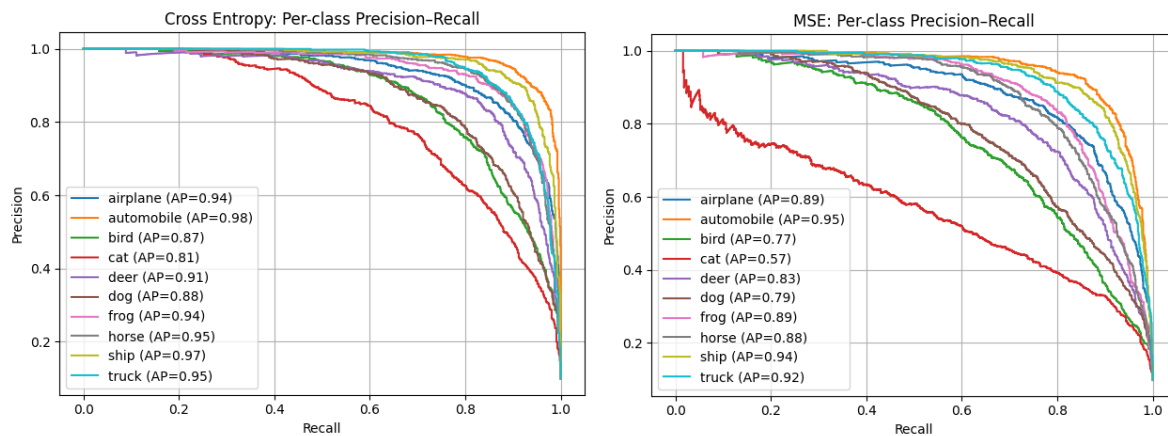Project 2

Machine Perception

John Brooks

For my implementation of the AlexNet architecture to classify to the CIFAR-10 dataset I developed two implementations. The first implementation utilizing Cross Entropy Loss and the second utilizing mean squared error loss. They both utilize stochastic gradient descent as the optimizer. I stuck with a batch size 64 and only trained each run to 20 epochs. Both models baseline setup utilized a learning rate of 0.005, a weight decay of 0.005, and a momentum of 0.9. The cross-entropy model achieved an accuracy of 82.4% on the training data and an 82.12% on the test data. The mean squared error model achieved an accuracy of 75.42% on the training data and a 75.15% on the test data. The training loss as a function of steps is graphed as such for cross-entropy and MSE:
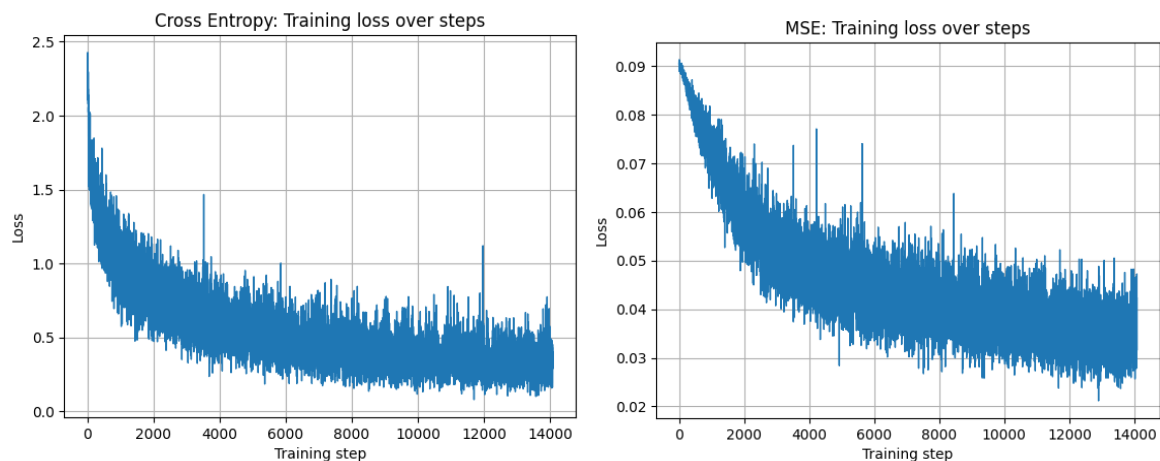
The confusion matrix is shown on the next page for both models:

