Assignment 3

Advanced Machine learning – Cats and Dogs

Problem statement:

To examine the relationship between training samples and the choice of training your model from scratch, versus using a pretrained convnet. Specifically, answer the questions provided in the assignment.

Dataset:

The dataset here used consists of around 24000 images of cats and dogs from Kaggle as instructed in class.

Analysis:

Our goal is to observe the accuracy with which the model will identify cats and dogs successfully by training.

For this case here 9000 images of cats and 9000 images of dogs, a total of 18000 images were taken from the original 24000 images.

The dataset is named **DCdataset**.

The model is trained from scratch and performance is optimized using the optimizer techniques Adam and Adagrad.

A pretrained model of Inceptionv3 is also used.

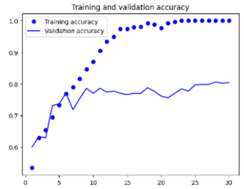
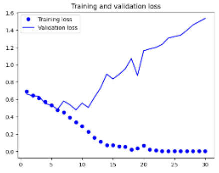
The overfitting issue is solved by using the augmentation method.

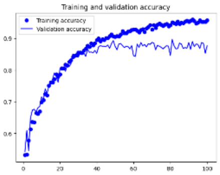
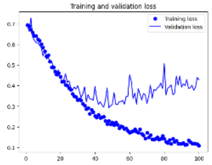
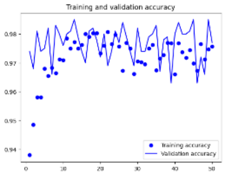
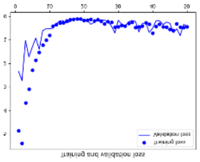
Observations:

Case 1:

Here initially we used a training sample of 1000, a validation sample of 500, and a test sample of 500. We used the technique of augmentation to reduce overfitting and to improve performance optimizer Adam is used in developing this network to train from scratch.

Finally, the model also trained with the pretrained model of Inceptionv3 to measure the performance of model.

Cases	Train loss	Train Accuracy	Test Accuracy	Validation Accuracy	Validation loss	Train and validation accuracy	Train and validation loss	Result
Initial Model Augmentation: NO Optimizer: No	0.5924	0.7470	0.747	0.8040	1.5333			Here, we have 74% of test and train accuracy.

Augmentation: Yes Optimizer: Yes	0.2985	0.8820	0.882	0.8770	0.4281			Here, we can observe the increase of accuracy to 88% after using the augmentation method.
Pretrained model using InceptionV**3.** Augmentation: Yes Optimizer: Yes	0.4508	0.9840	0.984	0.9850	0.4020			Here, we can observe that using a pretrained model improves the accuracy with a high margin of 98%

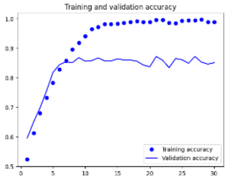
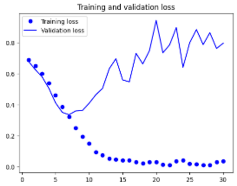
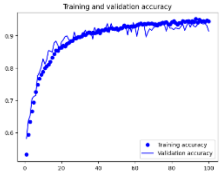
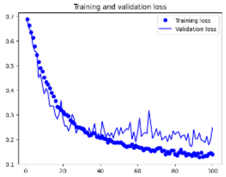
From the above results we can observe that initial performance accuracy of 74% can be improved by using the augmentation technique and optimizer methods which is increased to 84% accuracy.

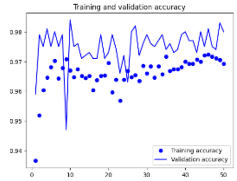
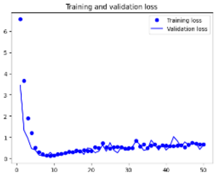
However, by using the pretrained model performance accuracy can be further improved to 98%.

