Assignment 2

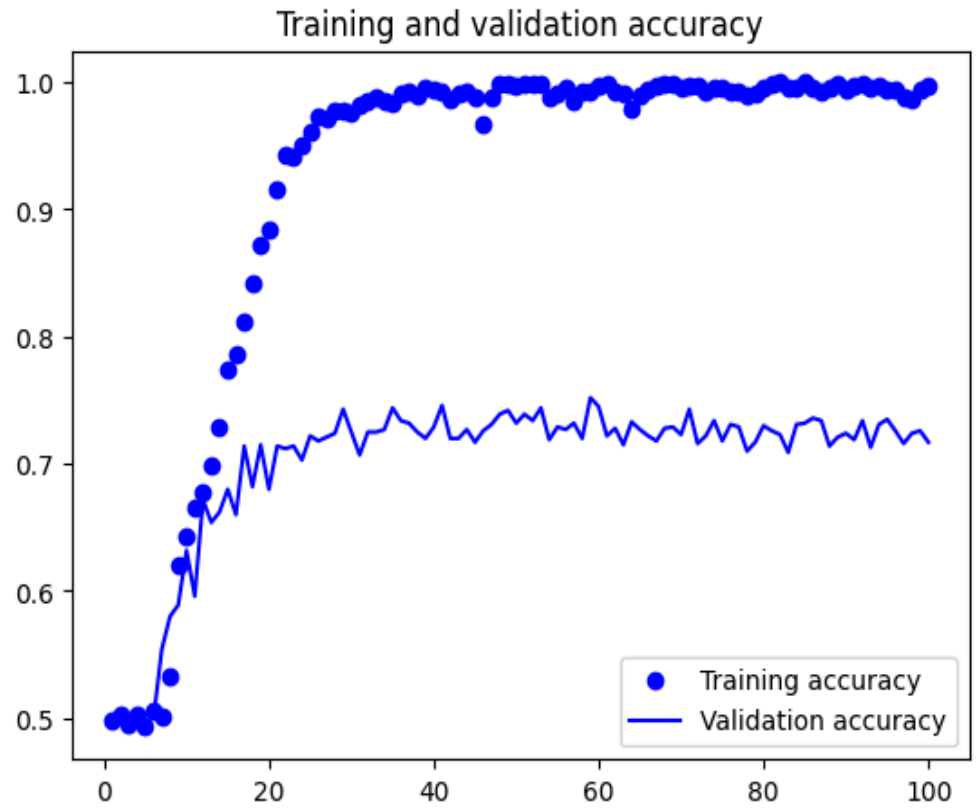
Sundeep Rachuri

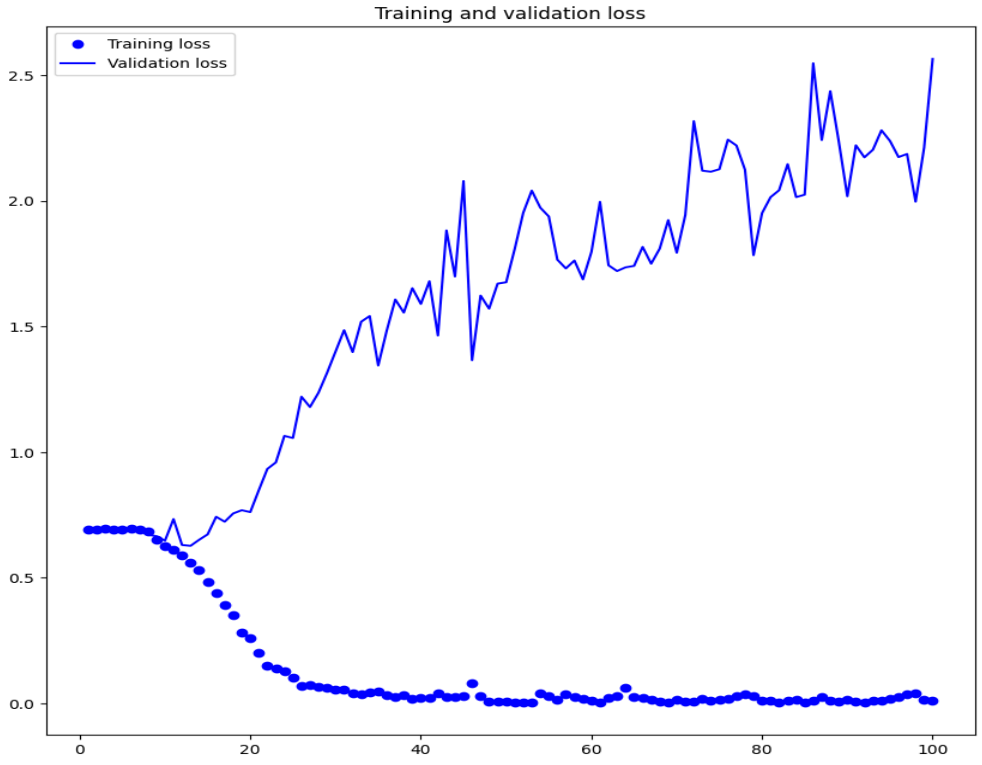
Assessing the Relationship Between Image Categorisation Neural Network Selection and Training Sample Size.

