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Assignment 1
CAP5516

1) Implementation Details

Data augmentation was used to resize all images to 224×224 pixels, converted to grayscale, and normalized. Additionally to improve the model's generalization, the images were randomly flipped, rotated, and brightness was adjusted. Both the model from scratch and the pre-trained model used ResNet-18 as the backbone. For task 1.1, there are no pretrained weights, weights are initiated randomly, and a custom fully connected layer. For task 1.2, the ResNet weights are used and the last layers of the network are fine-tuned.

Cross Entropy Loss with class weighting was used as the loss function and Adam optimizer with a learning rate of 0.0001. Both models include a dropout layer of 0.5 to reduce overfitting. A smaller batch size of 16, 30 training epochs, and weight decay of 1e-4 were used in both models because the model was overfitting.

2) Loss Curves
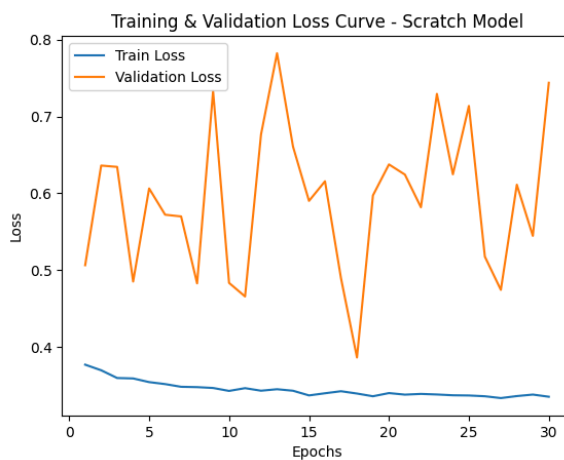
The Validation or Testing Loss fluctuates significantly which means the model may be unstable or overfitting.

Training & Validation Loss Curve - Pretrained Model
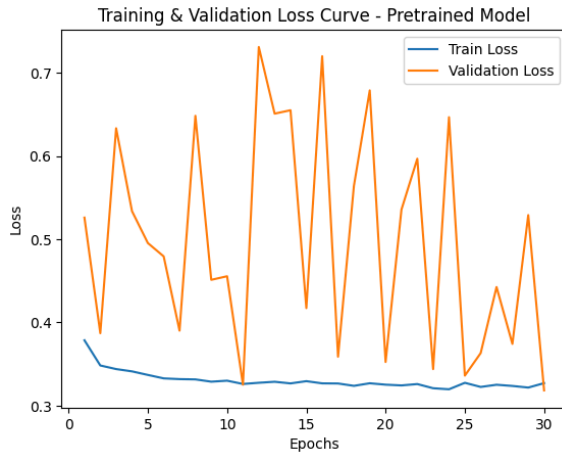
This instability in both datasets may be due to the fact that the validation set is so small with only 16 images, meaning the dataset is imbalanced. The fluctuations in both models also suggest that the model is still overfitting. A stronger regularization method might be necessary for the dataset.

Both models show a slow decrease in training loss which means the model is learning successfully. The pretrained model stabilizes quicker than the model from scratch, which may be due to transfer learning in the pretrained model.

3) Testing Set Classification Accuracy

Model from Scratch:

Overall Test Accuracy	Pneumonia Accuracy	Normal Accuracy
73.40%	99.74%	29.49%

Pretrained Model:

Overall Test Accuracy	Pneumonia Accuracy	Normal Accuracy
81.89%	99.74%	52.14%

The pretrained model performs better than the model from scratch.

4) Failure Cases