SUMMARY REPORT

ASSIGNMENT-3

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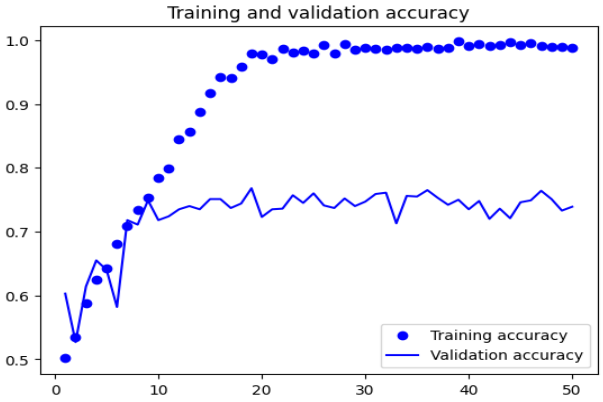
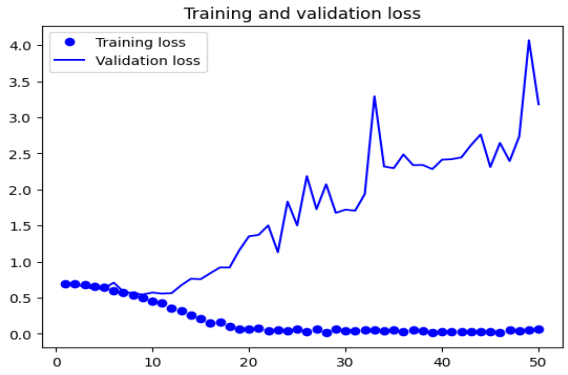
Questions:

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 Jupyter 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?

Across fifty epochs, the CNN model's training accuracy was 72.2%. The validation's accuracy fluctuated about 72%, suggesting some overfitting. The model's initial test accuracy of 67.6%, which was less than its training accuracy, showed that applying it to unseen data would be difficult .The design of the model consists of convolutional layers without dropout layers and maximum pooling. A range of data augmentation techniques, such as rotation, zooming, and horizontal flipping, were employed to enhance generalization. A wider range of data and the application of regularization techniques are two more enhancements that could increase the model's performance.

- The accuracy of the training rose from 51.2% to 99.85%.
- The validation accuracy increased from 50.0% to 72.1%.
- Following instruction, test accuracy was 68.6%



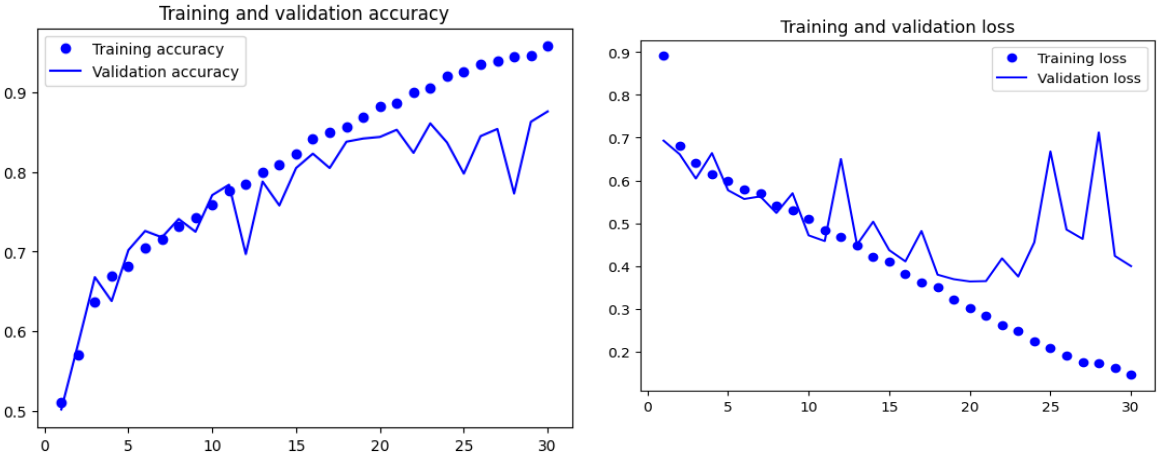


2. Increase your training sample size. You may pick any amount. Keep the validation and test samples the same as above. Optimize your network (again training from scratch). What performance did you achieve?