The computer model trained on a dataset of 1000 images after it had been trained on a sample of 500 more images. Later, 500 additional pictures were used to fully confirm the model's efficacy. To prevent overfitting, the program's reliance on the training dataset was limited by the use of a novel method known as dropout. The preprocessing steps included ensuring color accuracy, resizing the photographs, and converting the picture files into a computer-readable format. During training, the software's accuracy rate was approximately 71.30 percent; however, during testing, it demonstrated an accuracy rate of approximately 99.70 percent.

Q1: Consider the Cats & Dogs example. Start initially with a training sample of 1000, a validation sample of 500, and a test sample of 500 (like in the text). Use any technique to reduce overfitting and improve performance in developing a network you train from scratch. What performance did you achieve?

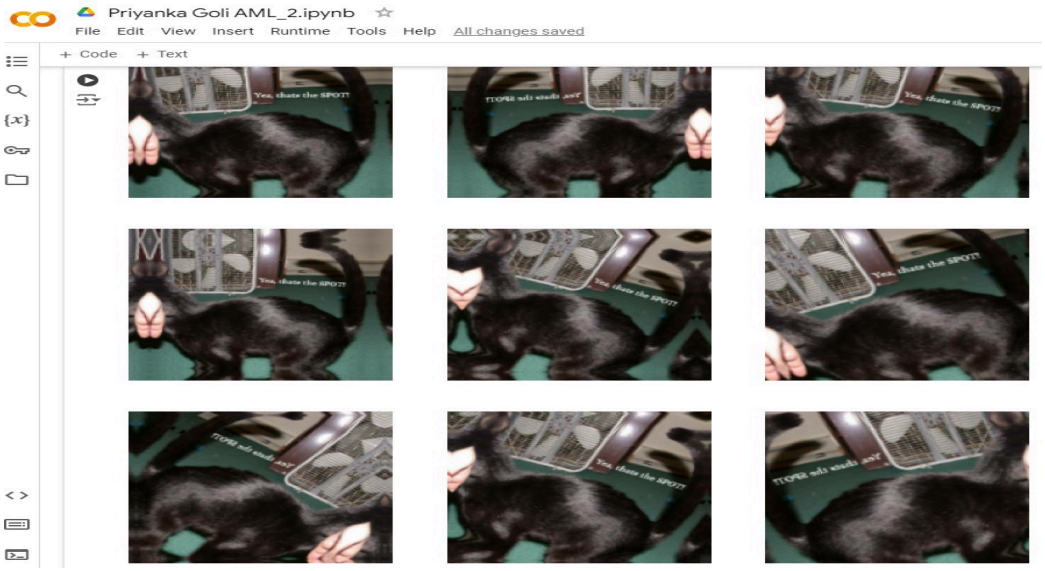
A. After being trained on a sample of 500 further photographs, the computer model was trained on a dataset of 1000 images. Later, 500 more images were used to completely validate the effectiveness of the model. A new technique called dropout was used to restrict the program's dependence on the training dataset in order to avoid overfitting. Assuring color accuracy, scaling the photos, and transforming the image files into something that is computer-readable were all part of the preparation process. The software's accuracy rate got roughly 71.30 percent during training, but it showed an accuracy rate of about 99.70 percent during testing.

