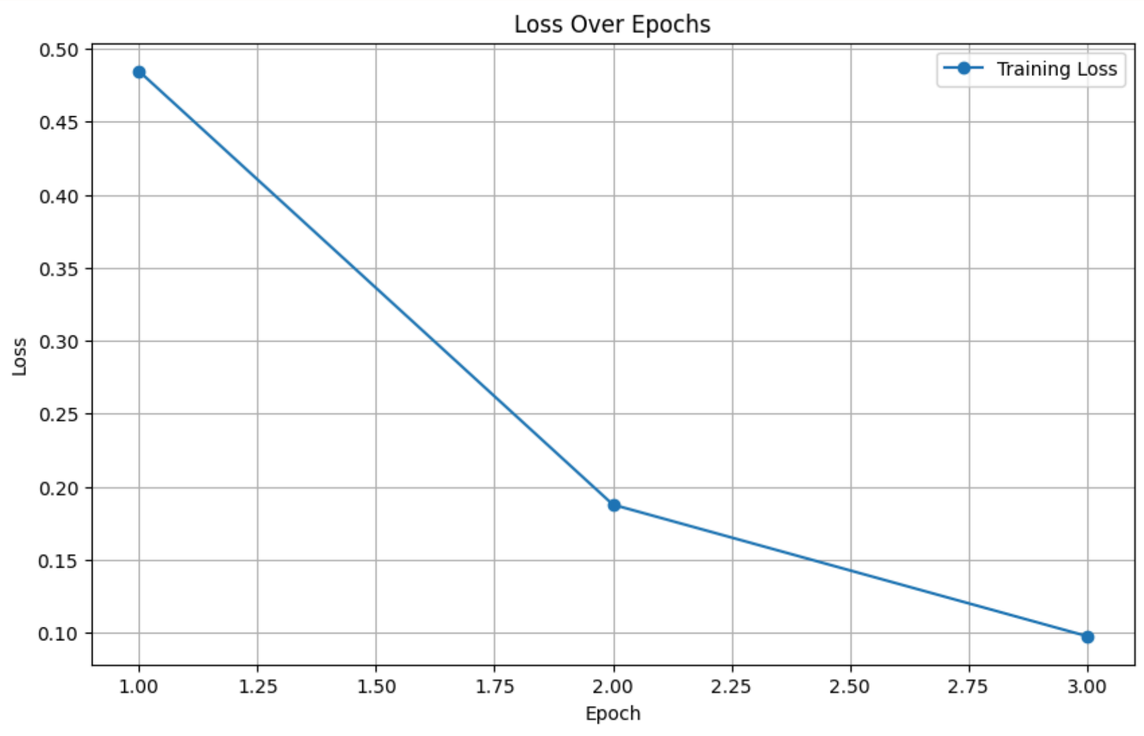


Loss Curve

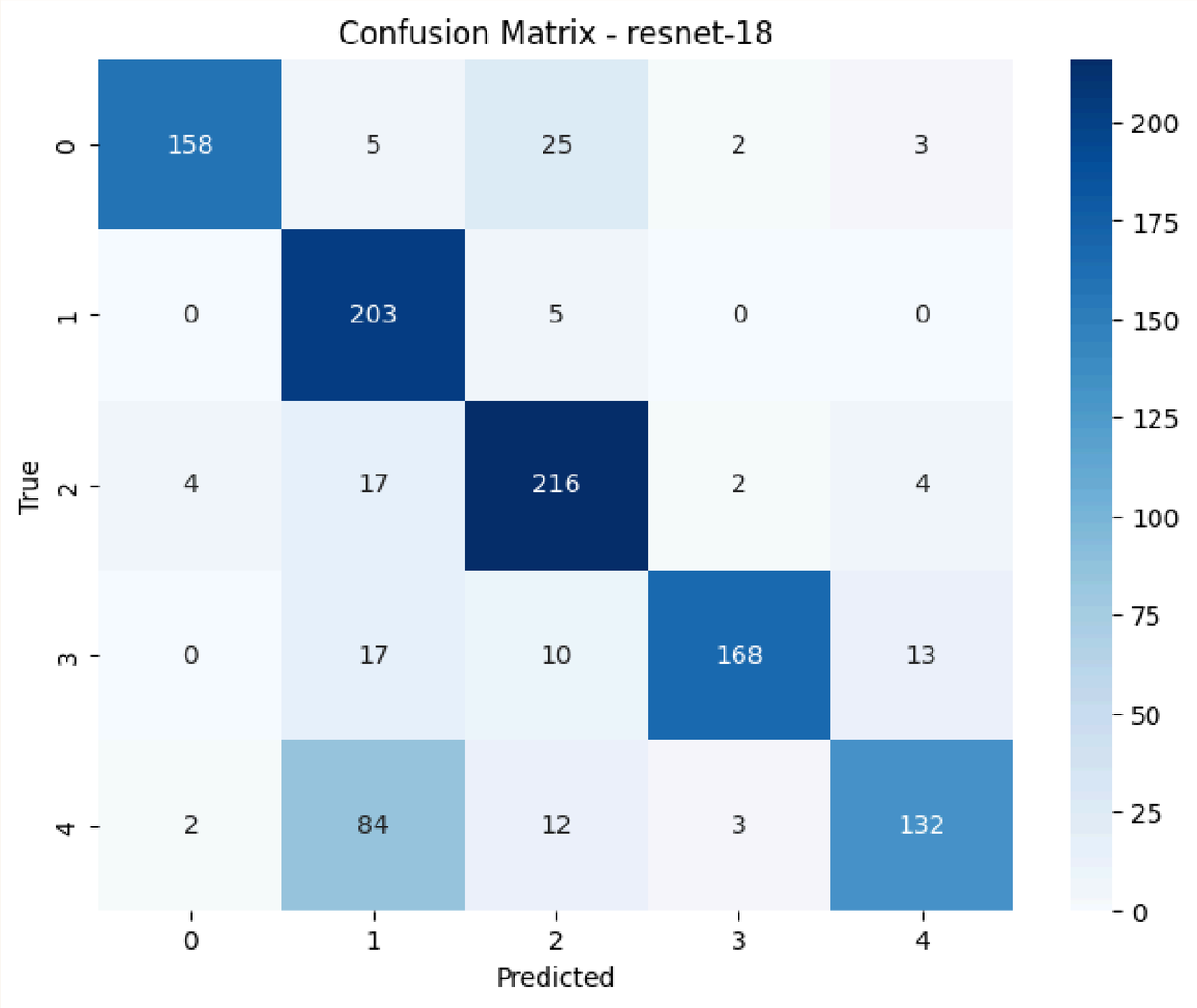
