ECGR 5106 Homework 1: Classification and Regression MLPs

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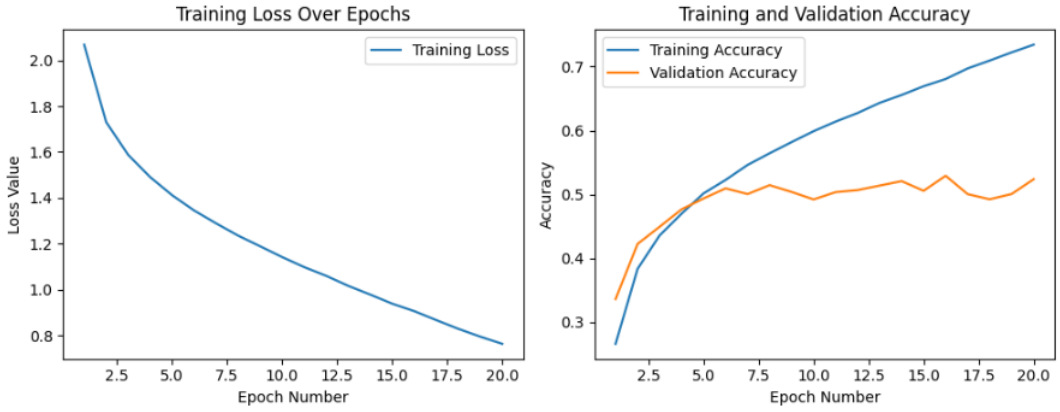
GitHub Link

Click here to view the code

Problem 1a.

CIFAR-10 Classification Training Results:
It appears that the model needed more epochs for a full training. Overfitting can be seen as the validation and training accuracies diverge with more epochs. The final training loss was found to be 0.7644303460483965. The training loss, training accuracy, and validation accuracy plots can be seen below in Figure 1.

Figure 1: Training Loss + Accuracy and Validation Accuracy

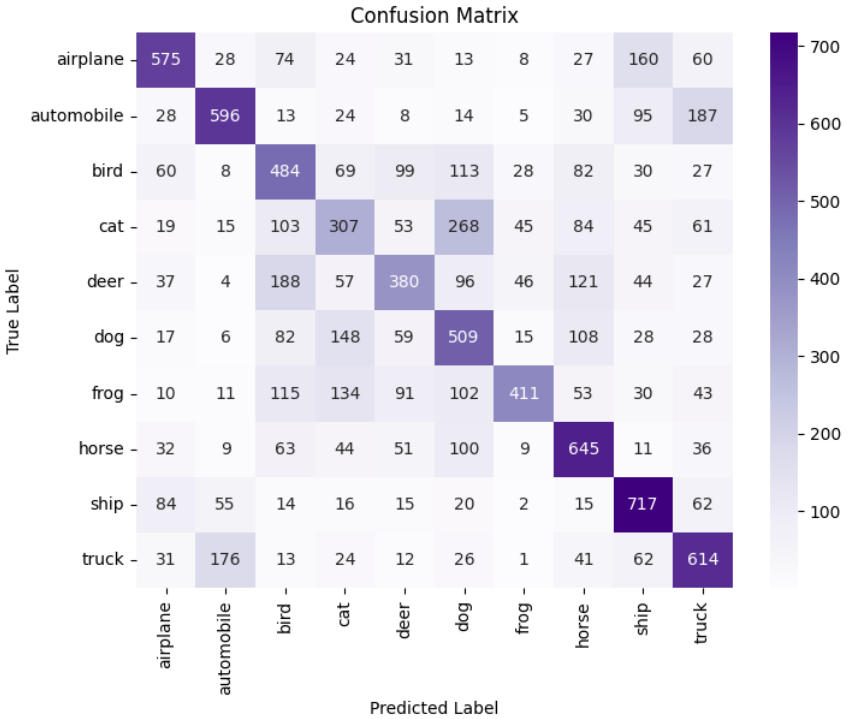


The precision, recall, F1 score, and confusion matrix can be seen in Figures 2 and 3 below:

Figure 2: CIFAR-10 Precision, Recall, and F1 Scores

	precision	recall	f1-score	support
0	0.64	0.57	0.61	1000
1	0.66	0.60	0.62	1000
2	0.42	0.48	0.45	1000
3	0.36	0.31	0.33	1000
4	0.48	0.38	0.42	1000
5	0.40	0.51	0.45	1000
6	0.72	0.41	0.52	1000
7	0.53	0.65	0.58	1000
8	0.59	0.72	0.65	1000
9	0.54	0.61	0.57	1000
accuracy			0.52	10000
macro avg	0.53	0.52	0.52	10000
weighted avg	0.53	0.52	0.52	10000

