Report assignment 1 IN4310

Task 1:

Figures 1, 2 and 3 show the accuracy per class and the average precision per class, in addition to the mean over all classes of both measures, for the 3 models I trained.

I chose to out 3 different optimizers for this task. The first model was trained using the AdamW optimizer, the second one was trained using RMSprop, while the third model was trained using SGD. I compared the three models only based on mean accuracy over all classes and chose the best one based on this comparison. From the figures below, we can see that the mean accuracy over all classes is the highest for model 3, so this is the chosen model.

Figure 4 shows the accuracy and average precision on the test set for the chosen model.

```
Statistics for model 1:

Accuracy for class 1: 0.9956803455723542
Accuracy for class 2: 0.9834368530020704
Accuracy for class 3: 0.7581573896353166
Accuracy for class 4: 0.8859813084112149
Accuracy for class 5: 1.0
Accuracy for class 6: 0.6496062992125984
Mean accuracy over all classes: 0.8788103659722589

The average precision score for class 1: 0.9577104520041604
The average precision score for class 2: 0.9962720224867331
The average precision score for class 3: 0.9797002290443428
The average precision score for class 4: 0.9656868370465815
The average precision score for class 5: 0.9877526696303933
The average precision score for class 6: 0.9608396842393069
The average precision score for all classes: 0.9746603157419198
```

Figure 1

```
Statistics for model 2:

Accuracy for class 1: 0.980561555075594
Accuracy for class 2: 0.9958592132505176
Accuracy for class 3: 0.982725527831094
Accuracy for class 4: 0.9252336448598131
Accuracy for class 5: 1.0
Accuracy for class 6: 0.9940944881889764
Mean accuracy over all classes: 0.9797457382009993

The average precision score for class 1: 0.9945697529579808
The average precision score for class 2: 0.9999110655568262
The average precision score for class 3: 0.983103946418224
The average precision score for class 4: 0.9836413229977485
The average precision score for class 5: 0.9932238676630434
The average precision score for class 6: 0.9978758233047025
The average precision score for all classes: 0.9920542964830875
```

Figure 2

```
Statistics for model 3:

Accuracy for class 1: 0.9935205183585313
Accuracy for class 2: 0.9917184265010351
Accuracy for class 3: 0.9865642994241842
Accuracy for class 4: 0.9850467289719627
Accuracy for class 5: 0.9918367346938776
Accuracy for class 6: 0.9960629921259843
Mean accuracy over all classes: 0.9907916166792625

The average precision score for class 1: 0.9970679228606655
The average precision score for class 2: 0.999191907957625
The average precision score for class 3: 0.9902919706694789
The average precision score for class 4: 0.9769151207892628
The average precision score for class 5: 0.9981818581799653
The average precision score for class 6: 0.9975894031087318
The average precision score for all classes: 0.9932063639276215
```

Figure 3

```
Accuracy for class 1: 0.9892008639308856
Accuracy for class 2: 0.9917184265010351
Accuracy for class 3: 0.9769673704414588
Accuracy for class 4: 0.983177570093458
Accuracy for class 5: 0.9918367346938776
Accuracy for class 6: 0.9960629921259843
Mean accuracy over all classes: 0.9881606596311165

The average precision score for class 1: 0.9952247040221762
The average precision score for class 2: 0.9992301432969604
The average precision score for class 3: 0.9896451458963992
The average precision score for class 4: 0.975524263218086
The average precision score for class 5: 0.9980857931994234
The average precision score for class 6: 0.9979733187949894
The average precision score for all classes: 0.9926138947380058
```

Figure 4

Figure 5 shows the loss curves for the training and validation sets over 20 epochs for the best model.