Dense-121

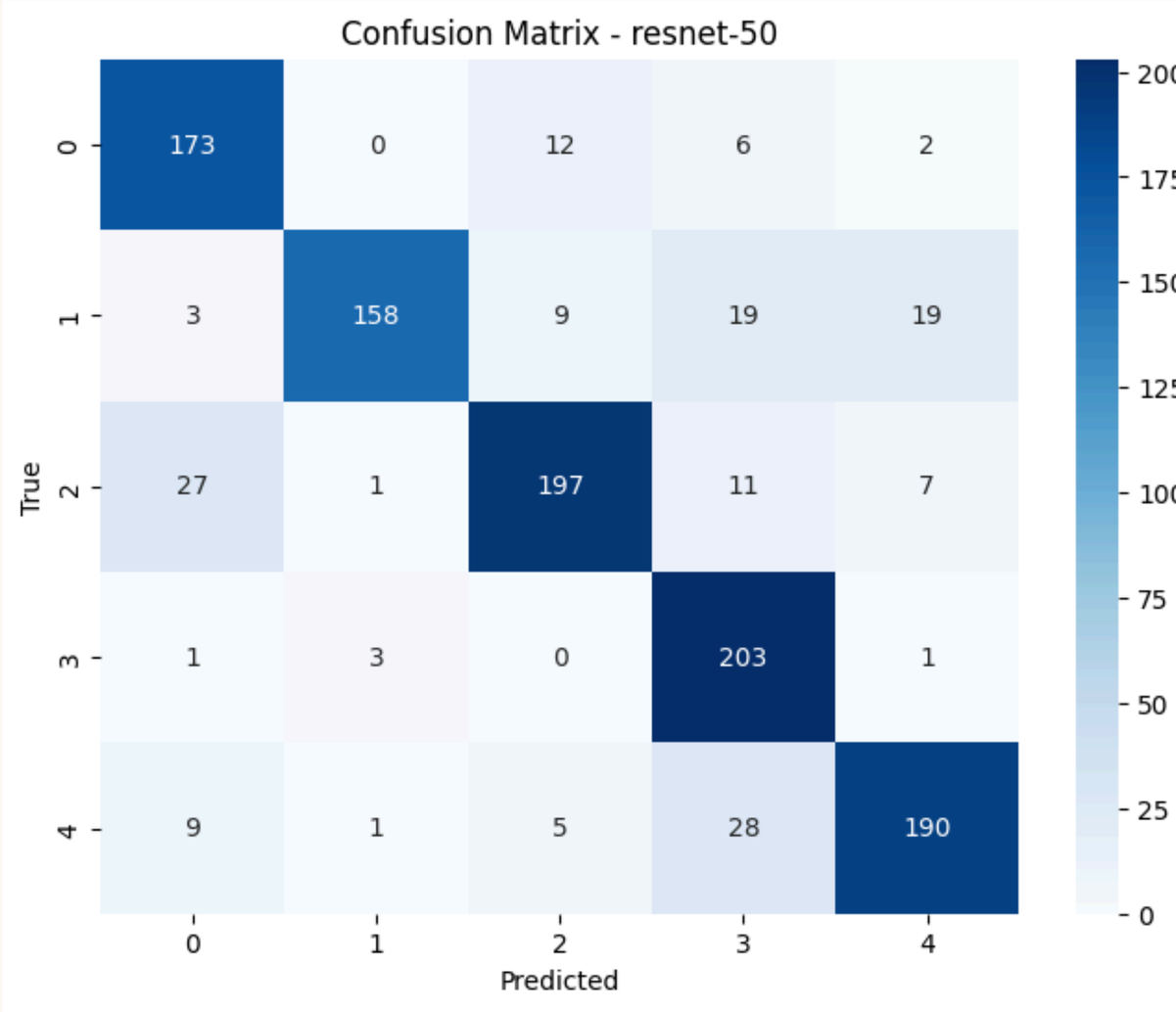


XCeption

