# **Machine Learning – Project Proposal**

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**Introduction**

The STL-10 dataset is an image recognition dataset for developing unsupervised feature learning, deep learning, self-taught learning algorithms, inspired by the CIFAR-10 dataset. We selected this data set because of the similarities to the CIFAR-10 dataset, one for which we already had prior experience. In this case there are also 10 total classes however the classes differ from the CIFAR-10 classes. Another reason is that all of the images are already standardized to be the same input size ( 96 x 96 in 3 channels ) which will eliminate a lot of preprocessing steps that are normally taken when doing image classification. Finally, this data set contains a total of 5000 images to train on and 8000 to test on giving us more than enough data to train a deep network.

## **Overview**

* 10 classes: airplane, bird, car, cat, deer, dog, horse, monkey, ship, truck.
* Images are 96x96 pixels, color.
* 500 training images, 800 test images per class.
* 100000 unlabeled images for unsupervised learning. These examples are extracted from a similar but broader distribution of images.

## **Problem**

We are going to do a comparative study of three vastly different neural net architectures and compare the various performances on classifying images in the STL-10 data set. We are going to perform supervised training on the 50,000 labeled images provided. We will be building one Multi-Layer Perceptron model and two Convolution Nets with varying hyper parameters(kernels and padding sizes) as well as differing number of layers. We are doing this in order to make comparisons and examine which type of model performs the best and how varying those hyper-parameters and the depth of the net can change the results. We are planning on implementing this via PyTorch because we are already familiar with building a MLP model from the midterm. In order to have a sufficient background on the models we are building we will follow the two architectures layed out in an *Overview for Convolutional Neural Network Architectures for Deep Learning* PDF for the two Convolution Neural nets while for the MLP we will build a deep fully connected net. (<https://pdfs.semanticscholar.org/64db/333bb1b830f937b47d786921af4a6c2b3233.pdf>). In all of the models, we will be minimizing the cross entropy in order to train the model using the ADAM(Adaptive Moment Estimation). From there, we can then build confusion matrices as well as examine the ROC curves to do further comparison between the models. Additionally we can compare the overall accuracy as well as the individual class accuracies from these confusion matrices.

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## **ML Technique**

1. We will be using Convolutional neural network (CNN) to improve the accuracy of image, where neural networks are learned either to represent data or for solving a classification task.CNN network learns to approximate the kernel feature map on training data.
2. We can also use drop out nodes in multiple/various layers to avoid overfitting and compare the performance.

## **Dataset**

The detailed description and the dataset itself can be found under the following URL: <https://cs.stanford.edu/~acoates/stl10/>

We can divide the data set into - training, testing and validating. (60%, 20%, 10%)