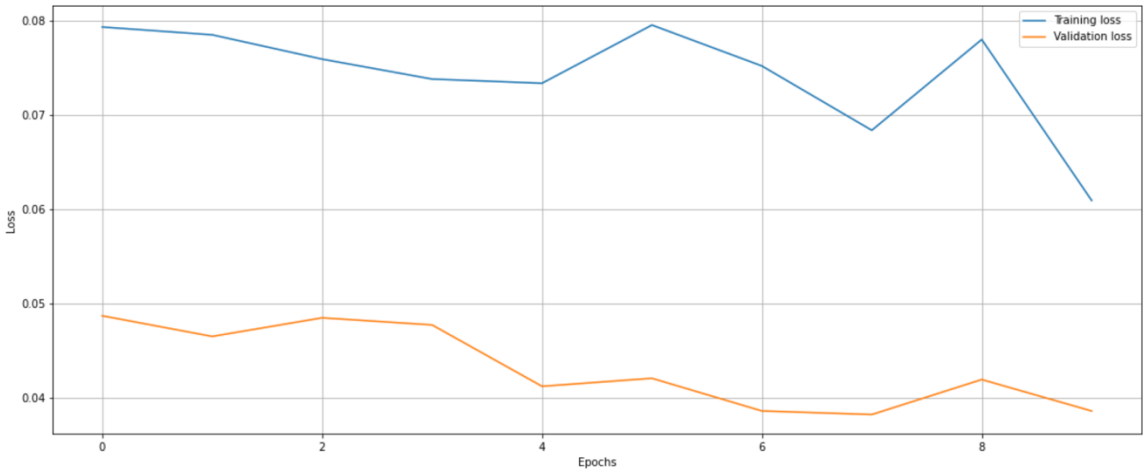

Figure 5

Figure 6 shows the mean class-wise accuracy for each of the 20 epochs for the best model. I understood the mean class-wise accuracy to be the mean accuracy over all classes for one epoch, which is what is plotted below.

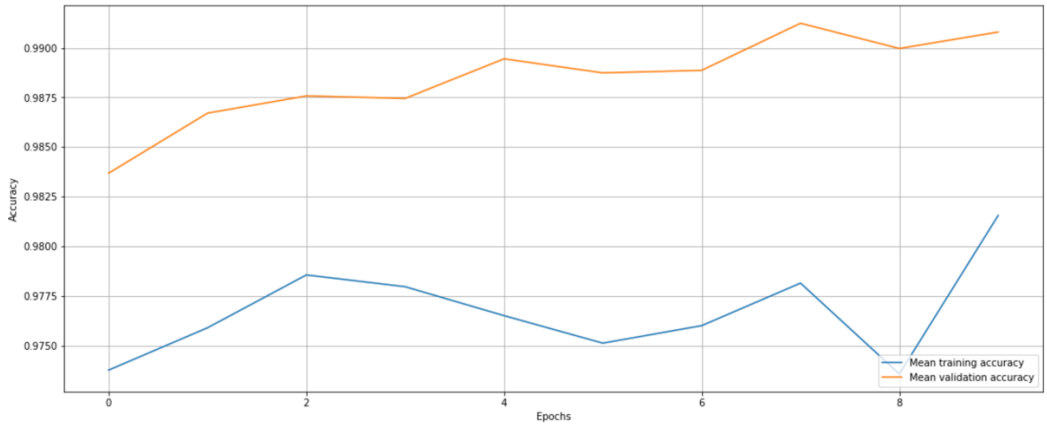

Figure 6

Figure 7 shows the top 10 classified images and the bottom 10 images for 3 chosen classes: glacier, mountains, and sea.