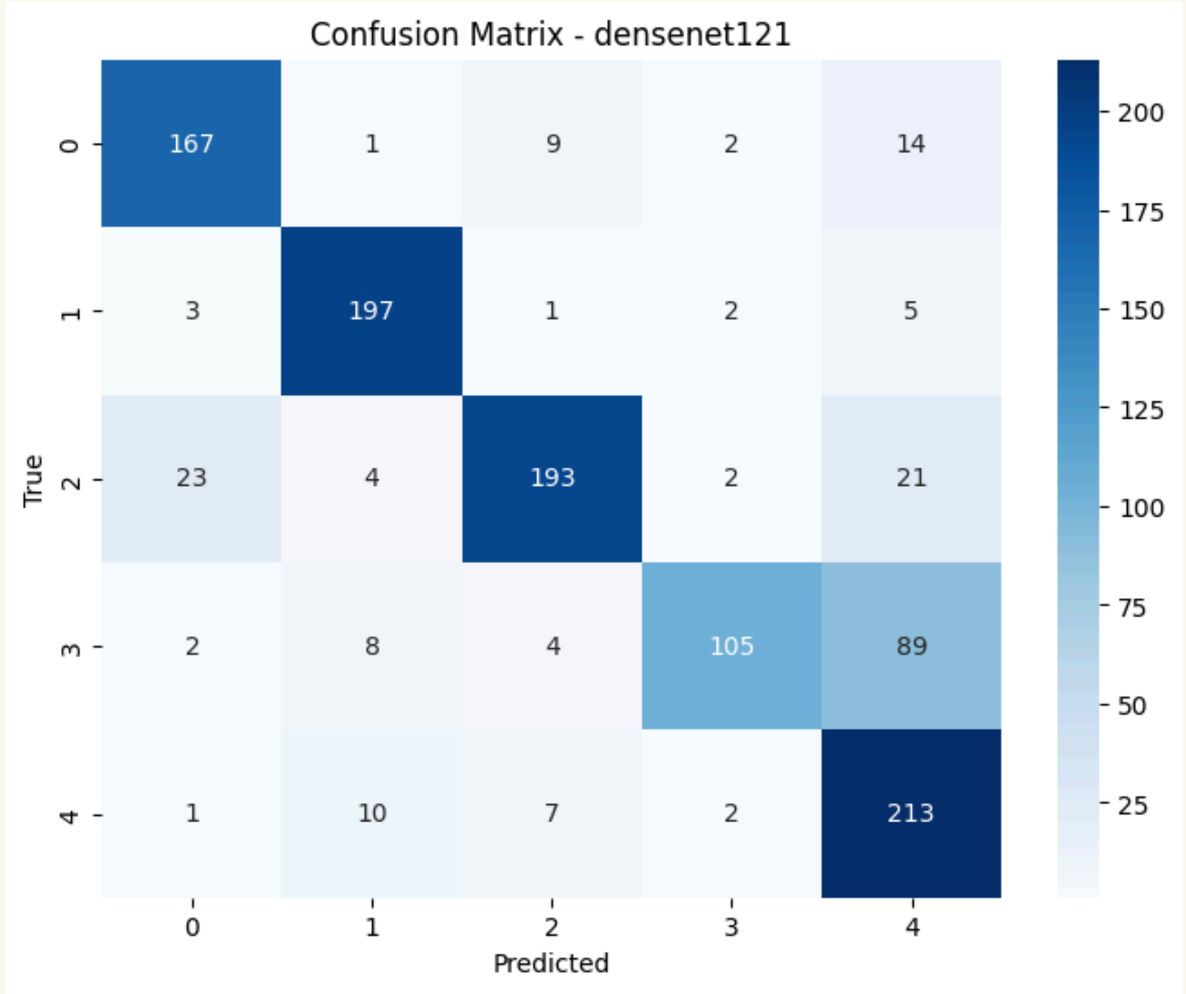


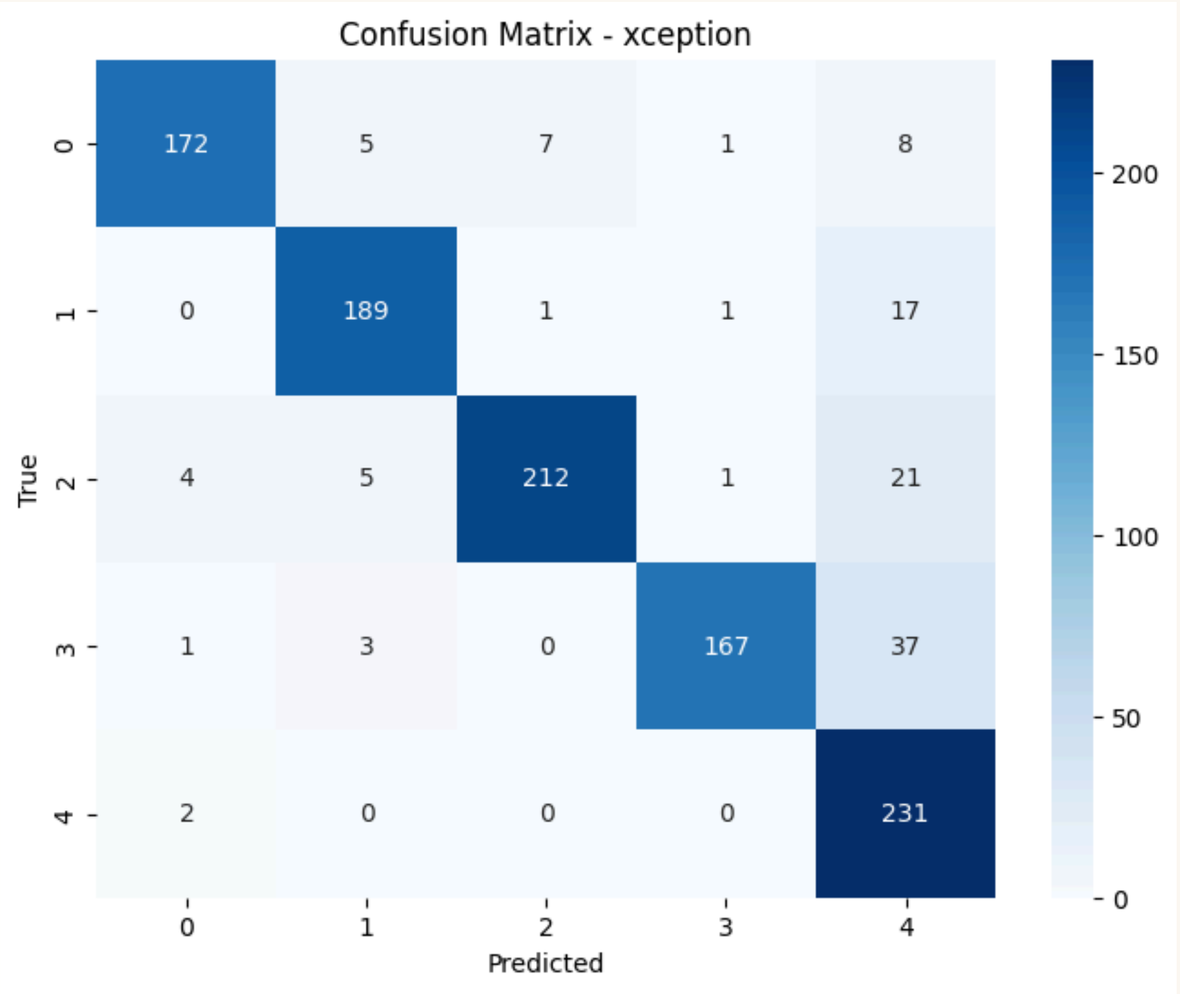
