Introduction

Binary classification is a machine learning problem where a model is trained to predict a label that can take on one of two possible values, based on a set of features as input. For example, in a binary classification problem to identify cats and dogs in images, the model might be trained on a dataset of images that are labeled as either "cat" or "dog," with a label of 1 indicating that the image contains a cat, and a title of 0 indicating that the image contains a dog. The model's goal is to learn the relationship between the features of the input images and the labels so that it can accurately predict the labels for new, unseen images.

For this classification problem, 4 different models were created.

1. Model 1 is a CNN model with only 2 convolutional layers and 2 fully connected layers and the activation function is relu.

2. Model 2 CNN model with 5 convolutional layers and 2 fully connected layers. The activation function is sigmoid.

3. Model 3 CNN model with 5 convolutional layers and 2 fully connected layers. the activation function is relu.

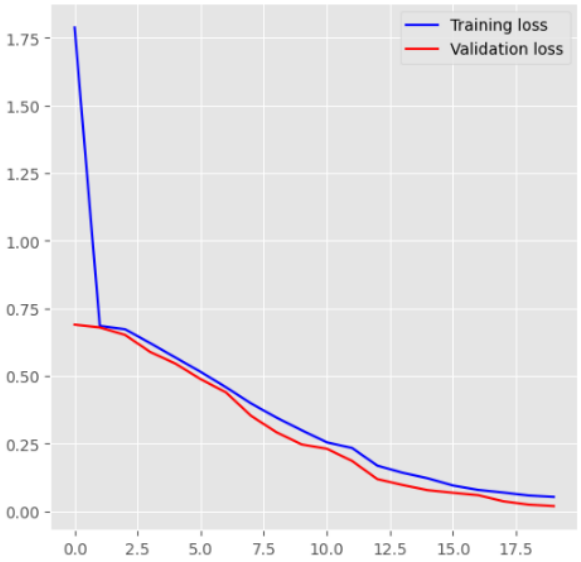
4. Model 4: Resnet-18-34 model.

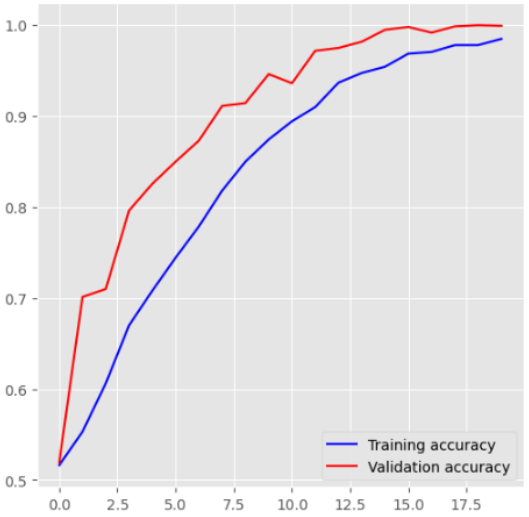
Experimental Framework

The experimental framework involved training and evaluating three different models: model_1, model_2, and model_3. Each model was trained using a dataset, and the training process involved optimizing certain parameters using a specific experimental setup. The following results were obtained for each model

Model 1

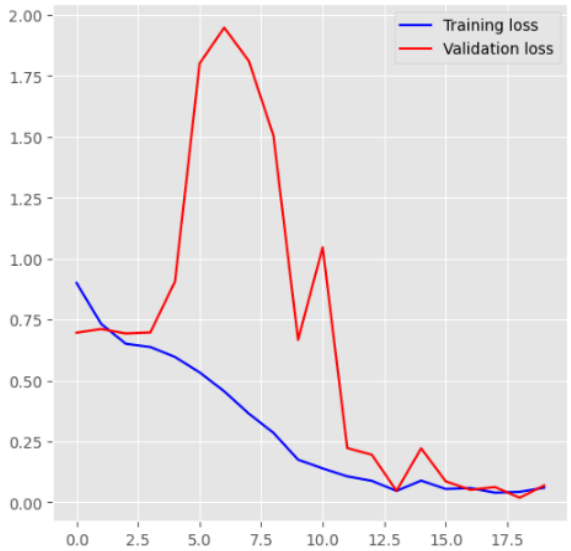
Training Time: 3s per step
Loss: 0.0463
Accuracy: 99.37%