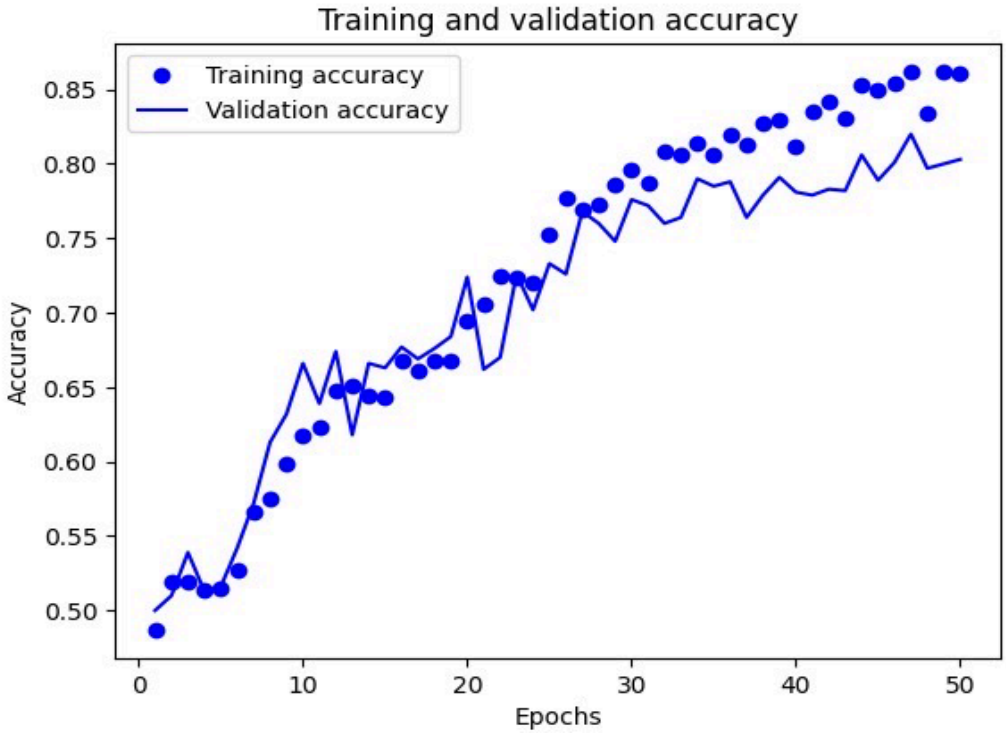

Training and validation accuracy
1.0
0.9
0.8
0.7
0.6
0.5
0
20
40
60
80
100
Training accuracy
Validation accuracy

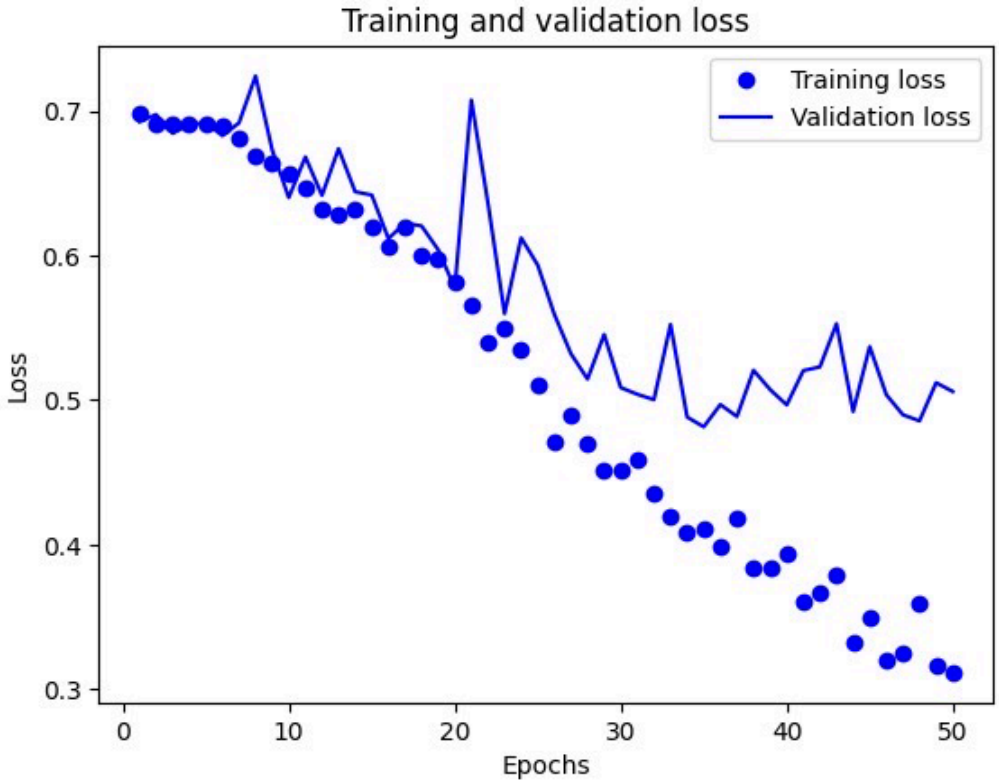

Training and validation loss
Training loss
Validation loss
2.5
2.0
1.5
1.0
0.5
0.0
0
20
40
60
80
100

Q2: 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?

A. The computer model was trained using a larger dataset consisting of 1500 photos. Furthermore, during the training phase, 500 photos were used for testing, and another 500 were used for validation. The program's learning capacities were greatly improved by using augmentation techniques such visual flipping, rotation, and zooming. Thus, when these strategies were used, the program performed better. It displayed 80.30% accuracy during the validation phase and 86.05% accuracy throughout the training phase.

