April 15th, 2019

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Assignment 4 Report

MULTI-LAYER PERCEPTRON RESULTS

Evaluate using randomly initialized weights:
Train Loss: 0.5105 Valid Loss: 0.5128 Train Acc: 0.4957 Valid Acc: 0.4825

----------Sample values for debugging:----------

z_s[1][0:4]=
[10.08685914 0.40671609 8.98672967 -6.87494907]

a_s[-1][0:4]=
[0.3495267]

d_w[-1][0][0:4]=
[0.14788401 0.0887785 0.14787168 0.00015266]

d_b[0][0:4]=
[3.19604823e-06 3.26817897e-04 1.98406730e-05 -1.78973802e-04]

W[0][0][0:4]
[0.47143516 -1.19097569 1.43270697 -0.3126519]

B[0][0:4]
[0.13423762 -0.475063 0.11270962 0.03957573]

Epoch # 1/40Train Loss: 0.2345 Valid Loss: 0.2397 Train Acc: 0.8433 Valid Acc: 0.8410
Epoch # 2/40Train Loss: 0.1981 Valid Loss: 0.2059 Train Acc: 0.8729 Valid Acc: 0.8605
Epoch # 3/40Train Loss: 0.1760 Valid Loss: 0.1826 Train Acc: 0.8922 Valid Acc: 0.8850
Epoch # 4/40Train Loss: 0.1542 Valid Loss: 0.1639 Train Acc: 0.9107 Valid Acc: 0.8930
Epoch # 5/40Train Loss: 0.1379 Valid Loss: 0.1503 Train Acc: 0.9201 Valid Acc: 0.8945
Epoch # 6/40Train Loss: 0.1256 Valid Loss: 0.1389 Train Acc: 0.9273 Valid Acc: 0.9025
Epoch # 7/40Train Loss: 0.1178 Valid Loss: 0.1303 Train Acc: 0.9312 Valid Acc: 0.9105
Epoch # 8/40Train Loss: 0.1104 Valid Loss: 0.1239 Train Acc: 0.9356 Valid Acc: 0.9155
Epoch # 9/40Train Loss: 0.1042 Valid Loss: 0.1176 Train Acc: 0.9386 Valid Acc: 0.9220
Epoch # 10/40 Train Loss: 0.0986 Valid Loss: 0.1127 Train Acc: 0.9420 Valid Acc: 0.9270

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SINGLE LAYER PERCEPTRON RESULTS

Evaluate using randomly initialized weights:
Train Loss: 0.4276 Valid Loss: 0.4532 Train Acc: 0.5755 Valid Acc: 0.5505

----------Sample values for debugging:----------

z_s[1][0:4]=
[7.88349796]

a_s[-1][0:4]=
[0.99962323]

d_w[-1][0][0:4]=
[0. 0. 0. 0.]

d_b[0][0:4]=
[-1.41902384e-07]

W[0][0][0:4]
[0.47143516 -1.19097569 1.43270697 -0.3126519]

B[0][0:4]
[2.33759847]

Epoch # 1/40Train Loss: 0.1570 Valid Loss: 0.1678 Train Acc: 0.8517 Valid Acc: 0.8405
Epoch # 2/40Train Loss: 0.1394 Valid Loss: 0.1515 Train Acc: 0.8710 Valid Acc: 0.8535
Epoch # 3/40Train Loss: 0.1302 Valid Loss: 0.1433 Train Acc: 0.8813 Valid Acc: 0.8640
Epoch # 4/40Train Loss: 0.1254 Valid Loss: 0.1388 Train Acc: 0.8843 Valid Acc: 0.8670
Epoch # 5/40Train Loss: 0.1223 Valid Loss: 0.1344 Train Acc: 0.8878 Valid Acc: 0.8720
Epoch # 6/40Train Loss: 0.1202 Valid Loss: 0.1313 Train Acc: 0.8897 Valid Acc: 0.8750
Epoch # 7/40Train Loss: 0.1186 Valid Loss: 0.1293 Train Acc: 0.8920 Valid Acc: 0.8790
Epoch # 8/40Train Loss: 0.1168 Valid Loss: 0.1277 Train Acc: 0.8947 Valid Acc: 0.8780
Epoch # 9/40Train Loss: 0.1150 Valid Loss: 0.1264 Train Acc: 0.8971 Valid Acc: 0.8805
Epoch # 10/40 Train Loss: 0.1134 Valid Loss: 0.1254 Train Acc: 0.9005 Valid Acc: 0.8840

Comparison
As shown by the rows highlighted by the red boxes, both the training and valid accuracies are higher when using a multi-layer perceptron over a single perceptron. This means that higher accuracy can be obtained by using this class of feedforward neural network.

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Feedback
This course has been informative overall. I would have, however, preferred that Professor Libbrecht had printable/downloadable lecture notes prepared ahead of time (maybe with some fill in the blanks scattered throughout the slides to encourage attendance). This is because I found that a lot of the content that he mentioned in class that I felt was important, wasn't written down, hence I would either rush to make a note of what he said in the moment, or have to go back to that exact moment in the video lectures to add that content to my notes. I think prepared lecture notes would really benefit other students in the future.

Hours spent on assignment: 25