# Assignment 3: Convolution

The aim of consortiums on "deep learning for computer vision" is to classify images efficiently. Consider the idea of Cats and Dogs. There were two ways to arrange Cats & Dogs utilizing convnets. You will investigate how the relationship between training samples and your choice is affected by using pre-trained convnets instead of building your model from scratch.

**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 (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?**

* The test accuracy in the unregularized model is around 75.2 using the ADAM optimizer.
* Beyond a certain epoch, the model is overfitting and may not generalize to the new data.
* Regularized with augmentation and dropout:
* This model performs better, with an accuracy improvement of 79.2.
* 1000 samples are taken for training in each of the models.
* The test accuracy is 82.0 after model fine-tuning, while the loss is 41.31.
* The 1000-person training sample is insufficient for the model to improve accuracy and decrease loss.

**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?**

* I've raised the sample size for this model to 5000.
* After a given time, it is noted that the unregularized model may be overfitting.
* Contrarily, the test accuracy of 0.833 is an improvement over the model with only 1000 training samples.
* Using a regularized model, it has been found that the accuracy is 0.8880, and the loss is 0.2726.
* The regularized model appears to be slightly more accurate than the unregularized model.
* The precision appears to be better than the prior model, but the loss is slightly less.

**3.Now change your training sample so that you achieve better performance than those from Steps1 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.**

* The training size for the unregularized model in this model is 10,000. It has been noted that the accuracy is 0.872 and the loss is 0.4258. It is noted that the loss for the regularized model is 0.2065 and the accuracy is 0.9140. This model is superior to the preceding model in comparison.

**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.**

* The network that has already been trained may be the same as or different from those utilizing the network that has already been trained. Again, employ all optimization methods to achieve the greatest results.
* The network that has already been trained may be the same as or different from those utilizing the network that has already been trained. Again, employ all optimization methods to achieve the greatest results.
* For training, use 5000 samples with regularization. The model's accuracy and loss are observed to be 0.8976 and 0.2429, respectively, after fine-tuning, which is better than the untuned regularized model.
* A sample size of 10,000 with regularization is used for training. After making final adjustments to the model, it was discovered that the accuracy was 0.9380, and the loss was 0.1656. It, so far, outperforms the untuned regularized model. the Complexity of space and time.

**Recommendations:**

* Every model performed well based on the various training sample sizes. Still, the fine-tuned model with greater training samples, dropout, and data augmentation is extremely accurate with a lower loss rate.
* Having more training samples has a disadvantage, though. Each training epoch for a model with 5000 training samples took about 59 seconds, while for a model with 10,000 training samples, it took about 63 seconds. With more complicated training sample models, there is a problem with time and space complexity. These problems are manageable if the right infrastructure is given.
* However, the most effective model is one that has been fine-tuned to use a larger training sample (5000–10000) and a pre–trained network, with test and validation samples remaining the same size of 500.
* It still took a long time, even though I only considered 35 epochs for each model and used GPU computing.
* Although I attempted to run the data augmentation and dropout model for 100 epochs, the collab was only able to run for 35.