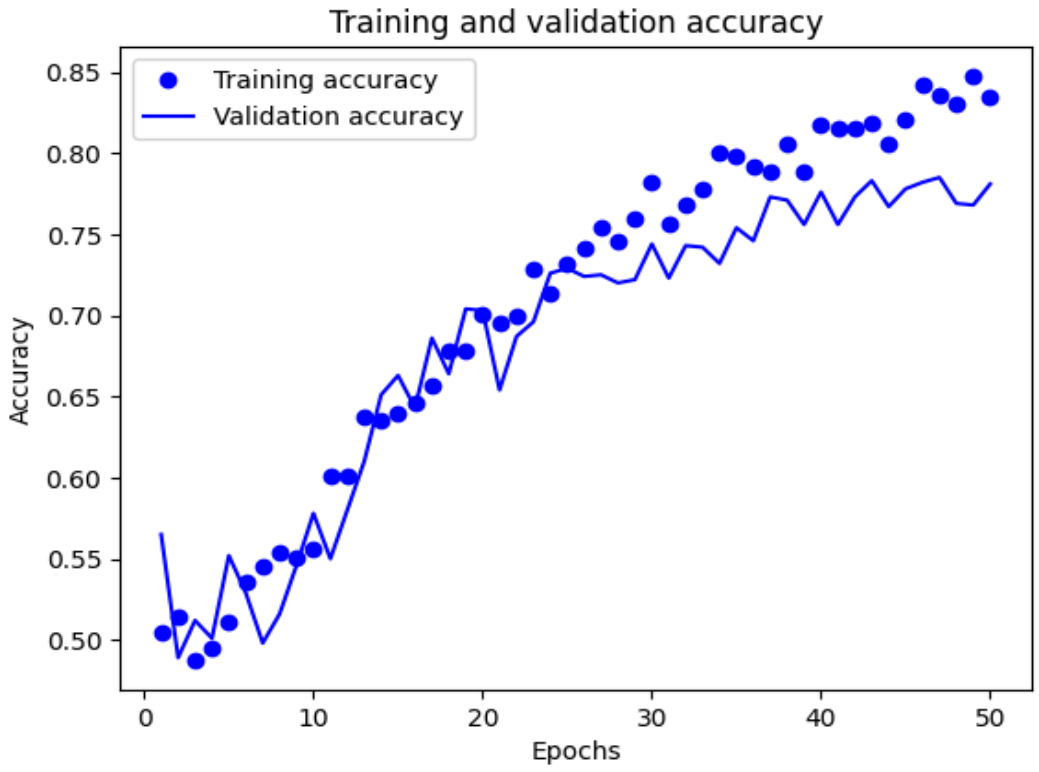


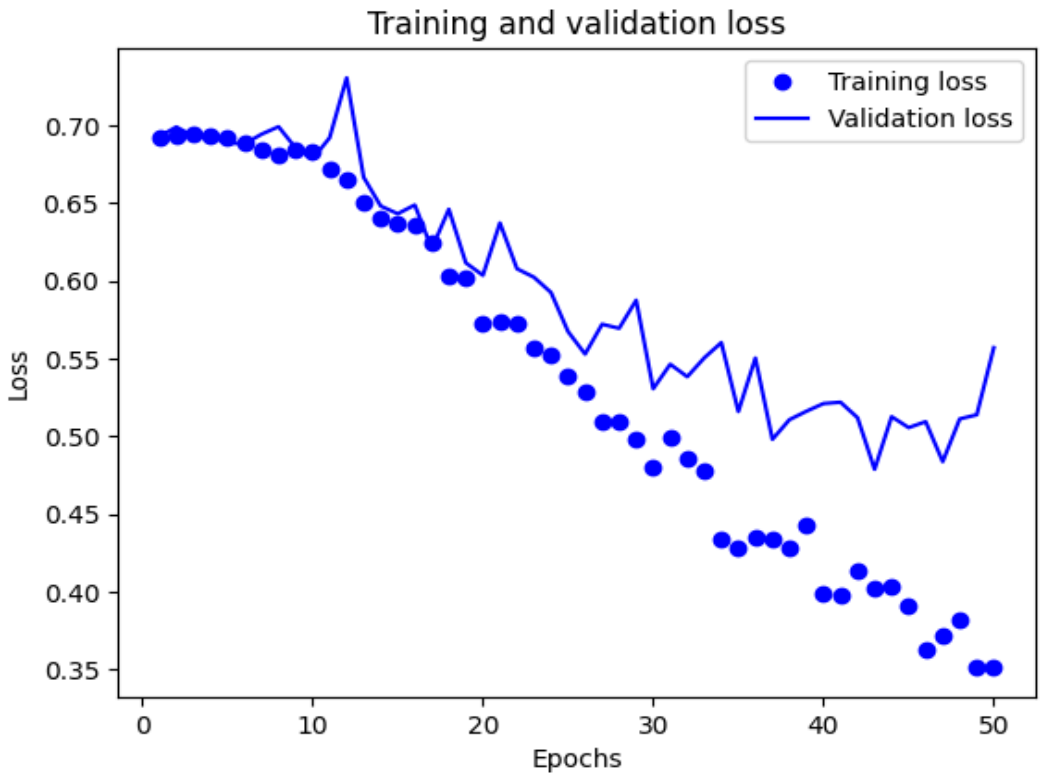

Training and validation accuracy
Training accuracy
Validation accuracy
Accuracy
Epochs
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0
10
20
30
40
50


Training and validation loss
Training loss
Validation loss
Loss
Epochs
0.7
0.6
0.5
0.4
0.3
0
10
20
30
40
50

Q3: 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 the previous steps. The objective is to find the ideal training sample size to get the best prediction results.