Cross Entropy: CIFAR-10 Confusion Matrix (Normalized) / MSE: CIFAR-10 Confusion Matrix (Normalized)
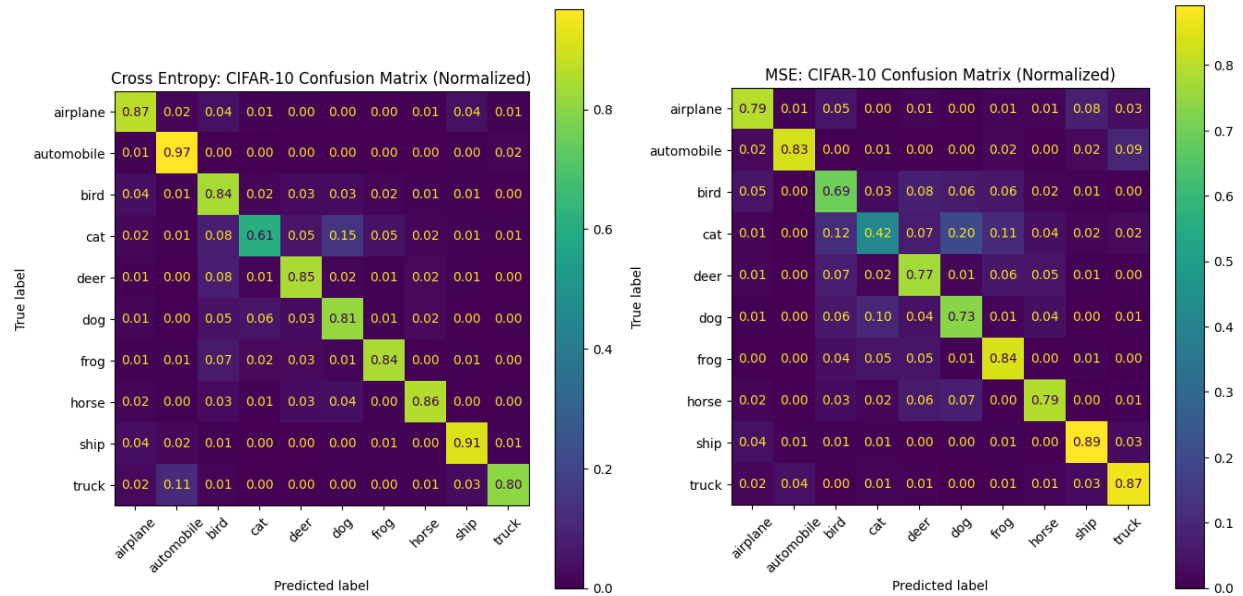
Shown below is the precision recall curve:

Cross Entropy: Per-class Precision–Recall / MSE: Per-class Precision–Recall

As can be seen in the MSE precision recall curve, cat had a very different precision compared to the rest of the classes in the model. Shown on the next page we can see a picture of a puppy that was classified as a dog by both models as well as the top 5 possible predictions the model thought the subject of the image was:

```
Top-1 prediction: dog (0.959)

Top-5 predictions:
dog          0.959
bird         0.022
frog         0.009
deer         0.005
cat          0.005
```

```
Top-1 prediction: dog (0.596)

Top-5 predictions:
dog          0.596
cat          0.149
horse        0.126
bird         0.072
truck        0.019
```

(Cross Entropy) Predicted: dog

(MSE) Predicted: dog

As can be seen in the above images, the cross-entropy model is far more confident that the dog is a dog compared to the MSE model. I also experimented with testing the models on planes which neither classified correctly and tested the models on a pickup truck (which does not exist in the dataset) and both models identified the vehicle as an automobile.