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Assignment-2 Report

Task:

To train and test Convolutional Neural Networks for image classification on the CIFAR10 dataset using PyTorch Module.

Data:

Train_images, train_labels, test_images and test_labels

Labels:

Each training and test image is classified into one of 10 catagories

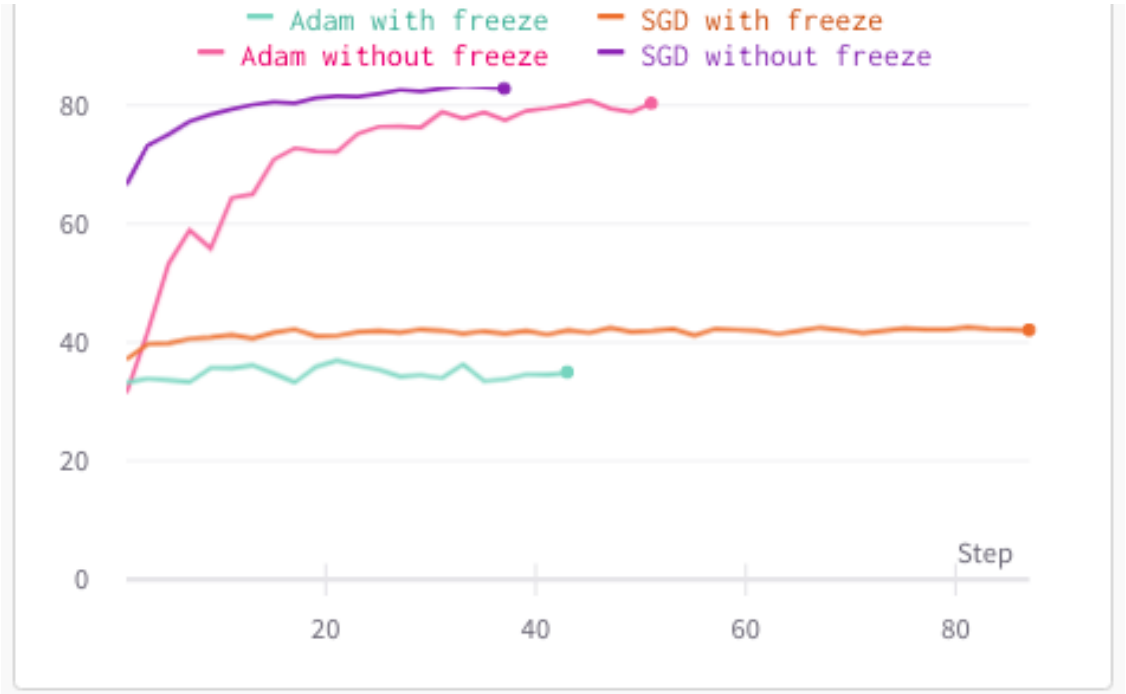
Runs:

This report is generated for the experimental run with the following variations:

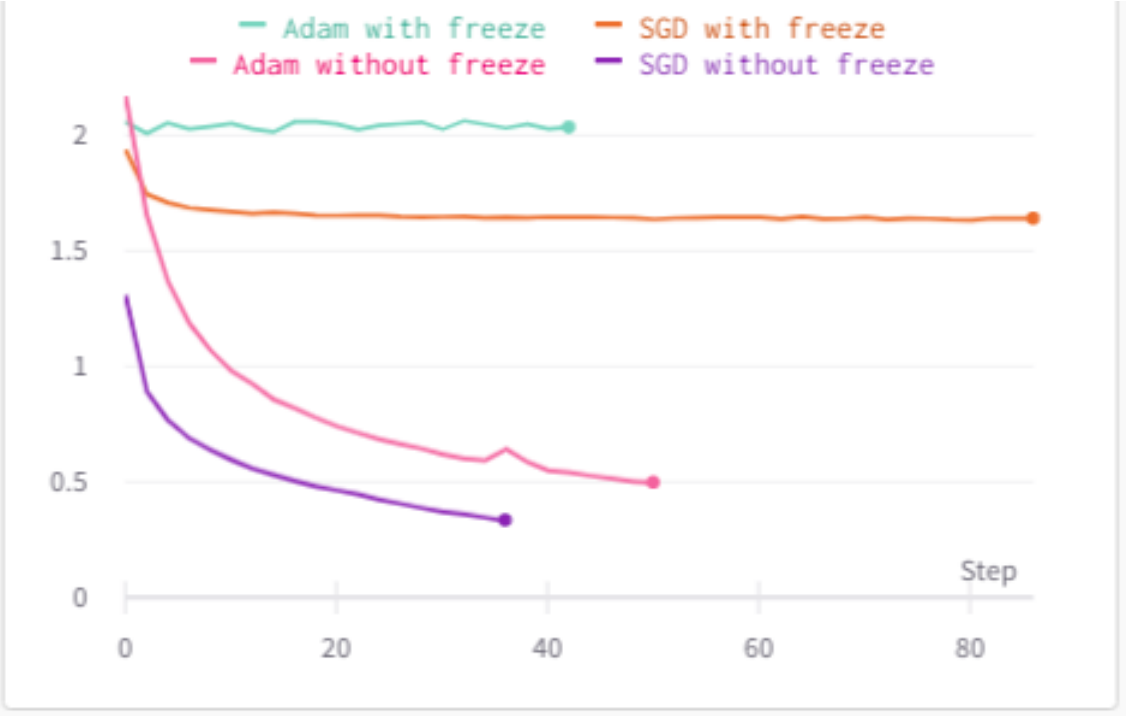
1. SGD without Freeze (lr=0.001, m=0.9)
2. Adam without Freeze (lr=0.001, m=0.9)
3. SGD with Freeze (lr=0.01)
4. Adam with Freeze (lr=0.01)

