

## Summary Report: Analysis of Training Sample Size and Network Choice on Cats vs Dogs Classification

The experiment aimed to find the best sample size for training to enhance performance in an image classification task (cats vs dogs). We looked at two approaches: train a model from scratch and using a pretrained VGG16 model. The goal was to explore how the size of the training dataset and the type of network (model from scratch or pretrained) impact the model's accuracy and overall performance.

**Dataset:** The dataset contains images of cats and dogs. The dataset is divided into training (1000-2500 samples), validation (500 samples), and test sets (500 samples).

**Model:** Two models were used to evaluate the accuracy on test set. First model was trained from scratch and other model which we used was the pretrained model that uses VGG16 architecture on ImageNet. To evaluate both the models we used different training sample sizes.

### Performance Results:

| Model            | Training Sample Size | Test accuracy |
|------------------|----------------------|---------------|
| From Scratch     | 1000 samples         | 0.610         |
| From Scratch     | 2000 samples         | 0.696         |
| From Scratch     | 2500 samples         | 0.687         |
| Pretrained VGG16 | 1000 samples         | 0.961         |
| Pretrained VGG16 | 1500 samples         | 0.960         |

- 1) From Scratch: When the sample size was increases from 1000 to 2000 samples, the model showed clear improvement, its accuracy increases from 0.610 to 0.696. But as we increase the sample size further, the performance began to decrease.
- 2) Pretrained VGG16: With just 1000 samples, pretrained VGG16 model shows very high accuracy of 0.961 and when the sample size is increased to 1500, the accuracy stays nearly the same at 0.960.

### Relationship Between Training Sample Size and Choice of Network:

#### 1) From-Scratch Networks:

The model's effectiveness increases with the size of the training dataset, peaking at 2000 samples, after which performance may plateau or decline. This trend suggests that while a larger dataset can enhance training outcomes from scratch, the network's capacity might limit further improvements as the dataset expands.

## 2) **Pretrained VGG16:**

The pretrained model demonstrates strong performance with just 1000 samples and when the sample size is increased to 1500, it shows minimal improvement. This tells us that pretrained models can perform at a high level with smaller datasets because they build on features, they've already learned from the ImageNet dataset, making them pretty good at handling new tasks even with less data.

## **Conclusion**

The pretrained VGG16 model performs better than the model from scratch, with just 1000 samples it shows higher test accuracy of 0.961. The model from scratch works well on larger dataset but the results are lower than the pretrained model. The pretrained model demonstrates strong performance with just 1000 samples. Thus, the pretrained model performs well with limited dataset and model from scratch works well with larger dataset.