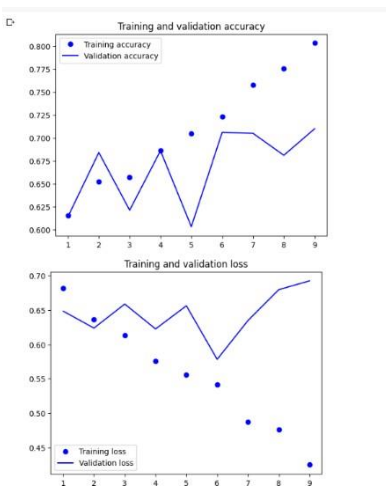
AML ASSIGNMENT-2

1.Consider the Cats & Dogs example. Start initially with a training sample of 1000, a validation sample of 500, and a test sample of 500. Use any technique to reduce overfitting and improve performance in developing a network that you train from scratch. What performance did you achieve?

1.Training sample size=1000, validation=500, test sample=500

Epoch	Drop-out	Data Augmentation	Training sample size	Validation Accuracy	Test Accuracy
9	-	-	1000	59.4	55.4



Here, from the plot, we can say that optimal epoch from the is nearly 6.

Tuning the model using dropout and data augmentation techniques for 1000 samples

Epoch	Drop out	Data Augmentation	Training sample	Validation Accuracy	Test Accuracy
6	0.5	Horizontal=0.1 Zoom=0.2	1000	64.0	62.7
6	0.1	Horizontal=0.1 Zoom=0.2	1000	65.3	65.5

After, drop out and Data augmentation and strides, accuracy has been increased. And we can observe that if we use dropout of 0.2, accuracy has been increased. Hence, we consider drop out as 0.2.

2. Increasing training sample sizes and keeping validation and test sets as constant and used optimization techniques to improve the accuracy.

Epoch	Training sample	Drop out	Data Augmentation	Validation Accuracy	Test Accuracy
6	3000	0.2	Horizontal=0.1 Zoom=0.2	74.7	80.2
6	3000	0.1	Horizontal=0.1 Zoom=0.2	76.90	78.3

Here, we have increased training sample size to 3000, and used dropout and augmentation technique to tune the model where, we can see an improve in accuracy of the model. And also further decrease in dropout to 0.1 we get better accuracy as compare.

3. Tuning the model using optimization techniques and changing the training sample size to find the ideal training sample size to get best prediction results.

Epoch	Training sample	Drop out	Data Augmentation	Validation Accuracy	Test Accuracy
6	5000	-	-	83.60	83.1
6	5000	0.1	Horizontal=0.1 Zoom=0.2	84.30	83.7
6	10000	-	-	89.5	87
6	10000	0.1	Horizontal=0.1 Zoom=0.2	85.3	89.9
6	12000	-	-	97.8	97
6	12000	0.1	Horizontal=0.1 Zoom=0.2	91.4	92.1

Now, we have increased the sample size to different sizes and see an increase in accuracy than the previous sample, but at certain level (12000) the test and validation accuracy has been started decreased after using augmentation techniques which means that the learning rate for the model is too high. Usually, For small datasets the model may overfit, hence we choose optimal training sample as 10000

4. Using pretrained model, finding optimal epochs and finding best accuracy using optimization techniques.

Pretrained model

Epoch	Drop out	augmentation	Training sample	Validation accuracy	Test accuracy
100	-	-	1000	96	96.5
100	0.5	0.1, 0.2	1000	97.1	97.5

We can observe that pretrained model has more accuracy than the scratch model with less sample size, which tells us that the model is highly recommended for the better performance.

5. Now, we check on different training samples to know how accuracy has been changing.

Epoch	Drop out	augmentation	Training sample	Validation accuracy	Test accuracy
7	0.2	0.1,0.2	3000	96.3	98.2
7	0.5	0.1,0.2	5000	97.0	97.2
7	0.2	0.1,0.2	10000	98.1	99.1
7	**0.2**	**0.1,0.2**	**12000**	**99.6**	**99.7**

Pretrained tends to give best accuracy than the scratch model which can be observed from the above results and the best accuracy is obtained at 12000 which is max dataset that I have chosen with accuracy of 99.7%

The best accuracy is observed for the training sample of 12000 with best validation accuracy of 99.6% and test as 99.7%.

CONCLUSION:

• Based on the data, we can conclude that there are reliable when we state that the selection of the network and the alteration of training samples have a significant influence on accuracy.

• A CNN's success is largely dependent on its network selection and training sample selection. To get the best results, it is necessary to carefully evaluate and experiment while choosing the right structure and training set.

• The size, configuration, and activation functions of the network, as well as the complexity and training data available, all influence the CNN's structure. Conversely, the selection of training samples dictates the particular instances that the network is trained on. In this instance, the images were classified as cats, dogs, cats, cats, etc.

• If the training sample is minimal, the CNN may overfit and perform badly on unknown data; if the training sample is high, the CNN may become overly noisy and find it difficult to identify patterns. Various optimization strategies, including dropout and data augmentation, are employed to enhance precision and ensure that the model is tuned to avoid overfitting.Training samples for a scratch model must be increased in order to get the best accuracy possible, which is much lower than that of a pretrained model.

• A pretrained model, on the other hand, uses less training data to achieve high performance on a given task by learning critical features for the data set. Because the pretrained model highly generalizes from training on big classes, it is extremely suitable for huge datasets.

• Based on the data, we can see that the pretrain model requires less training samples to achieve an accuracy of 96.5%, while the scratch model requires more training samples to achieve the highest accuracy of 87.2%. Increased training samples are necessary for a scratch model in order to achieve optimal accuracy, which is significantly lower than that of a pretrained model.

• In addition, we see that the pretrained model's accuracy has been rising with growing sample size, but the scratch model's test accuracy has been declining after it reaches a certain point, indicating that the model is too sophisticated for it.

Because pre-trained models have more intricate architectures, have been optimized through sophisticated methods, and have been trained on larger and more varied datasets than scratch models, they typically have higher accuracy than the latter. Scratch models, however, can still be useful provided they are trained appropriately and have an architecture that works for the task at hand.