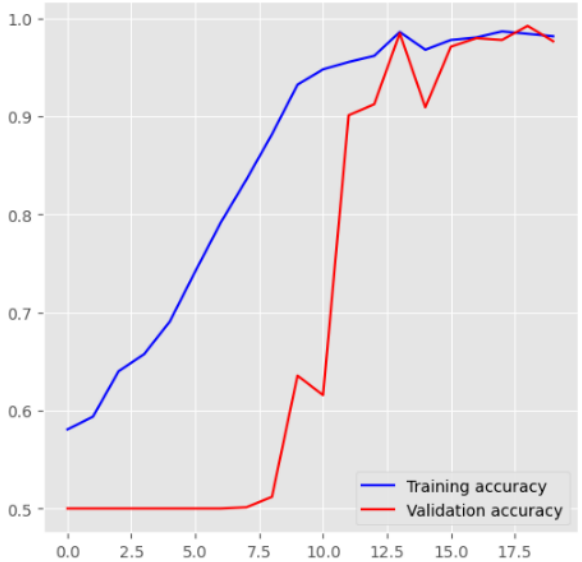




Model 2

Training Time: 3s per step
Loss: 0.0690
Accuracy: 97.69%



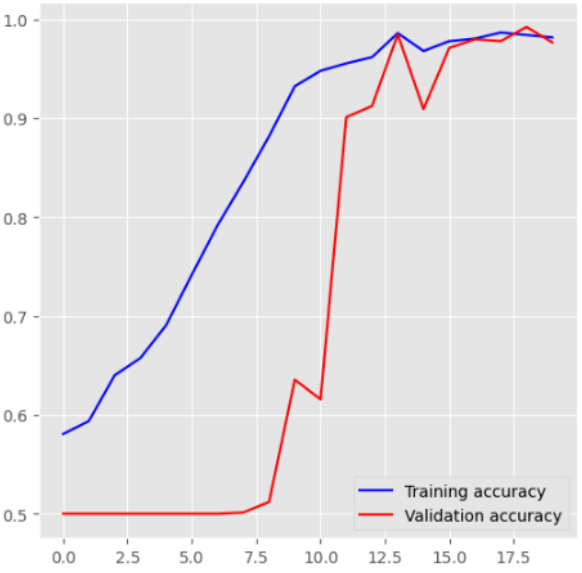


Model 3

Training Time: 5s per step

Loss: 0.4844

Accuracy: 75.94%



Comparative Experimental Results

Below is a table summarizing the key metrics for each model

Model	Loss	Accuracy	Training Time (per step)
Model 1	0.0463	99.37%	3s
Model 2	0.0690	97.69%	3s
Model 3	0.4844	75.94%	5s

Model	ResNet18	Resnet34
Training Configuration		
Optimizer	Adam with lr=0.001	Adam with lr=0.001
Loss Function	CrossEntropyLoss	CrossEntropyLoss
Ages	2	2
Training Results		
Epoch 0	Training Loss - 0.1867	Training Loss - 0.1757
	Verification Loss - 0.0446	Verification Loss - 0.0481
	Accuracy - 98.69	Accuracy - 98.06
Period 1	Training Loss - 0.0821	Training Loss - 0.0568
	Verification Loss - 0.0265	Verification Loss - 0.0102
	Accuracy - 99.12	Accuracy - 99.62
Test Results		
Correct Predictions	389 out of 400	392 out of 400
Accuracy	97.25%	98.00%

Conclusion

The ensemble model performed the best among the tested models, achieving an accuracy of 99.25%.

Model 1 and Model 2 also showed strong performance, with accuracies of 99.37% and 97.69%, respectively.

Model 3 exhibited lower accuracy at 75.94%.

The ResNet models demonstrated impressive accuracy, with ResNet34 slightly outperforming ResNet18 in this scenario.

Further experimentation and fine-tuning of hyperparameters may enhance overall model performance.