Assignment 3: Convolution

The aim of this assignment is to construct a convolutional neural network that can classify cat and dog images accurately and efficiently, by learning their distinct features.

The dataset used for this project was obtained from Kaggle and includes 25,000 training and 12,500 test images, each with an equal number of cats and dogs. However, we will only use a subset of 2000 images for building the model.

Question 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 (half the sample size as the sample Jupiter notebook on Canvas). Use any technique to reduce overfitting and improve performance in developing a network that you train from scratch. What performance did you achieve?

We have considered Cats & Dogs Data set with the training sample of 1000(validation =500 and test =500). Since the given training sample is 1000 in tend to be over fit, to overcome this issue I have used the technique as a drop out with the amount of 50%. Along with convolution architecture.

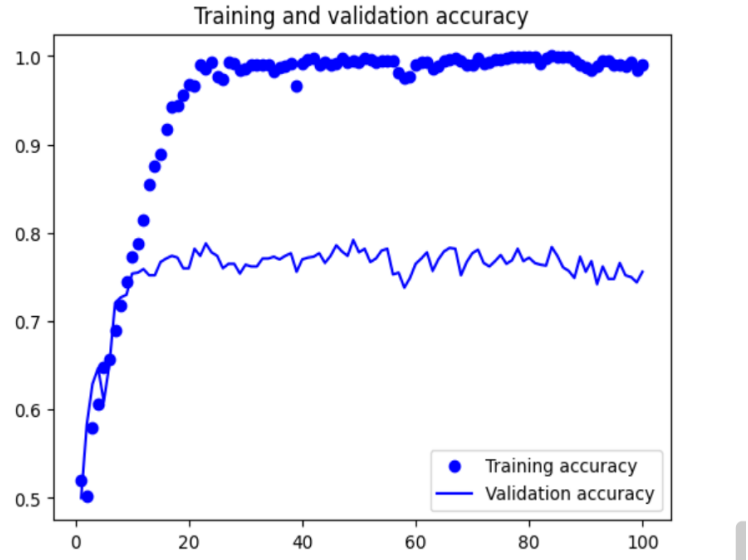
Convolution architecture:

In this I have used the 5 convolution layers including:

- Max Pooling layers
- Fully connected layers
- All other hyper tuning parameters

Hyper tuning parameters:

I have considered batch size as 255 and we have applied the data flattening technique to convert the data transformation. With the help of 100 epochs, we got to know the validation accuracy as 75.4 and test accuracy as 72.22.

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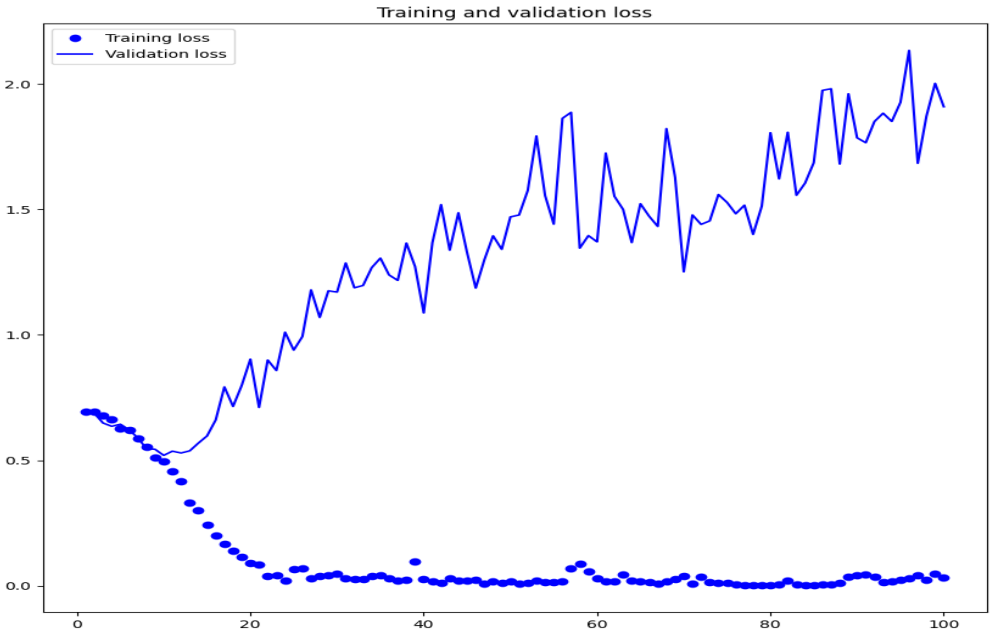


Question 2:

Increase your training sample size. You may pick any amount. Keep the validation and test samples the same as above. Optimize your network (again training from scratch). What performance did you achieve?

