# Laboratory Exercise 3
# FRA 311 Artificial Intelligence for Robotics and Automation
# Object Recognition in Images

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## 1 Objective

In this lab exercise, we will learn how to perform object recognition in images. As you may have learned some image classification techniques from your robotic project, you should be able to apply the knowledge to another image problem. Note that the coding exercise is more extensive than it seems, so start early.

## 2 Overview

The objective of this lab is very simple, to recognize objects in images. You will be working with a well-known dataset called CIFAR-10.

You can learn more about this dataset and download it here:
`https://www.cs.toronto.edu/~kriz/cifar.html`

In the webpage above, they also included a few publications based on CIFAR-10 data, which showed some amazing accuracies. The worst network on the page (a shallow convolutional neural network) can classify images with rouhgly 75% accuracy.

## 3 Load Images and Labels

The dataset webpage in the previous section also provide a simple way to load data from your harddrive using pickle. You may use their function for this exercise.

Construct two numpy arrays for train images and train labels from data_batch_1 to data_batch_5. Then, construct two numpy arrays for test images, and test labels from test_batch file. The original image size is 32 x 32 x 3. You may flatten the arrays so the final arrays are of size 1 x 3072.

# 4 Classify Dogs v.s. Cats

Let's start simple by creating logistic regression model to classify images. We will select only two classes of images for this exercise.

1. From 50,000 train images and 10,000 test images, we want to reduce the data size. Write code to filter only dog images (label = 3) and cat images (label = 5).

2. Create a logistic regression model to classify cats and dogs. Report your accuracy.

# 5 The Real Challenge

The majority of your score for this lab will come from this real challenge. You are going to construct a neural network model to classify 10 classes of images from CIFAR-10 dataset. You will get half the credits for this one if you complete the assignment, and will get another half if you can exceed the target accuracy of 75%. (You may use any combination of sklearn, opencv, or tensorflow to do this exercise).

Design at least 3 variants of neural network models. Each model should have different architectures. (Do not vary just a few parameters, the architecture of the network must change in each model). In your notebook, explain your experiments in details and display the accuracy score for each experiment.