Computer Vision CSCI-GA.2271-001

Assignment 0
Due date: Monday September 18th 2017

September 7, 2017

1 Introduction

The purpose of this assignment is two-fold: (i) to ensure that you have the pre-requisite knowledge necessary for the rest of the course and (ii) to help you get experience with PyTorch, the language we will be using in the course.

To install PyTorch, follow the directions at `http://pytorch.org`. This also contains a number of tutorials that it might be helpful to work through.

To turn in the assignment, please zip your code into a file named `lastname_firstname_assign1.zip` and email it to the grader Utku Evci (`ue225@nyu.edu`), cc'ing me (`fergus@cs.nyu.edu`).

2 Whitening Data

Pre-processing is an important part of computer vision and machine learning algorithms. One common approach is known as *whitening* in which the data is transformed so that it has zero mean and is decorrelated.

You should implement a PyTorch function that:

- Load up the 2D dataset from the file `assign1_data.py`.
- Visualize it by making a 2D scatter plot (e.g. using `matplotlib`).
- Translates the data so that it has zero mean (i.e. is centered at the origin).
- Decorrelates the data so that the data covariance is the identity matrix.
- Plot the whitened data.
- As a comment in your code, discuss the dependencies present in the whitened data.

3 Fitting a 1D function with a simple neural net

In PyTorch, generate the function $y = cos(x)$ over the interval $-\pi \leq x \leq \pi$, at discrete intervals of 0.01. Adapting the examples from `http://pytorch.org/tutorials/beginner/pytorch_with_examples.html`, implement a neural net that regresses this function. I.e. takes as input x and produces an estimate $\hat{y}$, where $\|y - \hat{y}\|_2$ is minimized. The network should have a single hidden layer with 10 units and a single $tanh()$ non-linearity. Make a plot of the true function y, with the network output $\hat{y}$ before and after training overlaid (please use different colors for each).