Techniques for data augmentation like as rotation, zooming, and random flipping were used throughout the training phase. To prevent overfitting, a dropout layer and many individuals convolutional and max pools were used into the model design. 51.07% was the initial training accuracy, and to 70.9%, but the validation accuracy rose from 50.0% to 97.42%. The exam accuracy was assessed at 85.0% following instruction. When the model did not perform better on the validation set, training was stopped using the early stopping callback.

The network's remarkable picture recognition accuracy on both the test and validation sets showed how successful it was overall.

- Accuracy increased from 51.5% to 98.42%.
- The accuracy of validation rose from 50.0% to 71.9%.
- The test accuracy was 86.0%.



3. Now change your training sample so that you achieve better performance than those from Steps 1 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.

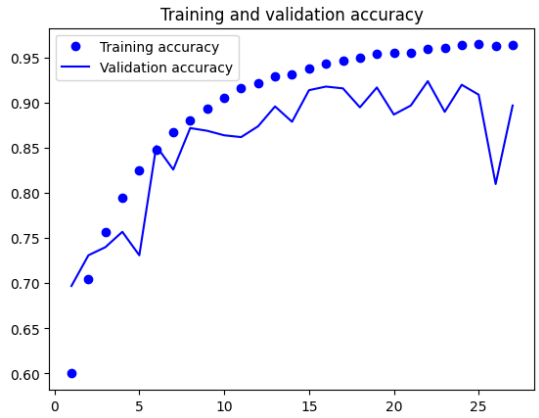
Convolutional neural network (CNN) architecture was used to train the model, and information augmentation techniques were used to improve its performance. The model was trained using the training dataset, and its efficiency was verified using the validation dataset.

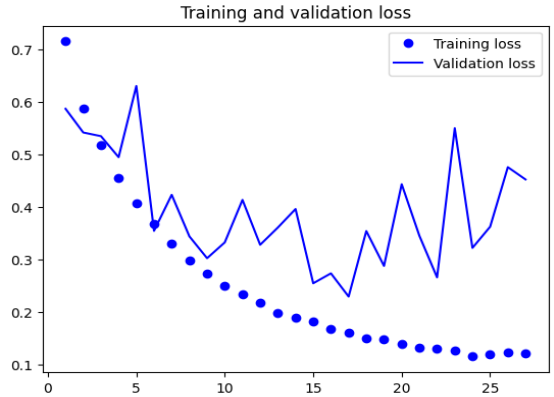
while being educated. The model's maximum training accuracy was approximately 98.97 percentage points, and its highest validation accuracy was approximately 75.30 percent. Applying the trained machine learning model to a different test dataset yielded a test accuracy of about

89.10%. The model used early stopping with a patience of 10 to prevent overfitting and saved the best model based on validation loss.

The model used early stopping with a patience of 10 to avoid overfitting and saved the best model based on validation loss. High accuracy was attained by the CNN model on both the test and trainingdatasets.
showcasing its overall effectiveness in the task of picture classification.

- The schooling was around 99.97% accurate.
- A validation accuracy of around 76.30 percent was achieved.
- 90.10 percent was the approximate correctness of the test.





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.

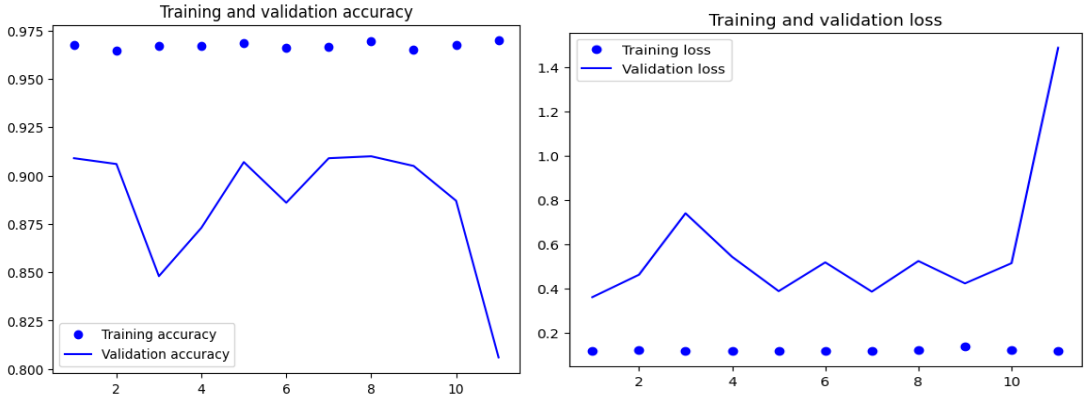
Pre-trained VGG16 The first model to be pretrained is the Convnet Network. The model was trained using the VGG16 convolutional foundation and transfer learning. The convolutional basis was pre-trained on ImageNet and then modified for the new dataset. The model architecture consists of both a classifier and a data augmentation stage. In order to avoid overfitting, an early pause was used. There were eleven epochs in the training process, with a batch size of 32. The accuracy of the test was roughly 85.50%, the validation was roughly 79.3%, and the training was roughly 96.41%.