Plots for Accuracy and Loss

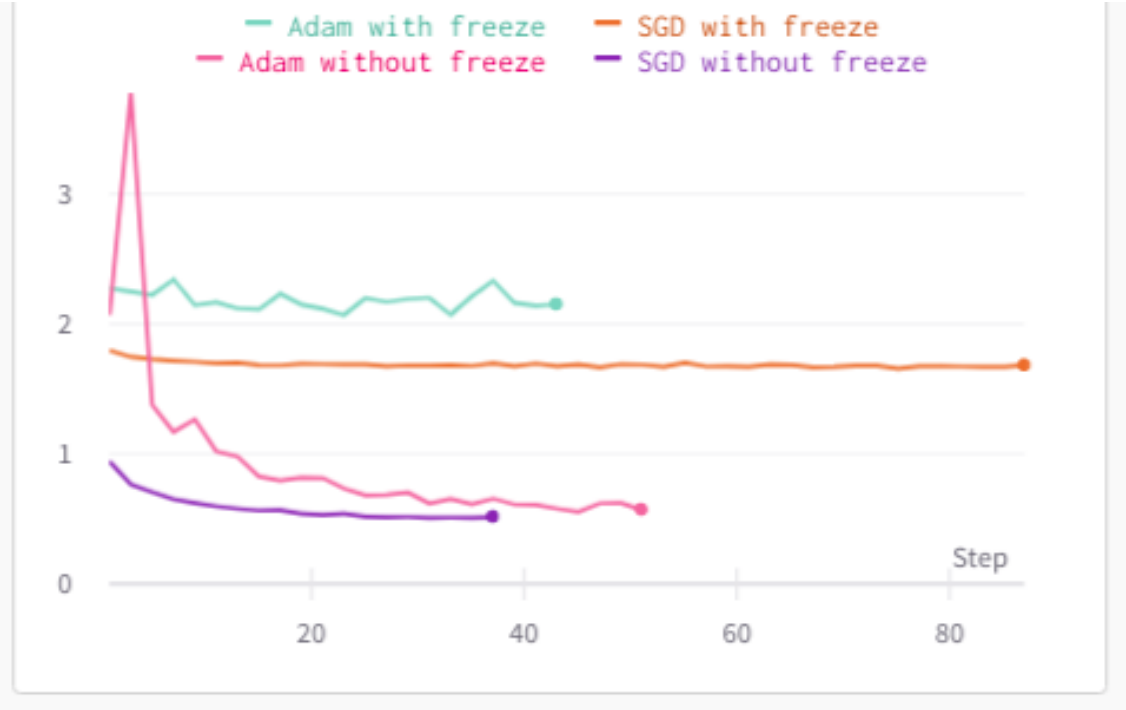
Test Accuracy vs Epochs



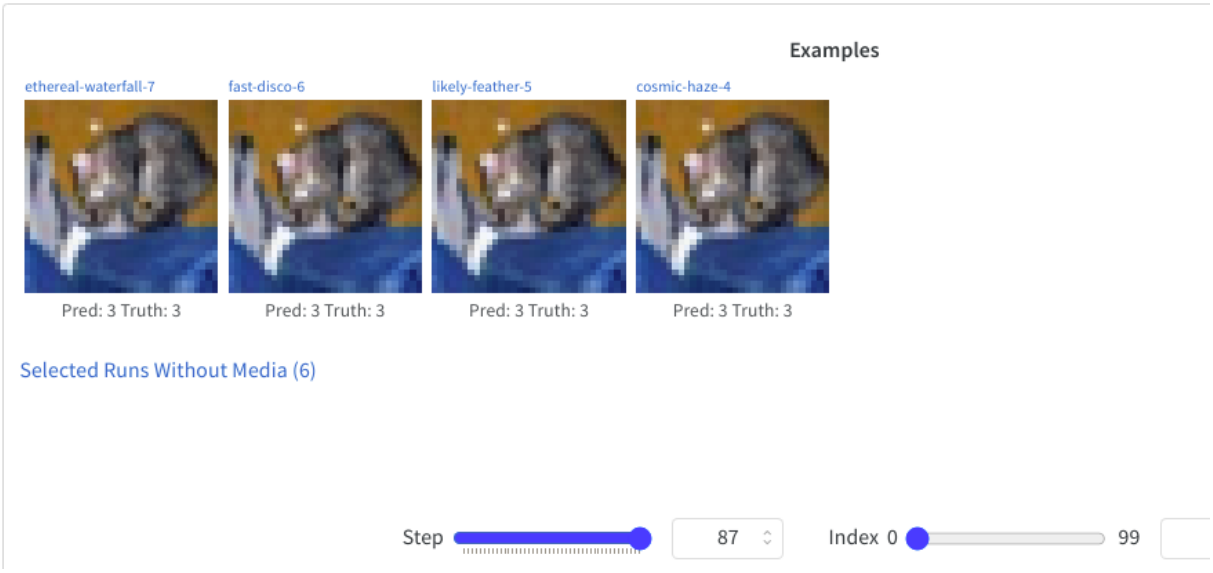
Train Loss vs Epochs



Test Loss vs Epochs



Prediction Samples:

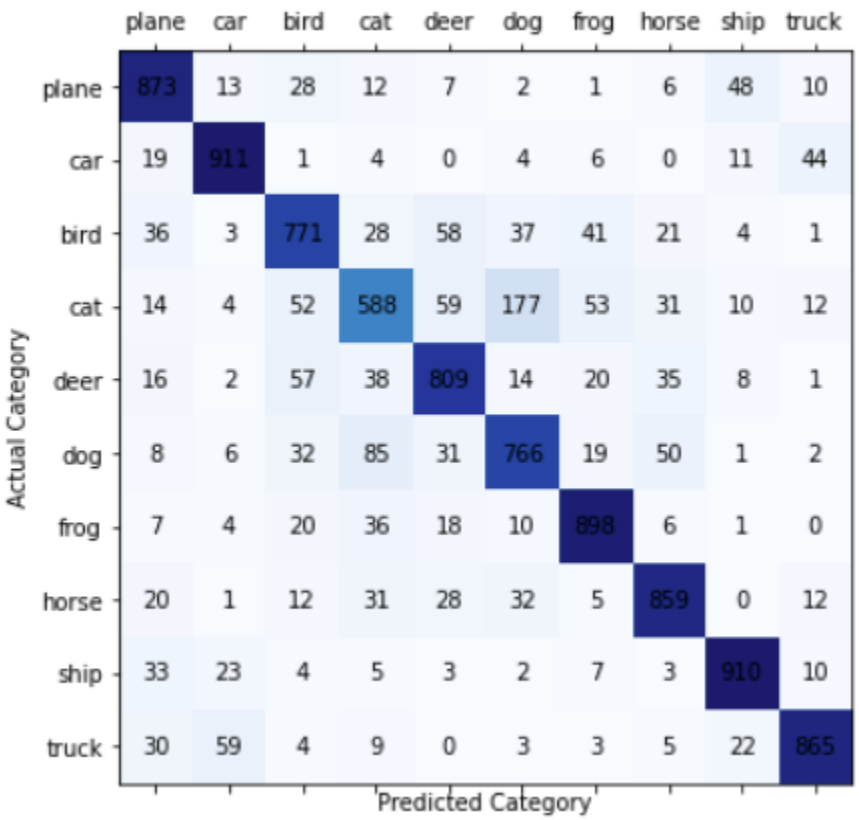


System Resource Utilization:

Confusion Matrices:

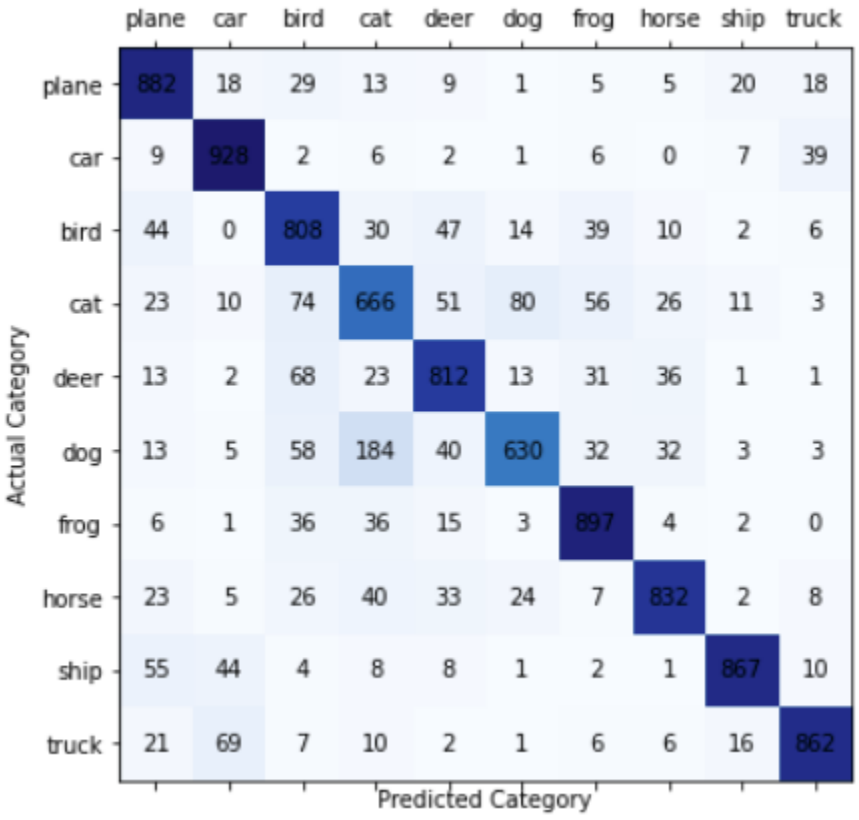
The classes with the best and worst number of correct predictions for each run are indicated below:

