

The American University in Cairo

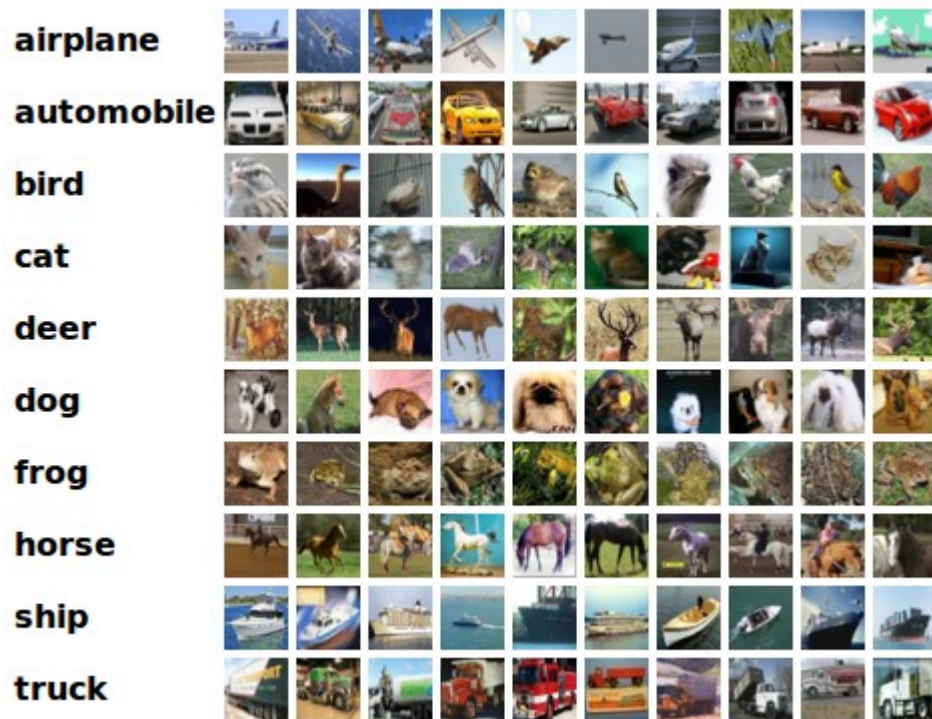
Department of Computer Science and Engineering

CSCE 4930 – Practical Machine Deep Learning

Dr. Mohamed Moustafa	Assignment 1 [10%]	Spring 2017
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Part 1

Implement a k nearest neighbor (k-NN) classifier that can **best** recognize the 10 different classes in the CIFAR-10 dataset.



Details:

- Download the dataset from <http://www.cs.toronto.edu/~kriz/cifar.html>
The CIFAR-10 dataset consists of 60000 32x32 colour images in 10 classes, with 6000 images per class. There are 50000 training images and 10000 test images.
- Train your best k-NN using the 50000 training set.
- Using 5-crossfold validation technique, find the best “k” for this dataset. Answer also the following:
 - Is L1 distance better than L2 in this problem?
 - Is grayscale image space better than the original color space?

- d) Use the 10000 testing set to report the accuracy of your classifier.

Part 2

Implement a linear least square classifier (LLS) that can **best** recognize the 10 different classes in the CIFAR-10 dataset.

You are expected to deliver: (one file: `first.lastname.assignment1.zip`)

1. source code of your implementation. **[3%]**
2. short report containing:
 - a) a plot of cross-validation accuracy (Y axis) versus number of neighborhood 'k' (X axis) showing the best chosen 'k'. **[1%]**
 - b) For the best chosen 'k' in a), show how did you answer: **[2%]**
 - Is L1 distance better than L2?.
 - Is grayscale image space better than the original color space?
 - c) Describe how did you calculate W for the LLS classifier **[1%]**
 - d) Correct Classification Rate of each of the 10 classes separately. CCR_n is the ratio of the number of correctly classified images in class n divided by the total number of test images in class n (which is 1000). Report CCR_n for k-NN versus LLS classifiers. **[1%]**
 - e) Average Correct Classification Rate (ACCR) using the 10000 testing set. ACCR is the number of correctly classified images divided by the total number of testing images (which is 10000). Report ACCR for k-NN versus LLS classifiers. **[1%]**
 - f) How do you check whether you have overfit the data for either the k-NN or the LLS classifiers? **[1%]**
 - g) Can you design a nonlinear least square classifier that is more accurate than the linear one you trained? If yes, show its ACCR. **[Bonus 1%]**
 - Human ACCR for this dataset is known to be ~ 0.94 ¹
 - if you beat the 0.9553 record² you get an A in the course :)

¹<http://karpathy.github.io/2011/04/27/manually-classifying-cifar10/>

²<https://www.kaggle.com/c/cifar-10/leaderboard/public>