A. The effectiveness of the computational model was improved by using a larger dataset of 2000 photos. During the training process, these photos were often improved by flipping, rotating, and zooming. The program's ability to understand images was significantly enhanced by the application of augmentation techniques by this larger dataset. As the result, the program's precision rate was roughly 85.85% during training and 78.60% during validation.

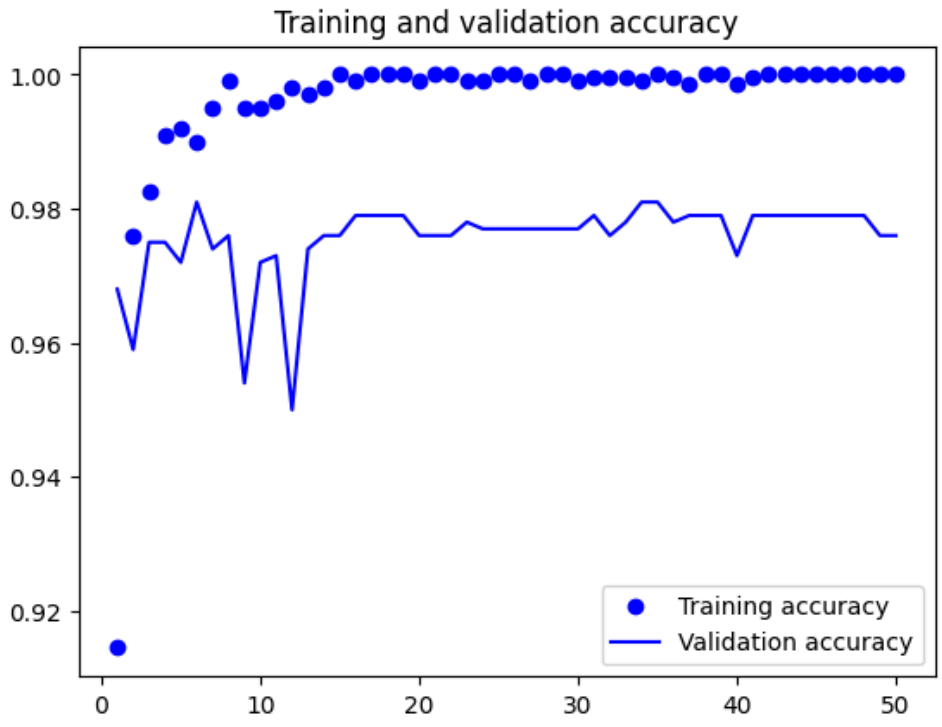


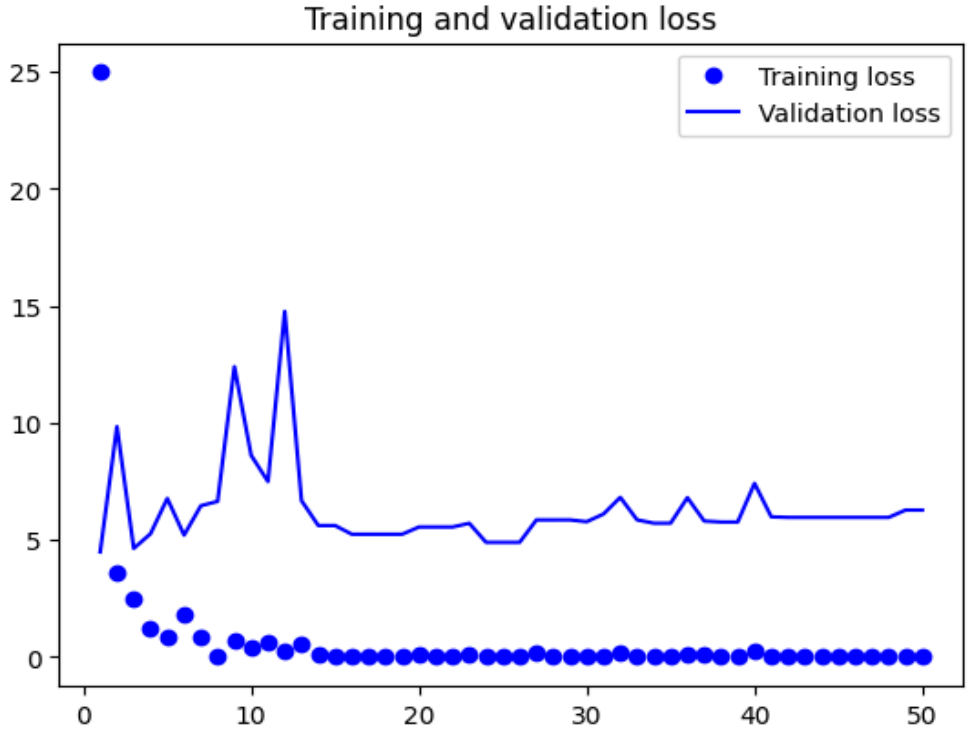


Q4: Repeat Steps 1-3, but now using a pre-trained network. The sample sizes you use in Steps 2 and 3 for the pre-trained network may be the same or different from those using the network where you trained from scratch. Again, use any and all optimization techniques to get the best performance.