1. SGD without Freeze



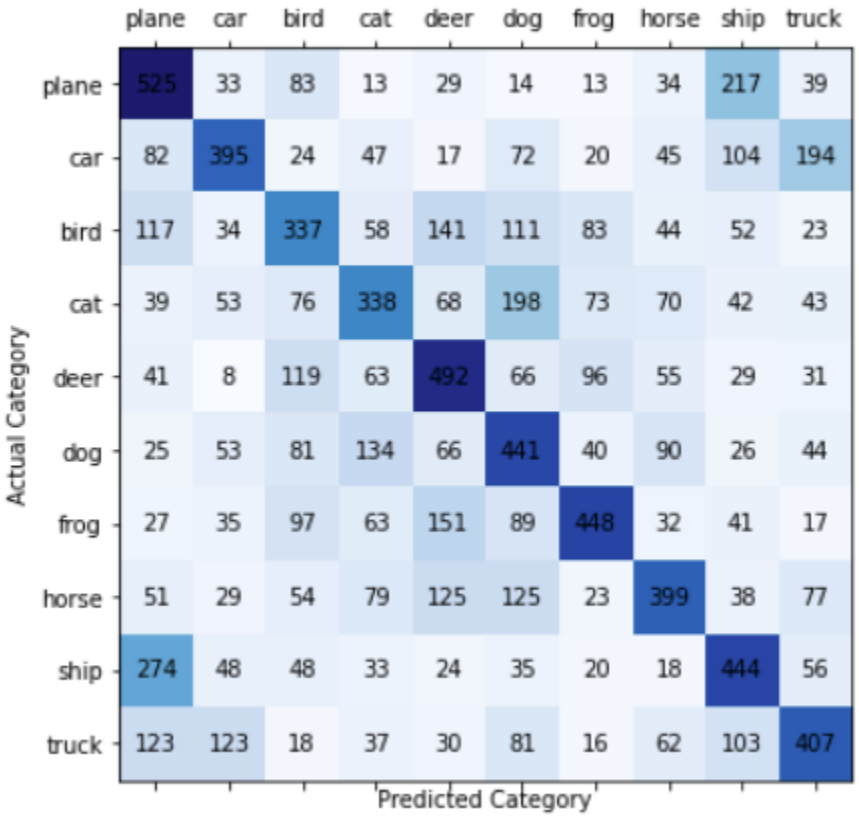
   - Best = Car (911)
   - Worst = Cat (588)

2. Adam without Freeze



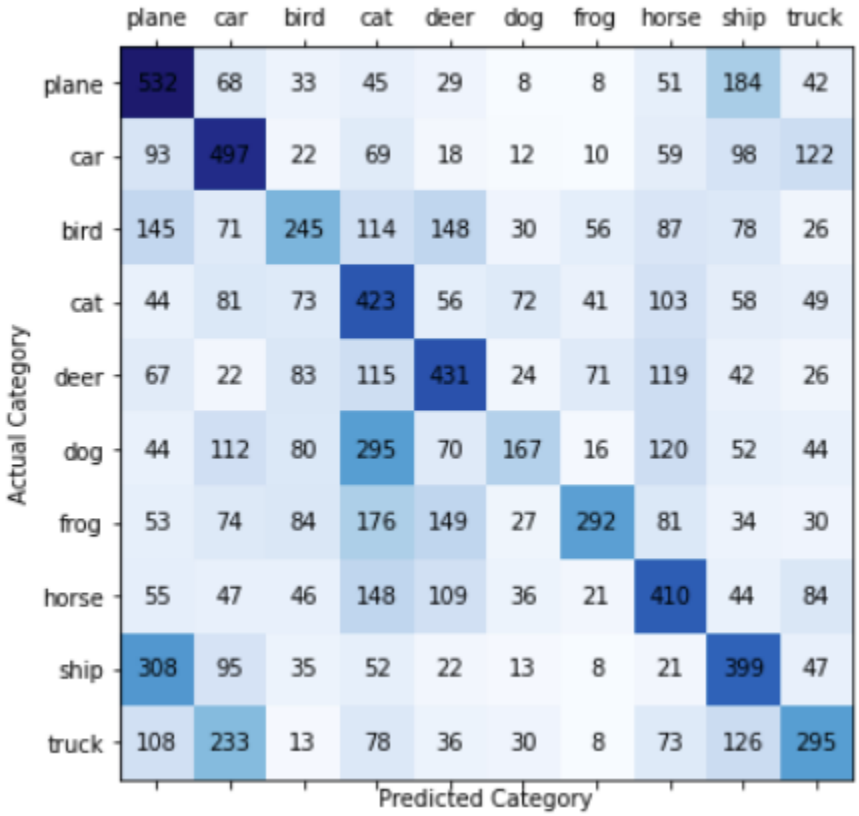
- Best = Car (928)
- Worst = Dog (630)