All the below result are based on the training sample 1500 validation 500 test 500.

Test Accuracy – 82.70 Validation accuracy-86.20 from here the results clearly indicates better results from the earlier (Question 1) due to following reasons:

- We have increased the training sample by an amount of 500 (1000-1500) which has helped to improve the performance of the model, As we can see that train and validation accuracy have increased by nearly 10%.

- Moreover, along with the convolution layer we have implemented the data augmentation which has helped us to improve the featured extractions that resulted in better performance.

Question 3:

Now change your training sample so that you achieve better performance than those from Steps1 and 2. This sample size may be larger, or smaller than those in the previous steps. The objective is to find the ideal training sample size to get best prediction results.

Answer:

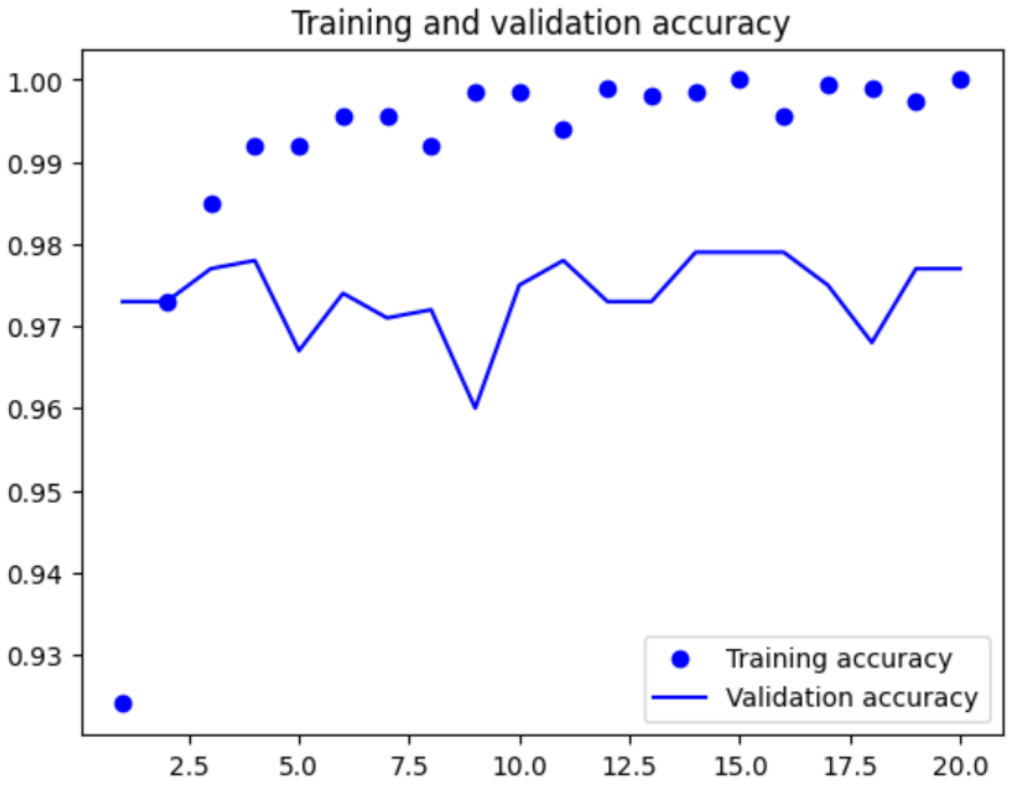
- As we know using more and more data will helps to improve the model performance so we can't really decide the ideal sample size
- Here we have increased the data size by 500, which will help to improve the model performance.
- Our model performance has improved from 82.7 to 83.5 with the help of data augmentation and increasing sample size by 500.
- Generally implementing data augmentation prevents the model from overfitting. some augmentation combinations can lead to underfitting. However, the model is not able to learn much information even though we have implemented data augmentation and increased the sample size along with the defined convolution architecture to give accurate predictions.