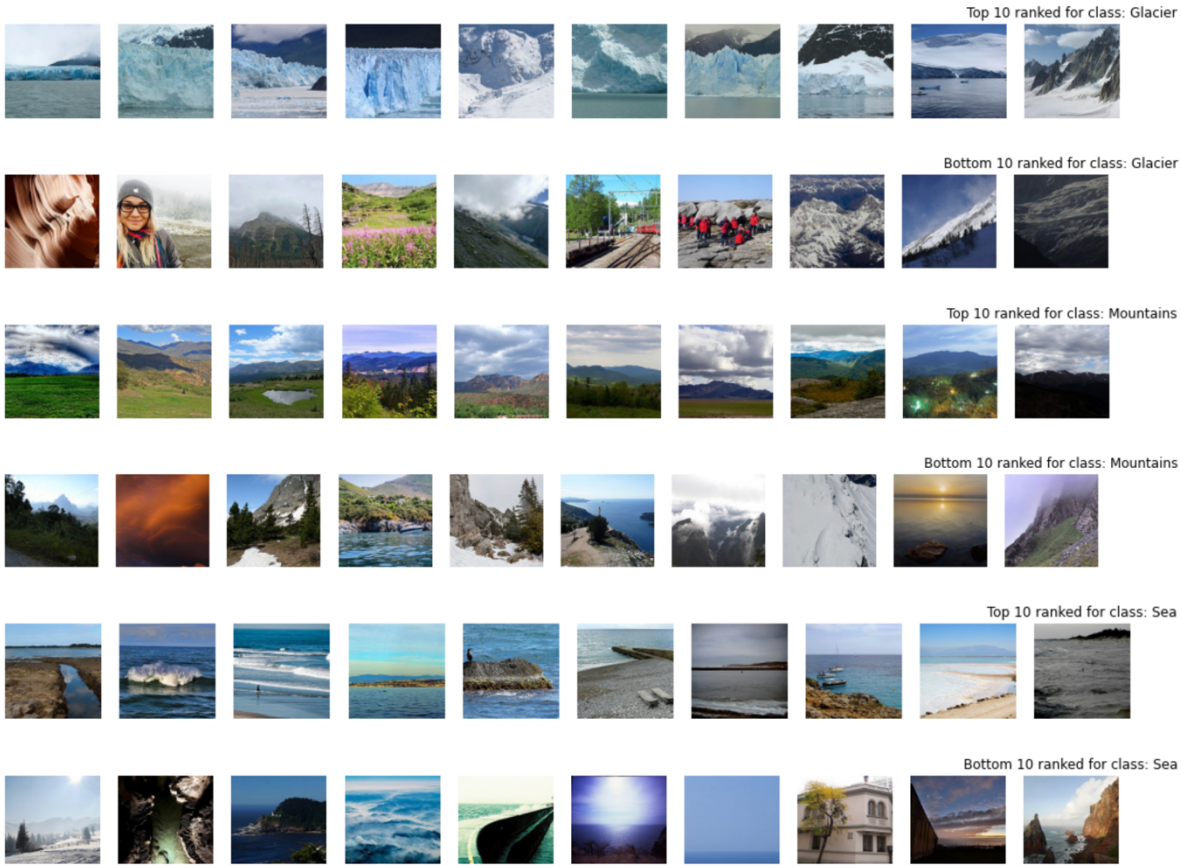

Figure 7

Task 2:

Figure 8 shows the percentage of non-positive values averaged over all channels and special elements.

```
Convolutional layer – percentage
conv1 – 47.0
layer1.1.conv1 – 65.2
layer2.1.conv1 – 69.0
layer3.1.conv1 – 63.9
layer4.1.conv1 – 74.3
```

Figure 8

Task 3:

Figures 9, 10 and 11 show the 15 first eigenvalues of the empirical covariance matrices that were computed on the feature maps for 5 modules in the ResNet18 model. Each figure shows the run on a different dataset, where our dataset was used to get the results in figure 9, the imagenet dataset for figure 10 and CIFAR10 dataset for figure 11.

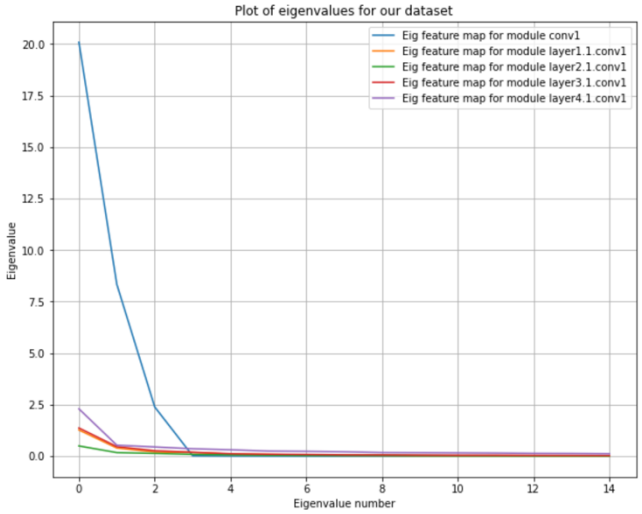

Figure 9

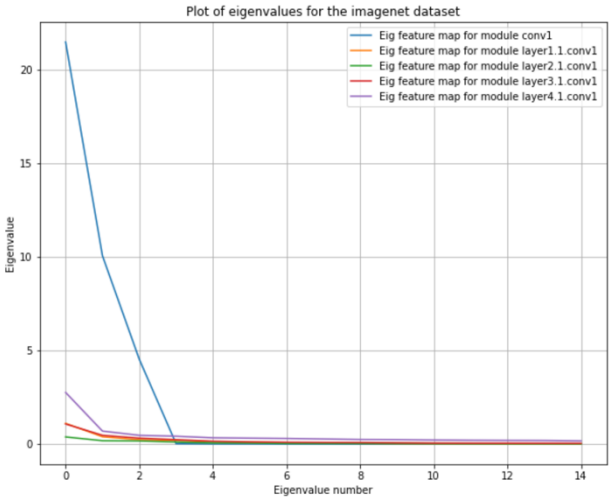

Figure 10

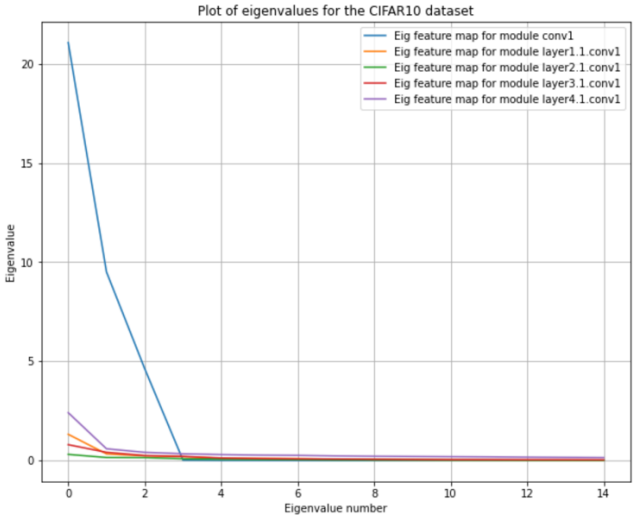

Figure 11