

Homework 1

TAs

September 2015

1 Instructions

For this lab, we would like you to write your own implementations; do not use any toolboxes. We recommend that you use MATLAB, but if you insist, you're welcome to use any other programming language.

- Send your handin in one zip file named yourandrewid.tar.gz (or .zip)
- Submit your code; please use logical file names relating to the assignments.
- If you do not use MATLAB, or if it is not self-explanatory, please provide a README file with instructions on how to execute your code.
- Submit one pdf file with all your answers, figures etc.
- Submit your homework to the homework directory in AWS using the following command or FTP tools if you are windows users

```
scp -i 11785_homework.pem yourandrewid.tar.gz  
student@ec2-54-209-64-139.compute-1.amazonaws.com:/home/ubuntu/HW1/
```

please avoid submitting large files.

Released: Fri, 2015/09/11

Due: Wed, 2015/09/23

2 Part1

Implement Back-propagation with sigmoid activation function.

3 Part 2

Use your code from Part1 to explore the width and depth of multi-layer feed-forward neural networks.

- Implement a single-hidden-layer multi-layer Perceptron with different hidden nodes (less than 8) to classify the example shapes including a circle, a diamond and a random shape (RShape) in the attached figs.mat file. Report the best accuracy you can get with the constrained networks. Visualize the testing outputs of the hidden nodes and output nodes using colormap (heatmap). For hidden nodes, please visualize in a log space; for output nodes, please also visualize the prediction results.
- Implement a multi-layer Perceptron to classify the random shape (RShape) and disconnected random shape (DRShape) in the attached figs.mat file. Explore the network structure (depth and width) to achieve best testing accuracy you can get. Report the testing accuracy. Visualize the testing outputs of the 4 random chosen hidden nodes and output nodes using colormap (heatmap). For hidden nodes, please visualize in a log space; for output nodes, please also visualize the prediction results.