Case 2:

Here, Increasing the training sample size to 5000. This sample consists of a training sample of 4000, a validation sample of 500, and a test sample of 500.

In this model optimization for the initial model followed by the pretrained model performance is also observed.

Cases	Train loss	Train Accuracy	Test Accuracy	Validation Accuracy	Validation loss	Train and validation accuracy	Train and validation loss	Result
Initial Model Augmentation: NO Optimizer: No	0.3691	0.8380	0.838	0.8510	0.7968			Here, we have 83% of test and train accuracy.
Augmentation: Yes Optimizer: Yes	0.2402	0.9130	0.913	0.9140	0.2468			Here, we can observe the increase of accuracy to 91% after using the augmentation method.

Pretrained model using InceptionV**3.** Augmentation: Yes Optimizer: Yes	0.4360	0.9840	0.984	0.9730	1.3732			Here, we can observe that using a pretrained model improves the accuracy with a high margin of 98%

From the above results we can observe that initial performance accuracy of 83% can be improved by using the augmentation technique and optimizer methods which is increased to 91% accuracy.

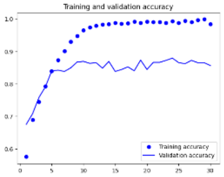
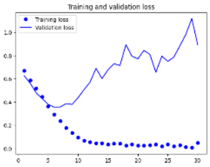
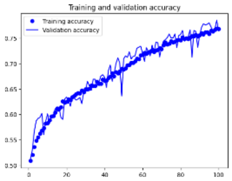
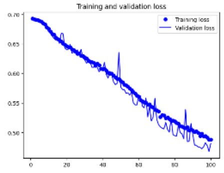
However, by using the pretrained model performance accuracy can be further improved to 98%

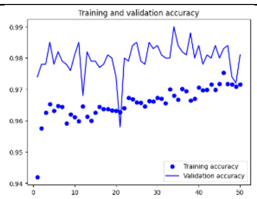
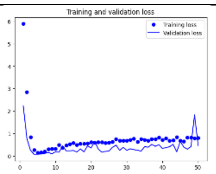
We also can observe that the performance of initial model without using any optimizing and augmentation method is having more accuracy for 5000 samples than the 2000 samples.

Case 3:

Now the training sample is a training sample of 7000, a validation sample of 500, and a test sample of 500. We used the technique of augmentation to reduce overfitting and to improve performance optimizer Adagrad is used in developing this network to train from scratch. This sample size is larger than those in the previous steps.

In this model optimization for the initial model followed by the pretrained model performance is also observed.

Cases	Train loss	Train Accuracy	Test Accuracy	Validation Accuracy	Validation loss	Train and validation accuracy	Train and validation loss	Result
Initial Model Augmentation: NO Optimizer: No	0.3653	0.8290	0.829	0.8560	0.8920			Here, we have 82% of test and train accuracy.
Augmentation: Yes Optimizer: Yes	0.5000	0.7560	0.756	0.7640	0.4816			Here, we can observe the decrease of accuracy to 76% after using the augmentation method. However, it became more robust

Pretrained model using InceptionV3. Augmentation: Yes Optimizer: Yes	0.6729	0.9820	0.982	0.9820	0.5386			Here, we can observe that using a pretrained model improves the accuracy with a high margin of 98%

From the above results we can observe that initial performance accuracy of 82% can be improved by using the augmentation technique and optimizer methods which is decreased to 76% accuracy, which shows the robustness of the model.

However, by using the pretrained model performance accuracy can be further improved to 98%

We also can observe that the performance of initial model without using any optimizing and augmentation method is having more accuracy for 5000 and 8000 samples than the 2000 samples.

Conclusion:

From the observations we can say that by increasing the samples, model performance accuracy also increases even without using any optimization or overfitting reducing techniques. It also proves that using the pretrained models gives more accuracy performance. We can also observe that based on the performance the network with 5000 samples is the best on among the three. We can also observe that having less number of samples causes overfitting of model.