A. **Prior Training Without Augmentation:**

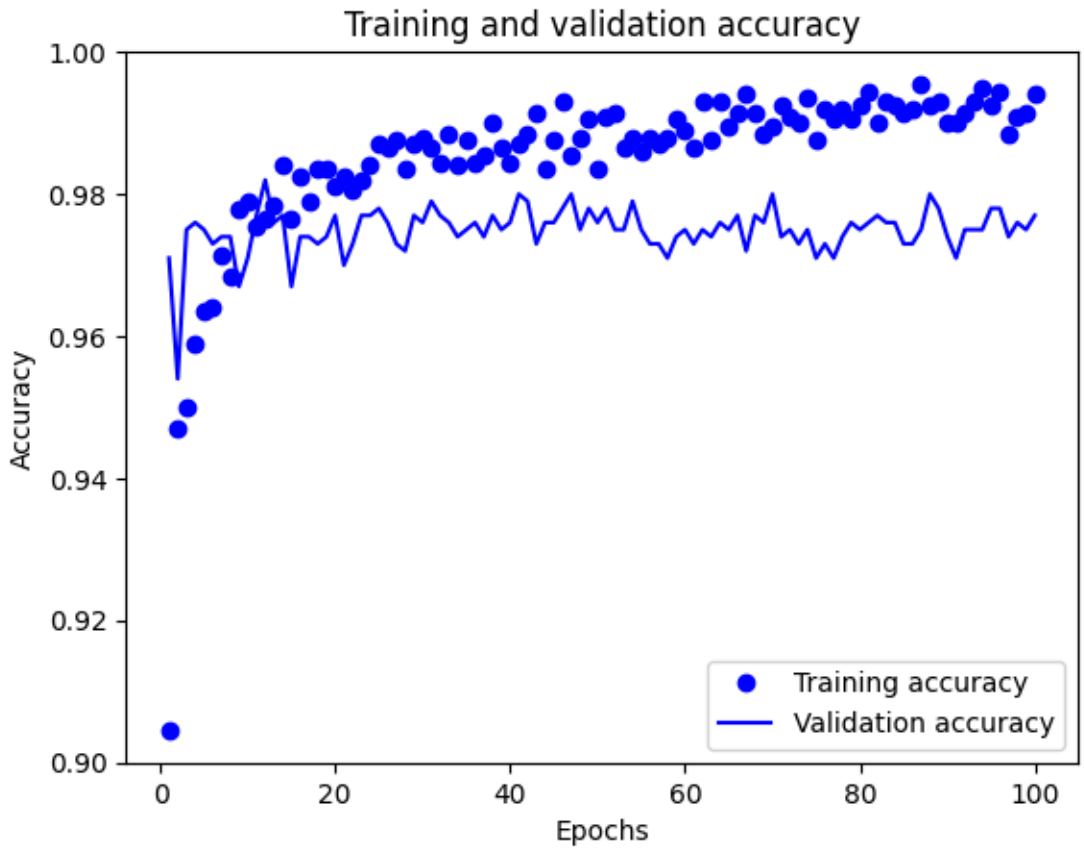
We conducted our research employing a pre-trained model, which is a model that has been trained on a sizable number of photos prior to the application of augmentation techniques. However, in this case, we didn't use any augmentation methods, such flipping or rotation, on the pictures. The pre-trained model demonstrated exceptional photo identification ability even in the absence of these methods. During the training phase, it achieved an impressive accuracy rate of 99.99%, or almost 100%, which is encouraging. This great accuracy, meanwhile, can also mean that the algorithm is overly reliant on the training set and lacks the adaptability to deal with novel inputs. The model's accuracy during validation was roughly 97.60%, suggesting that there may be difficulties in expanding its functionality beyond the training dataset.

