Assignment 3: Convolution Summary Report

Cats & Dogs is a collection of information including 25000 photos of cats and dogs suitable for training. I have taken 10000 out of it for training my model. A subset of the information was utilized to train the model for predicting cats and dogs utilizing convolution networks. For the first model, I used 1000 pictures to train, 500 pictures to verify, and 500 pictures to test. The architecture utilized to make the model can be seen in the image below.

```
inputs = keras.Input(shape=(180, 180, 3))
x = layers.Rescaling(1./255)(inputs)
x = layers.Conv2D(filters=32, kernel_size=3, activation="relu")(x)
x = layers.MaxPooling2D(pool_size=2)(x)
x = layers.Conv2D(filters=64, kernel_size=3, activation="relu")(x)
x = layers.MaxPooling2D(pool_size=2)(x)
x = layers.Conv2D(filters=128, kernel_size=3, activation="relu")(x)
x = layers.MaxPooling2D(pool_size=2)(x)
x = layers.Conv2D(filters=256, kernel_size=3, activation="relu")(x)
x = layers.MaxPooling2D(pool_size=2)(x)
x = layers.Conv2D(filters=256, kernel_size=3, activation="relu")(x)
x = layers.Flatten()(x)
outputs = layers.Dense(1, activation="sigmoid")(x)
model = keras.Model(inputs=inputs, outputs=outputs)
```

After creating the model, I utilized an binary cross entropy loss function, the Adam optimizer, and consistency as metrics for constructing it. After executing the modelI obtained a training accuracy of 0.5840 a validation accuracy of 0.7320 and a test accuracy of 0.7910

The above findings show that the model is overfitting, since its training precision is significantly higher than test accuracy. I tried multiple methods to reduce overfitting. When compared to other methods, enhancement has resulted in the best final results. It achieved a training accuracy of 0.7050, a validation accuracy of 7470 , and a test accuracy of 0.791

For the second model, I expanded the training data to 2000 from 1000 and kept the rest of the model exact same as the first. This has given a training accuracy of 0.7870, a validation accuracy of 0.8180, and a test accuracy of 07910.

As a method to enhance the accuracy I utilized enhancement for this model and it has achieved a training accuracy of 0.7940, a validation accuracy of 0.8390, and a test accuracy of 0.793.

As can be noticed from the results above, I increased 4000 of the training set's picture count has enhanced test accuracy.

In view of the preceding conclusion, I extended the training data for the third model to 4000 photos. The resulting accuracy values are 0.9961 for training 0.8410 for validation, and 0.835 for testing. The training accuracy of a comparable model with augmentation was 0.9475, the validation accuracy was 0.8390, and the test accuracy was 0.795.

creating a model with a pre- trained network:

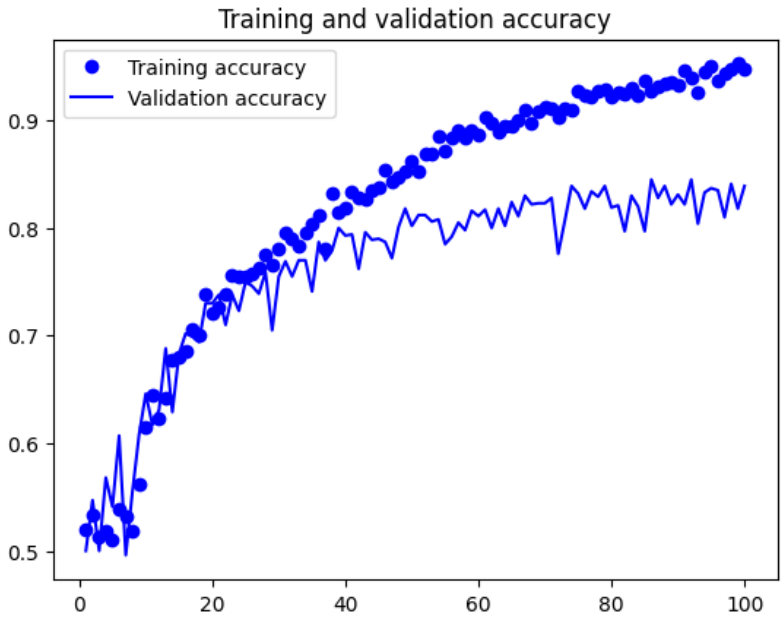
To create the model, I utilized the VGG16 pre-trained network. In the end, I employed accuracy, binary cross entropy loss function, flattener and dropouts, dense layers, and flattener and dropouts as measures for building the model.