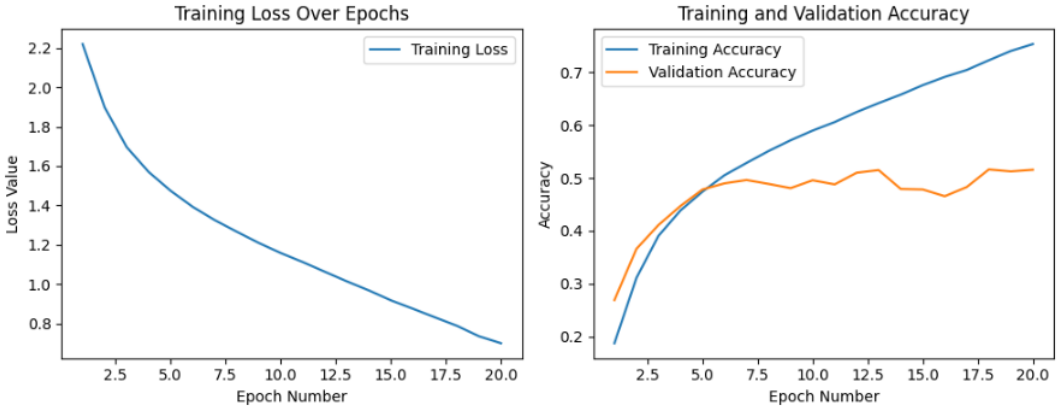
Figure 3: CIFAR-10 Confusion Matrix



Problem 1b.

Expanded CIFAR-10 Classification Training Results:
Overfitting is still present in the wider and deeper model, but there was a better reported loss, accuracy, and overall F1 scores for the majority of classes. This shows that increasing the complexity of a model has improved results. The final training loss was found to be 0.6996427907053467. The training loss, training accuracy, and validation accuracy plots can be seen below in Figure 4.

Figure 4: CIFAR-10 Confusion Matrix



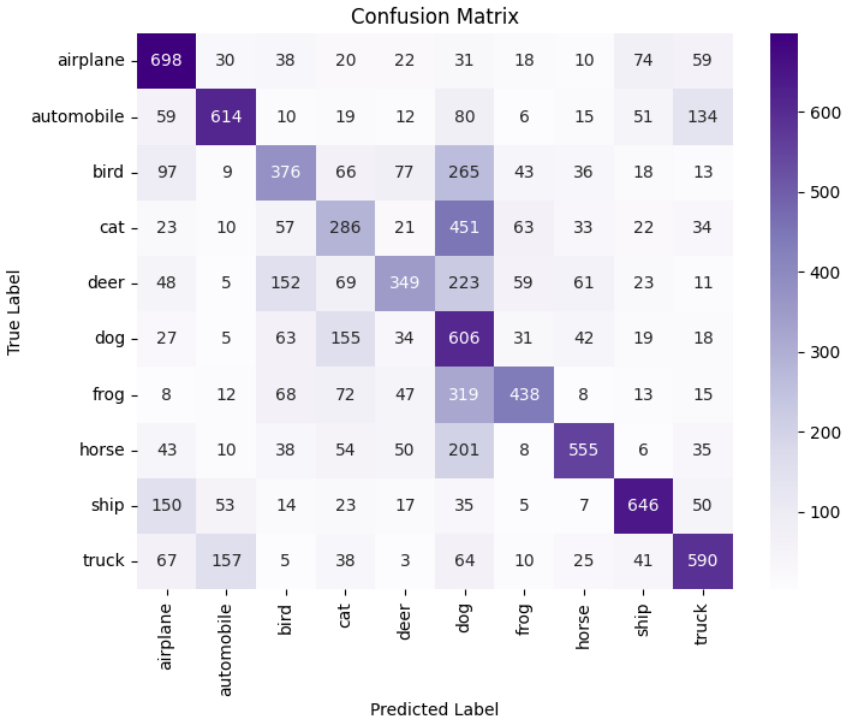
The precision, recall, F1 score, and confusion matrix can be seen in Figures 5 and 6 below:

Figure 5: CIFAR-10 Confusion Matrix

Epoch Number

	precision	recall	f1-score	support
0	0.57	0.70	0.63	1000
1	0.68	0.61	0.64	1000
2	0.46	0.38	0.41	1000
3	0.36	0.29	0.32	1000
4	0.55	0.35	0.43	1000
5	0.27	0.61	0.37	1000
6	0.64	0.44	0.52	1000
7	0.70	0.56	0.62	1000
8	0.71	0.65	0.68	1000
9	0.62	0.59	0.60	1000
accuracy			0.52	10000
macro avg	0.56	0.52	0.52	10000
weighted avg	0.56	0.52	0.52	10000

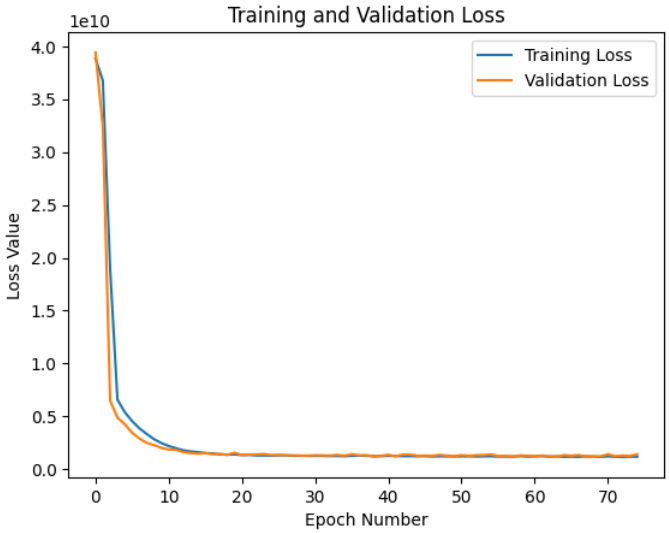
Figure 6: CIFAR-10 Confusion Matrix



Problem 2a.

Housing Regression Training Results:
The final accuracy according to root mean squared error was reported to be 37666.9640364873. The final training loss was 1188941950.9041095 and the final validation loss was 1418800179.7260275. The first layer had 248 outputs, the second had 64 outputs, and the third had 8 outputs. The training and validation losses can be seen in Figure 7 below:

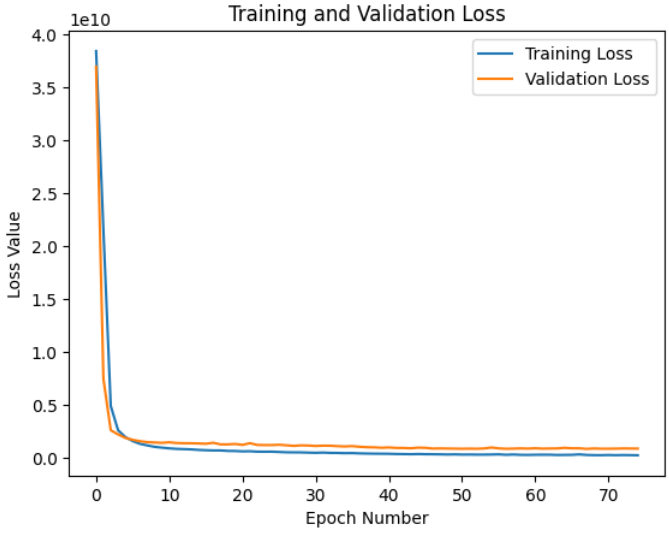
Figure 7: Housing Training and Validation Losses



Problem 2b.

Hot-Encoding Housing Regression Training Results:
The final accuracy according to root mean squared error was reported to be 29431.532367164506. The final training loss was 233502416.43835616 and the final validation loss was 866215097.479452. The first layer had 248 outputs, the second had 64 outputs, and the third had 8 outputs. In adding the hot encoding, the losses actually appeared to diverge more. The training and validation losses can be seen in Figure 8 below:

Figure 8: Housing Training and Validation Losses



Problem 2c.

Expanded Hot-Encoding Housing Regression Training Results:
The final accuracy according to root mean squared error was reported to be 30844.105300378254. The final training loss was 247015451.61643836 and the final validation loss was 951358831.7808219. In adding complexity to the hot encoding, the losses actually appeared to diverge more and the loss values got worse. The training and validation losses can be seen in Figure 9 below:

Figure 9: Housing Training and Validation Losses