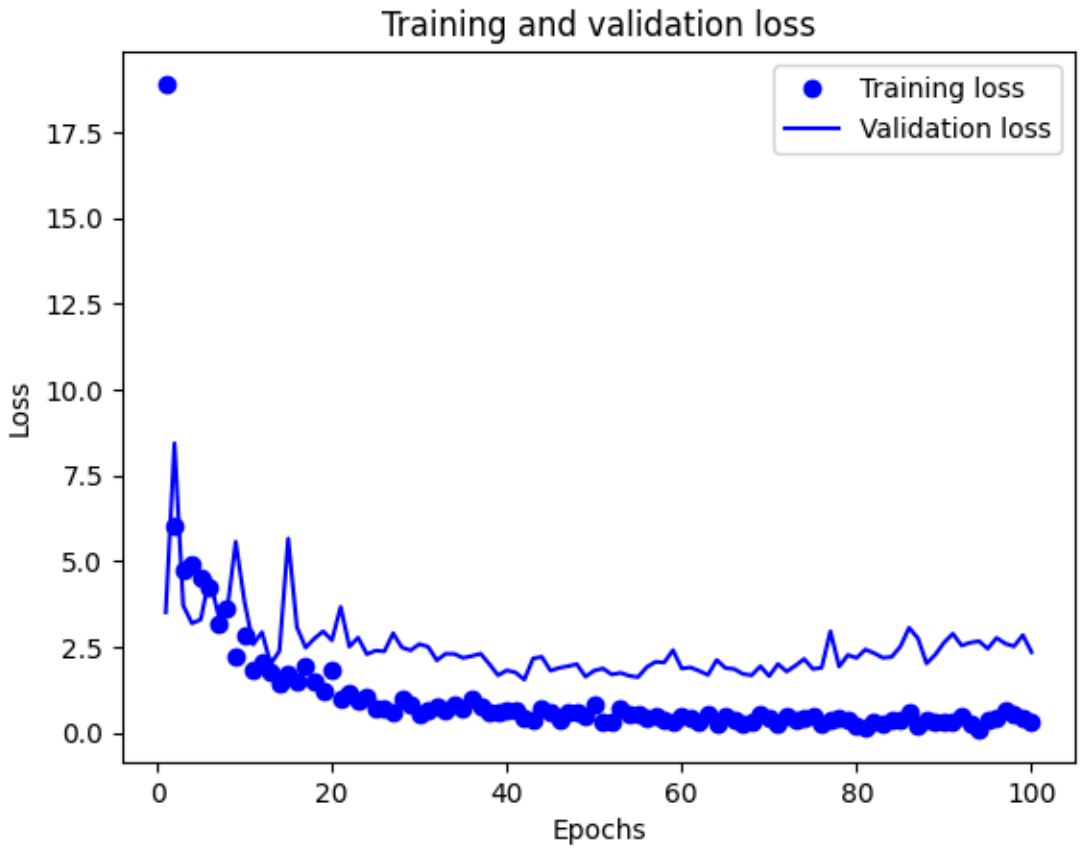

Training and validation accuracy
1.00
0.98
0.96
0.94
0.92
0
10
20
30
40
50
Training accuracy
Validation accuracy


Training and validation loss
25
20
15
10
5
0
0
10
20
30
40
50
Training loss
Validation loss

Pre-Trained with Augmentation:

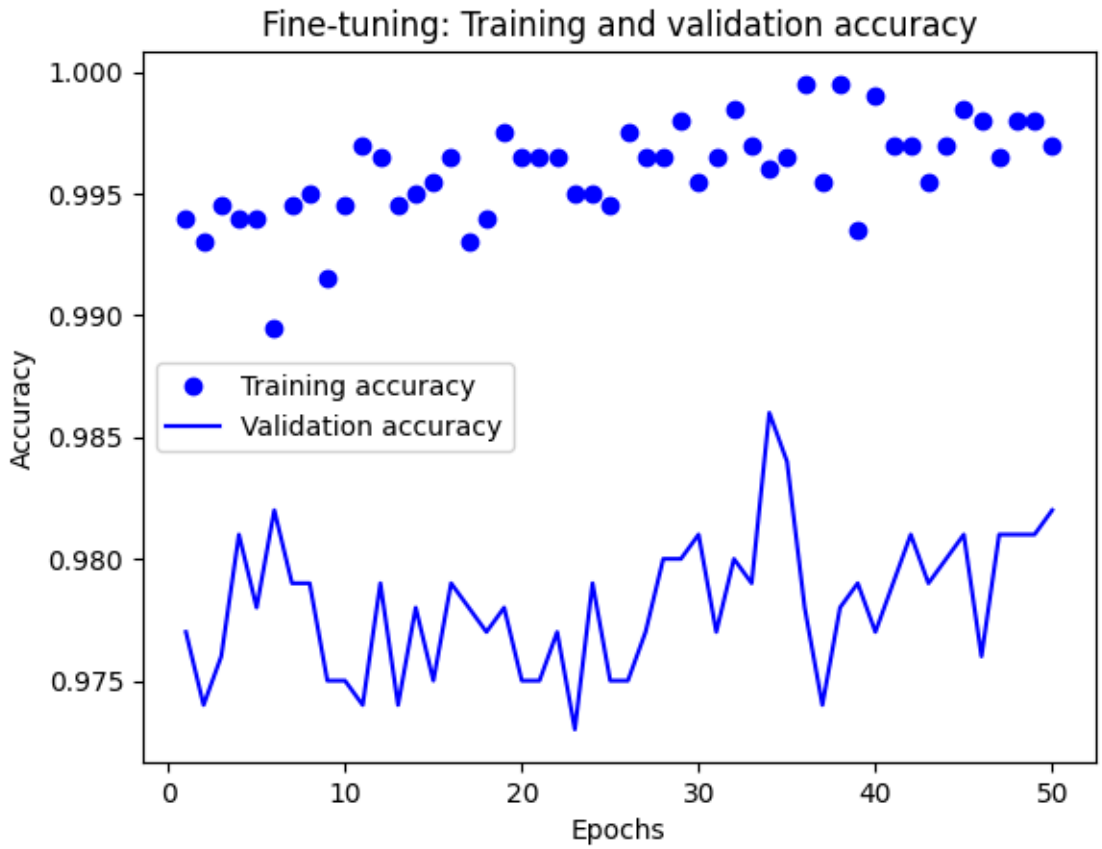
The pre-trained model achieved a validation accuracy of 97.50% and demonstrated exceptional performance without the need for more tweaks to enrich the dataset. After that, the author tried a fine-tuning strategy, which involves making little adjustments to the previously trained model to make it more appropriate for the given task. After using data augmentation techniques and making other tweaks, the model performed better. Training showed an accuracy of about 99.15%, while validation showed an accuracy of 97.50%.