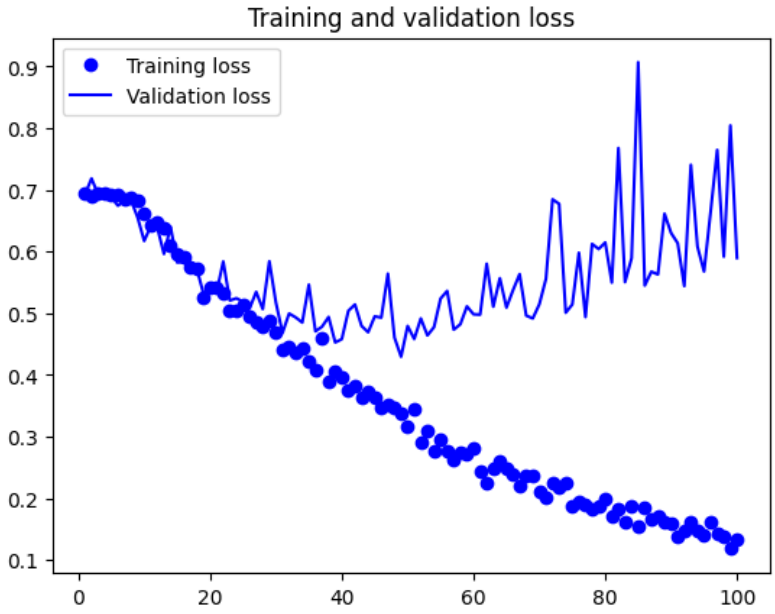
In order to train the first model, I utilized 1000 photos. As a result, the following things have happened:

Training Accuracy	Test Accuracy	Validation Accuracy
0.7050	0.791	0.7320

The following model was trained using 4000 photos, and the output was as follows.

Training Accuracy	Test Accuracy	Validation Accuracy
0.8410	0.895	0.8390





The previously mentioned outcomes demonstrate that the model using a pre-trained network with an accuracy of 97.4, the sample of 4000 has done better than other models. This is a result of the huge datasets comprising millions of pictures used to train the VGG 16 network. Given that this model has already learned many aspects from the vast data set, it is extremely likely that it will perform better than models that are created from scratch.

What is the relationship between training sample size and choice of the network?

Before training the model, it is very important to select the appropriate sample size. This is a consequence of the fact that a limited sample size will cause the model to be overfitted, which causes it to weakly generalize as it attempts to closely replicate the patterns of the training set. On unknown data, such a model doesn't function well. Therefore, in general, as the model seeks to capture more generic properties of the data, extending the sample size will result in better model performance.

It is preferable to employ a straightforward network with a limited number of layers whenever the training sample size is minimal as this will prevent overfitting. On the other side, we must utilize a complicated network with several layers if the sample used for training size is huge. However, if the sample size for training is large, we must employ a complex network with several layers.

Conclusion:

When analysing each of the models, it is clear that the model performs better on the test when the training sample size is larger. Therefore, in order to prevent overfitting, it is preferable to utilize a big data set while training a model. Whenever a pre-trained network is utilized, the accuracy of the model has significantly increased since the pre-trained network had previously picked up numerous characteristics from millions of photos. To perform better on the test set, it is often preferable to utilize bigger training sets and pre-trained networks.