Deep Learning
M Hagan, A Jafari
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TensorFlow Introduction

In this fourth LAB, you will experiment with the Theano. Theano is a framework for deep learning that can be accessed through Python. You will need to read the file GettingStartedPyCharm.pdf on the D2L site to learn how to set up PyCharm for use with Theano.

Theano Basics

You will need to go through parts of the Theano documentation `https://media.readthedocs.org/pdf/theano/latest/theano.pdf` to find answers to the following questions.

1. What are the arguments to the Theano `function` command.
2. How do you set a default value for a function argument?
3. What are `shared` variables used for?
4. Does the Theano `grad` function return numpy arrays, or symbolic Theano variables?
5. Is it possible to enforce the shape of a Theano variable when building a graph?
6. What does ”broadcasting” mean in Theano?

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 Theano Basics section.

3. Download the file `one_layer_theano.py` from D2L. Debug the program in PyCharm, stepping line by line through the code. Explain what the program is doing.

4. Modify `one_layer_theano.py` to solve Problem 3 on Homework 1. Perform steepest descent, 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 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 '+'.

5. Read the restricted Boltzmann machine tutorial at http://deeplearning.net/tutorial/rbm.html. Download the file associated with that tutorial at http://deeplearning.net/tutorial/code/rbm.py. Debug the program in PyCharm. Reproduce the results described in the tutorial.