Confusion Matrix





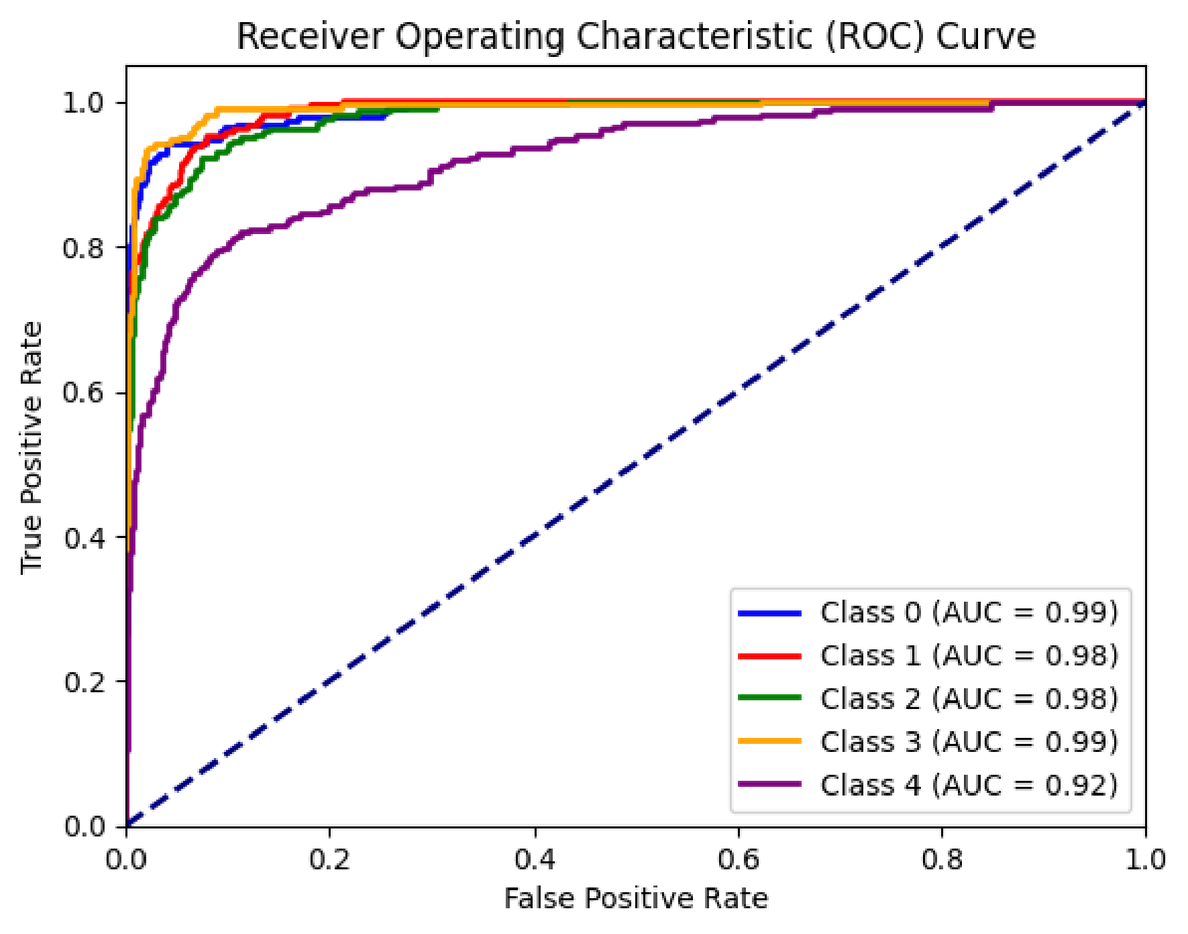
Confusion Matrix