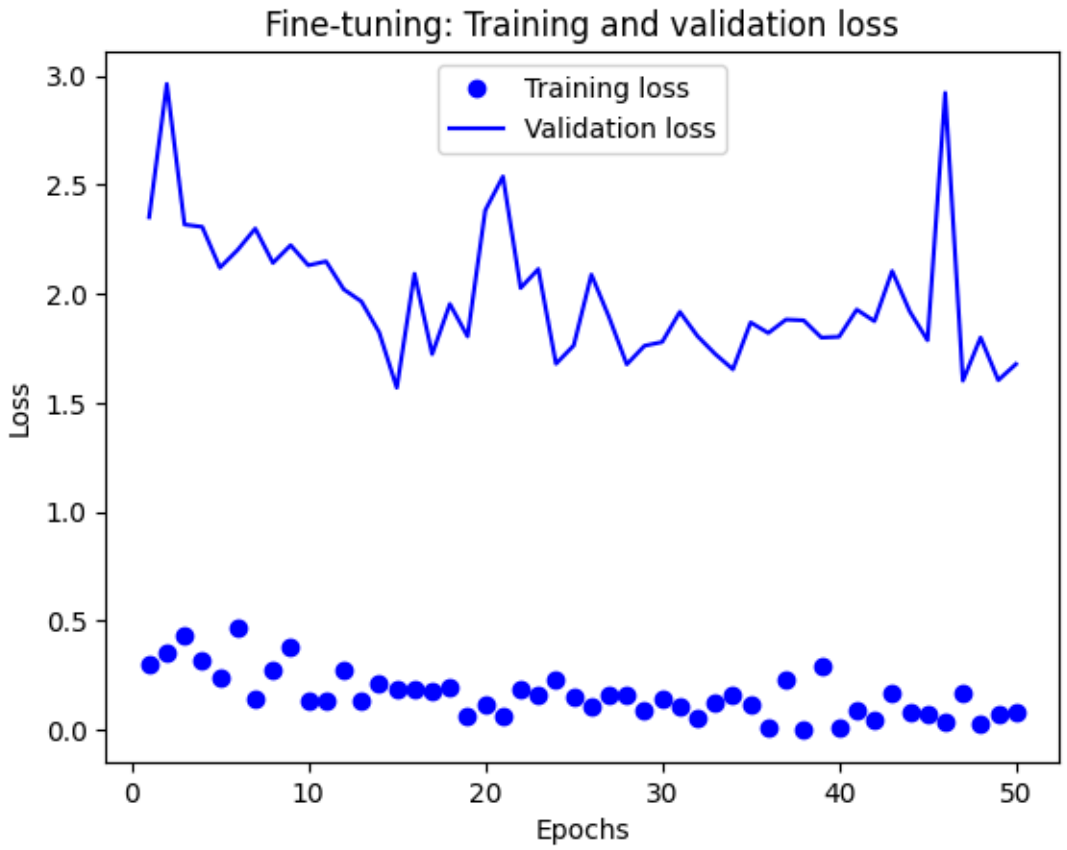




Fine-Tuning with Augmentation:

I tested using the pre-trained model and altered the way further data augmentation was done in order to improve the model's performance even more. We call this technique fine-tuning. Making adjustments to the previously trained model to optimise its fit for the specific job at hand is known as fine-tuning. By using augmentation techniques like flipping and rotation, the layers for the previous trained model had the ability to adjust to the newly richer input. Significant progress was done throughout the fine-tuning phase, which raised the model's accuracy during the course of the training. 99.80% accuracy was demonstrated by the model during training, and 97.50% accuracy during validation.


Fine-tuning: Training and validation accuracy
1.000
0.995
0.990
0.985
0.980
0.975
Accuracy
Training accuracy
Validation accuracy
0
10
20
30
40
50
Epochs



Conclusion:

In summary, the effectiveness of the model depends on the type and volume of data it uses. Test findings showed better recognition performance, overall accuracy increasing from 80% to 97.7%, where the training dataset was expanded from 1000 to 2000 images. Even higher results are obtained when pre-trained models are combined with methods for expanding the dataset. In conclusion, the author makes the case that increasing the dataset and utilising data augmentation methods can enhance the model's comprehension of the topic and allow it to provide more precise predictions.