



Deep Learning
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Python and Caffe Introduction

In this second LAB, you will experiment with the Python programming language and Caffe. Caffe is a framework for deep learning written mainly in C++. It can be accessed from the command line, or through Python or MATLAB. We will use the Python interface. You will need to read the file GettingStartedPyCharm.pdf on the D2L site to learn how to set up PyCharm for debugging python code.

Python Basics

You will need to go through parts of the Python tutorial <https://docs.python.org/2/tutorial/> to find answers to the following questions.

1. What is an "immutable" object? Give some examples.
2. What is a "module" in Python?
3. What is a method?
4. What is a class?
5. Explain how indentation is used in Python
6. Identify differences between the interactive interpreter and Pycharm debugger.
7. How do you execute a Python program from the command line?

Deliverables

1. For all parts below, include the results into one PDF file, and upload it to the dropbox on D2L. Include all program listings, plots, command line printouts, discussion, etc.
2. Hand in the answers to the questions in the Python Basics section.
3. Write a Python function to solve Problem 3 on Homework 1. (Use classes, methods and modules.) Perform steepest descent until the magnitude of the gradient is less than 0.01, starting with the initial weight and bias equal to zero. Use pyplot (see http://matplotlib.org/api/pyplot_api.html for instructions) to plot the sum squared error versus the iteration number. (You will need a line `import matplotlib.pyplot as plt`.) Also, plot the final network response on the same plot with the target values versus the input as `p` ranges from -1.5 to 1.5 in steps of 0.1. Plot the network response as a continuous line and the targets with a '+'.
4. Download the files `Square_diamond_Net.prototxt`, `Square_diamond_solver.prototxt`, `SquareDiamond_Batch.py`, `SquareDiamondLMDB.py` and `SquareDiamond.py`. First, run `SquareDiamondLMDB.py` to create the data set. (For all of the programs, you may need to adjust `my_root` to the correct path on your computer.) Then, run the other two Python programs to verify that they are working correctly. These represent two different ways to train a convolution network. They both train networks to learn to identify squares and diamonds. Modify the `.prototxt` files to change the learning rate and momentum to find out what value will produce the fastest convergence.
5. Modify the `prototxt` files so that the network has two convolution layers and two pooling layers, to make a five layer network. Use batch training. Compare the performance with the original three layer network. Investigate the trained kernels in both layers, and try to explain how the two convolution layers are working together.