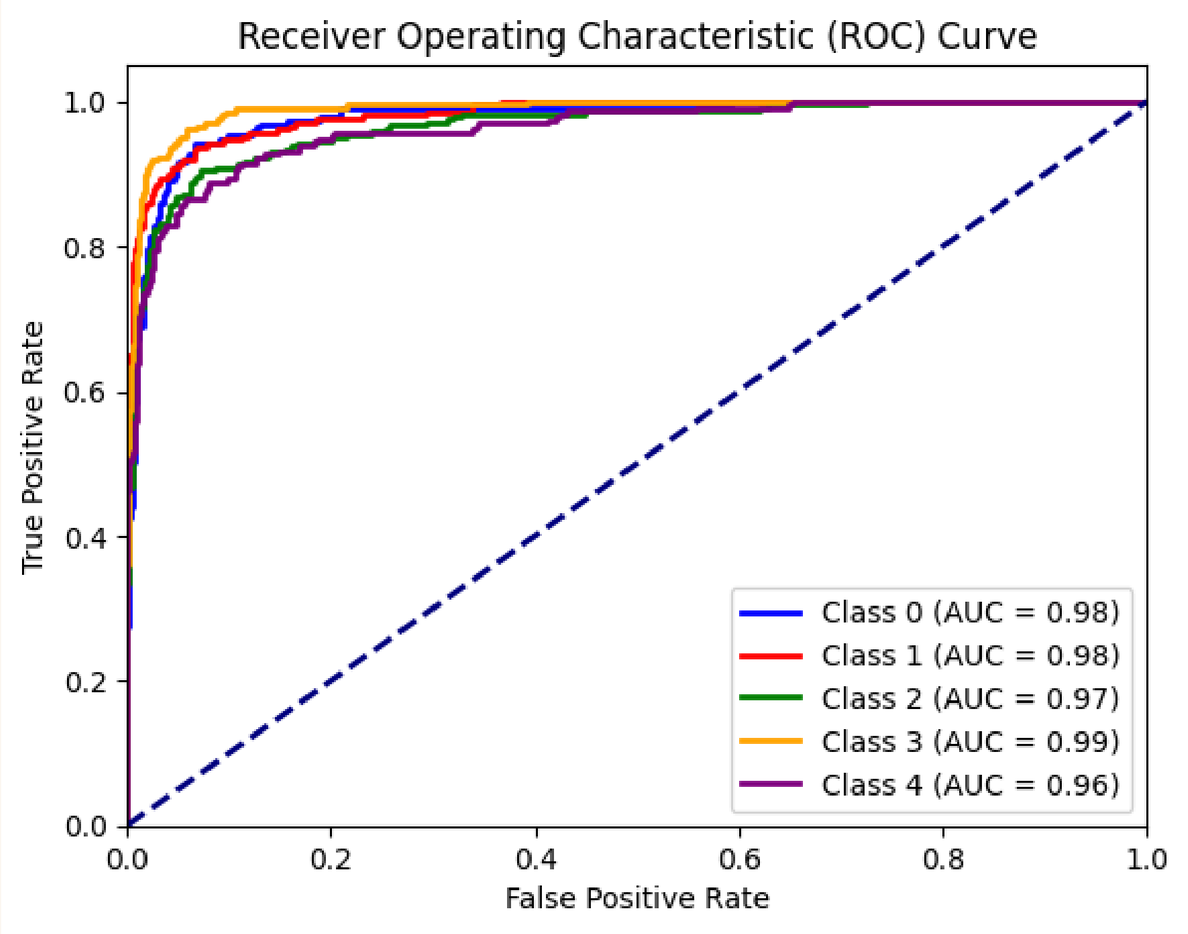


ROC AUC Curve

ResNet-18