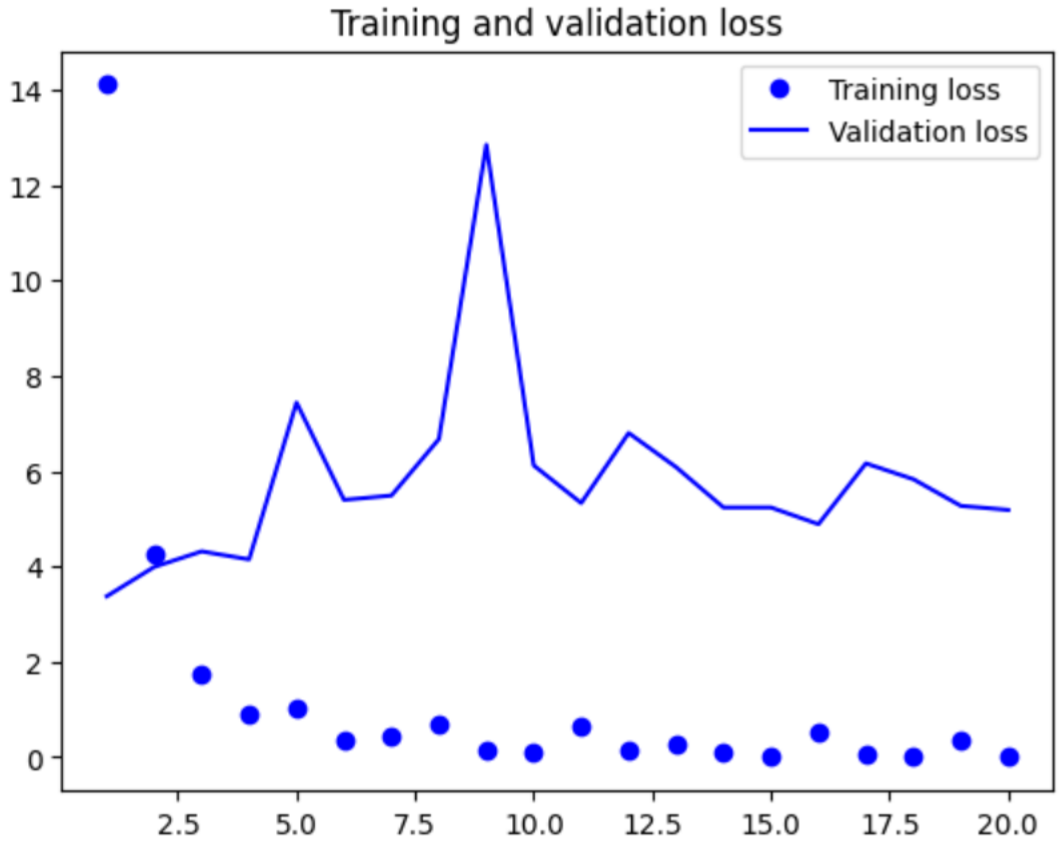
Question 4:

Repeat Steps 1-3, but now using a pretrained network. The sample sizes you use in Steps 2 and 3 for the pretrained network may be the same or different from those using the network where you trained from scratch. Again, use any and all optimization techniques to get best performance.

Pre-Trained model without Augmentation

Our validation accuracy is 98.10% and test accuracy is 97.3% and test accuracy is higher than the accuracy we attained during the tiny model's first training. Despite utilizing dropout with a rather high rate, the plots clearly show that we are overfitting practically right away.




Training and validation loss
Training loss
Validation loss
14
12
10
8
6
4
2
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0

Pre-Trained model with Data Augmentation:

The collection of samples used to assess a model is always important! Strong findings on one sample set may not necessarily generalize to all other sets since some sample sets may be more challenging than others. When we compare Pretrained model without Augmentation and with augmentation the results are 97.3 and 98.1 respectively.

Model	Training samples	Validation Accuracy	Test Accuracy
Model 1	1000	75.4	72.22
Model 2	1500	86.2	82.7
Model 3	2000	84.4	83.5
Model 4	Pretrained Model without data augmentation	98.1	97.3
Model 4	Pretrained Model with data augmentation	98.5	98.1

Conclusion:

From the above results it clearly indicates that data is fuel to model when we increase the training sample from 1000 to 2000 we can increase the test accuracy from 72.22 to 83.5%. Moreover, Pretrained Model with data augmentation can get better performance. Overall, we can say that using data augmentation with increasing data points we can be able to generalize well with better accuracy.