3. SGD with Freeze



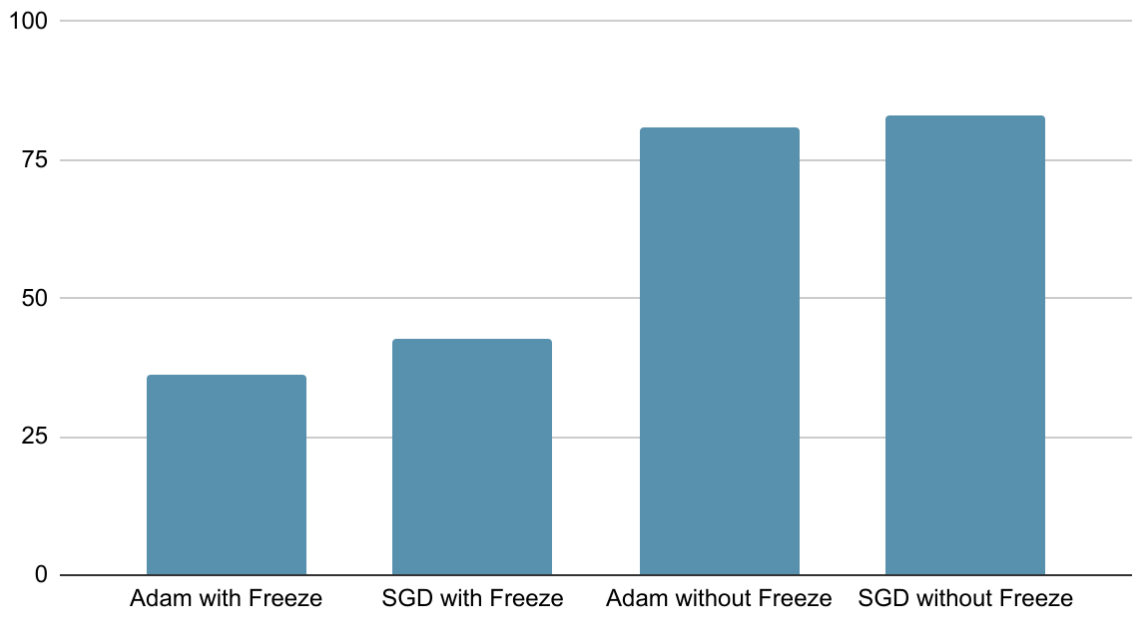
- Best = Plane (525)
- Worst = Bird (337)

4. Adam with Freeze



- Best = Plane (532)
- Worst = Dog (167)

Best accuracy for each variation



Name	Accuracy %
Adam with Freeze	36.35
SGD with Freeze	42.61
Adam without Freeze	80.85
SGD without Freeze	82.86

Observations and reason of different accuracies

Comparison of SGD and Adam :

- It is easy to observe that with number of epochs of training, train loss and test loss is reducing in general for all 4 experiments which means that the model is able to generalize well.
- It can be observed that as a consequence of the decrease in loss, test accuracy increases with more epochs of training and stabilizes after 15-20 epochs.
- The SGD optimizer is able to converge really fast in less no of epochs as compared to the Adam optimizer, also the best test accuracy is highest in the case of SGD optimizer. When all layers are frozen except for the final layer, the test accuracy is significantly lower.

Conclusion:

- It can be inferred that the accuracy with using SGD optimizer is highest as SGD optimizer gives slightly better results than if Adam optimizer is used in this case.
- Also, when all layers are free to be trained, the accuracy reaches about much higher than if only the last layer is free to be finetuned. From this, we concluded that the pre-trained ResNet-18 model is not able to Generalize well with Cifar-10 dataset as all other layers do not carry enough information to classify the sample only using a final linear layer.
- This means that the common 512 features obtained after passing through the fixed pre-trained neural network are very confusing for differentiating between some classes as evident from the confusion matrix

Made from :
https://wandb.ai/akhilchoudhary/SDM_Assignment_2/reports/Assignment-2-Report--VmlldzoxMDM4MzM1