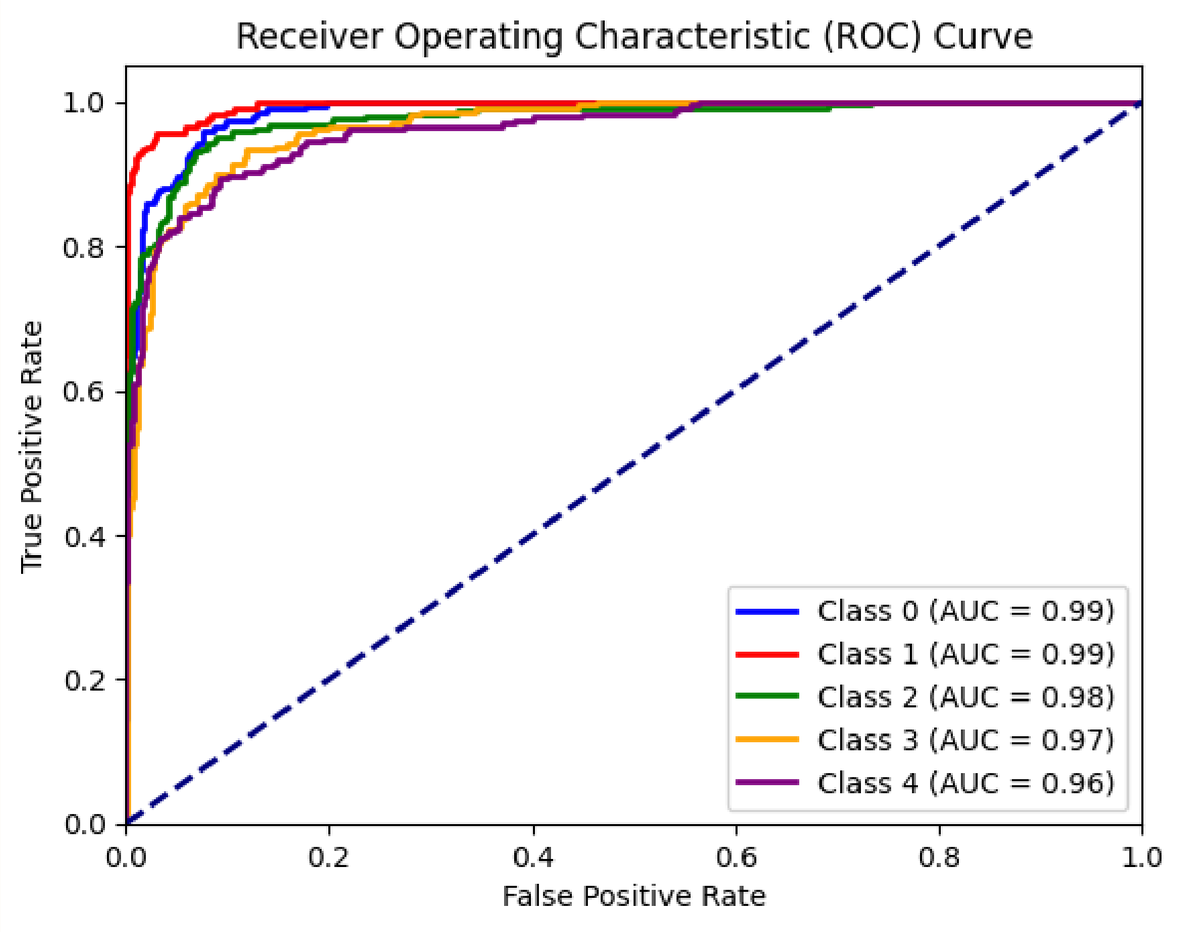


ResNet-50

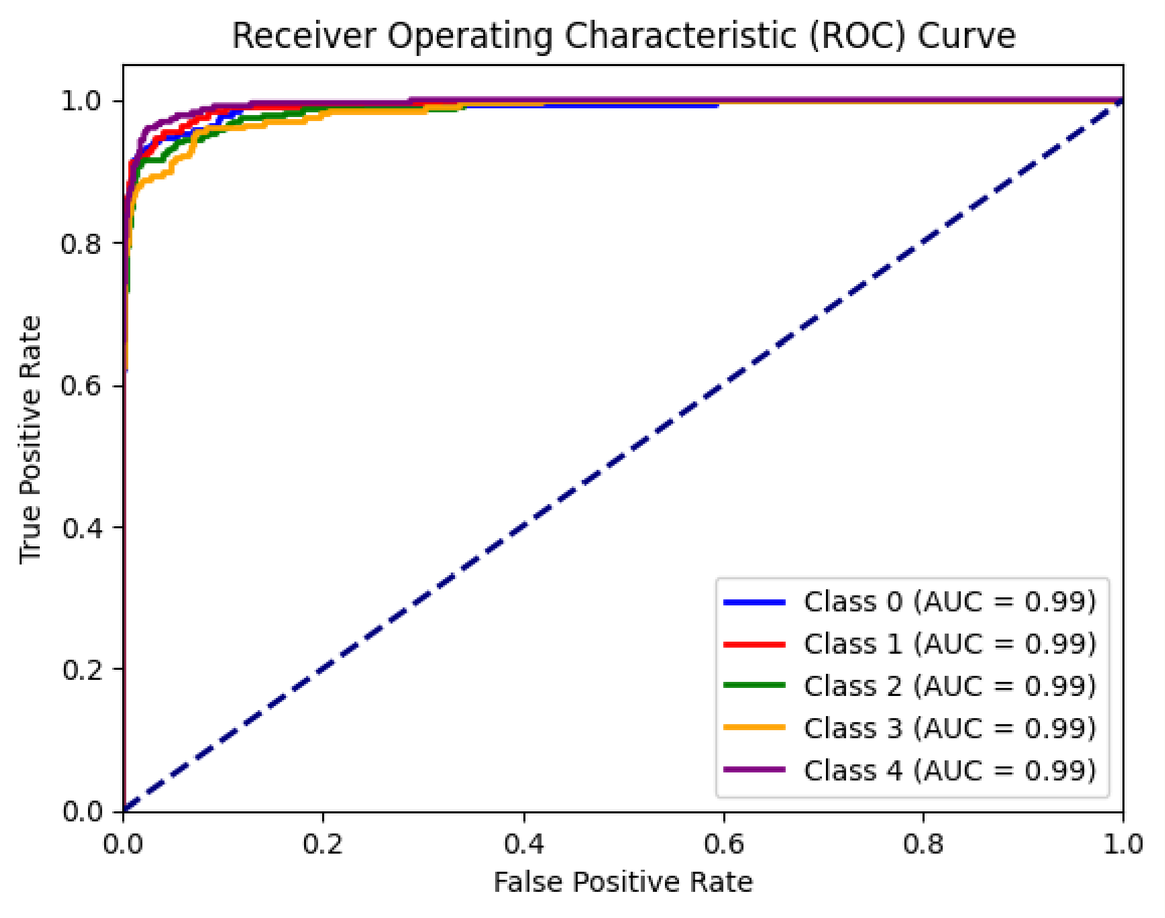


ROC AUC Curve

DenseNet-121



XCeption



References

BirdSong Dataset

DenseNet Paper

ResNet Paper

Pytorch Models Hub

XCeption Paper

Pytorch Docs