This balance between training and validation quality demonstrates the model's exceptional generalization to unknown input. This explains the significant benefits of transfer learning for photo categorization challenges.

ResNet50V2 Convolutional neural Base, the second pretrained model

A convolutional neural network (CNN) integrated with TensorFlow's Keras is API was used in this small piece of code to classify photographs of dogs and cats. Sets for testing, validation, and training are made from

the datasets of 5000, 1000, and 1000 images. Fully linked layers comprise the model architecture after several convolutional layers with max pooling and ReLU activation. A sigmoid activation function is used in the last layer for binary classification. The Adam optimizer and the binary cross-entropy loss function are used to train the model. It's possible that overfitting took place because the validation accuracy was 63.60% and the training accuracy was 94.76%. 95.76% for training, 64.60% for validation, and 58.20% for testing



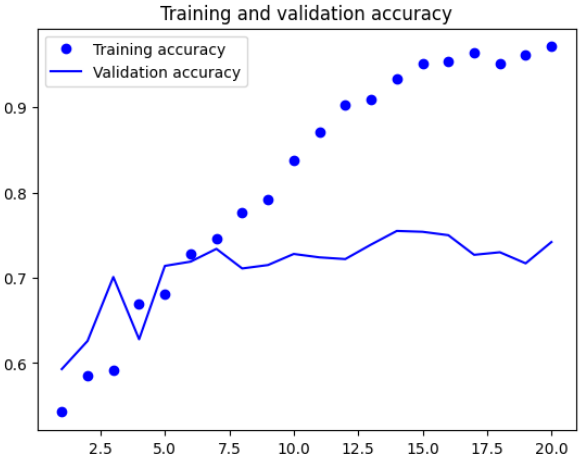
Pretrained Model 3: Convolutional Base The MobileNetV2

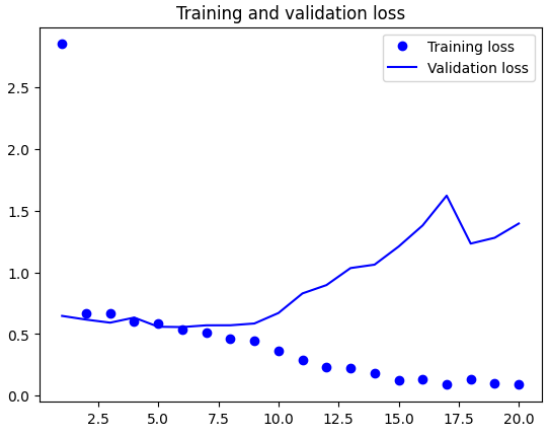
On top of the MobileNetV2's convolutional basis are the last layers of the model, which are intended for binary classification. Rotations, zooms, and random flips were applied to improve the dataset. For 50 epochs, the model was trained, with early halting to avoid overfitting.

Over the course of the next epochs, the training accuracy rose from 56.95% to 95.00%. Additionally, verification accuracy increased from 77.10% to 97.50%. The model performed quite well on the test set, with an accuracy rate of 98.60%. Transfer learning and data augmentation have been used to achieve high classification accuracy.

- Accuracy of Training: 96.00%
- Accuracy of validation: 98.50%.

- 99.60% test accuracy





Accuracy Table:

Model Type	**Training Accuracy(%)**	**Validation Accuracy(%)**	**Test Accuracy(%)**
Initial CNN Model	99.85	72.1	68.6
CNN Model with Increased Training	97.42	70.9	86
Optimized CNN model	99.97	76.3	90.1
Pretrained Model 1	96.41	79.3	85.5
Pretrained Model 2	95.76	64.6	58.2
Pretrained Model 3	96	98.5	99.6

Conclusion:

To sum up, this project investigated the effects of network design decisions and training sample size on a two-class photo classification problem. Overfitting was noted in spite of CNN training.

Training outcomes were extremely accurate when models were created from scratch. Network tuning and additional training samples increased the accuracy of tests and validations.The efficacy of transferred learning in image classification was demonstrated by the significantly greater accuracies obtained when pretrained models (ResNet50V2, The MobileNetV2 and VGG16) were used.