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Assignment Number 3
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CMPT 496L-111: Deep Learning w Tensor Flow
Due: 2017-11-27

Assignment 3

Exercise 1a.

Vary the number of hidden units exponentially as follows; if your last name starts with a letter between A and K vary the number of neurons between 32, 64, 128, 256, and 512; in three layers only, for a total of 10 experiments. ***If your last name has any other letter (L to Z), you will do two layers and will vary the number of neurons between 32, 64, 128, 256, 512, 1024; for a total of 15 experiments.*** *Please include tables and/or plots to support your answers.*

Response.

Neuron # Combination (Layer 1, Layer 2)	Training Error	Validation Error	Testing Error
(64, 32)	0.1667	0.6500	0.7533
(128, 32)	0.0667	0.6667	0.7167
(128, 64)	0.0667	0.6333	0.7833
(256, 32)	0.0333	0.6833	0.7333
(256, 64)	0.0500	0.7167	0.7167
(256, 128)	0.0333	0.5500	0.7167
(512, 32)	0.0167	0.6167	0.6667
(512, 64)	0.0167	0.7667	0.7500
(512, 128)	0.0000	0.7500	0.7833
(512, 256)	0.0167	0.7500	0.7667
(1024, 32)	0.2333	0.6500	0,7000
(1024, 64)	0.0500	0.6667	0.7000
(1024, 128)	0.1833	0.6833	0.6667
(1024, 256)	0.0333	0.7500	0.6833
(1024, 512)	0.0500	0.7500	0.7333

Exercise 1b.

Which combination of neurons gave you the best testing accuracy? Why do you think that is?

Response.

The Neuron # Combination that gave us the best results over all was (512, 32).

- Training Error: 0.0167
- Validation Error: 0.6167
- Testing Error: 0.6667

While significant conclusions cannot be drawn from this data, due to the fact that our data set is quite small and the results seen above are most likely the result of the ensuing over-fitting that occurs in such a case, most likely occurring around the 400 epoch mark. We can; however, see that there is not a significant change, for better or for worse, in all three error calculations. In this case it is also safe to assume that the scope of the problem is is not large enough for the number of neurons present.

Exercise 2a.

Using the combination of neurons that gave you the best test accuracy, vary the learning rate for each layer three times using different combinations, you may use any learning rate between [0.1 and 0.00001].

Response.

Learning Rate Combination	Training Error	Validation Error	Testing Error
(1, 1)	N/A	N/A	N/A
(01, 01)	N/A	N/A	N/A
(0.1, 0.001)	N/A	N/A	N/A
(0.01, 0.01)	0.1833	0.6500	0.6500
(0.01, 0.001)	0.0167	0.7333	0.6167
(0.001, 1)	N/A	N/A	N/A
(1, 0.001)	N/A	N/A	N/A
(0.001, 0.1)	0.4667	0.7667	0.7833
(0.001, 0.01)	0.3333	0.65000	0.7167
(0.0001, 0.0001)	0.0000	0.6500	0.8000

Exercise 2b.

Which combination of neurons gave you the best testing accuracy? Why do you think that is?

Response.

The Learning Rate Combination that gave us the best results over all was (0.01, 0.001).

- Training Error: 0.0167
- Validation Error: 0.7333
- Testing Error: 0.6167

Similarly with the first table and the conclusions drawn from it, the results above may be suffering from over-fitting due to the small data set. N/A indicates that the test used up too much memory and crashed or possibly because of loss divergence due to the learning rate being too high. It would seem that a relatively low learning-rate combination will result in the best testing result, this is most likely due to the the Auto Encoder having more time to analyze the testing images, without using too many heuristics. Juggling the number of neurons and learning rate in this particular case may not be as significant as in the previous homework, as the fault most likely lies with the data set.
