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Assignment 5

I trained the convoluted neural network on 40 epochs and a learning rate of .0001 using the CPU and GPU to see how the time and accuracy differed:

Device	Test Loss	Test Accuracy	Time (seconds)
CPU	.006659	88.18	630.989
GPU	.006655	88.25	273.598

Here are the confusion matrices for the runs with the CPU and the GPU:

CPU	GPU
<pre> 0 0 1 2 3 4 5 6 7 8 9 0 951 0 15 2 1 12 14 2 11 12 1 0 1090 1 7 3 8 10 24 15 8 2 2 9 897 20 3 7 25 30 10 7 3 7 8 12 907 0 74 1 3 36 13 4 1 1 19 1 872 32 14 8 13 36 5 2 1 0 20 0 706 22 0 34 6 6 7 5 29 2 27 16 866 1 12 1 7 1 0 17 16 2 1 1 886 16 36 8 9 21 42 23 5 27 5 9 812 17 9 0 0 0 12 69 9 0 65 15 873 </pre>	<pre> 0 0 1 2 3 4 5 6 7 8 9 0 951 0 16 2 1 11 14 2 11 12 1 0 1091 1 7 3 8 10 24 14 8 2 2 8 893 20 3 6 23 29 8 7 3 4 7 11 902 0 71 1 3 28 13 4 1 1 19 1 871 30 13 8 12 36 5 3 2 2 24 0 715 25 0 37 8 6 8 5 30 2 27 17 866 1 12 1 7 1 0 17 17 2 1 1 885 15 36 8 10 21 43 23 5 25 5 9 823 17 9 0 0 0 12 70 8 0 67 14 871 </pre>

I found that the GPU was significantly faster than the CPU, but it also had similar accuracy, which differed from what I expected from the assignment instructions. This was a nice surprise to me, and I had no trouble with the **torch.manual_seed(0)** line in cnn.py.

Here's what I found after running the SLP, MLP, and CNN each for 500 epochs and a learning rate of .0001 (256 hidden units for the MLP). I ran them all with the GPU:

Type	Test Loss	Test Accuracy
SLP	.005909	89.54
MLP	.004692	91.00
CNN	.001032	97.56

And here are the confusion matrices:

SLP:

	0	1	2	3	4	5	6	7	8	9
0	959	0	13	6	1	15	16	3	10	14
1	0	1103	7	1	4	6	3	19	10	8
2	2	2	886	18	5	6	7	30	11	7
3	3	4	19	897	1	43	2	4	30	11
4	0	1	16	1	903	15	14	11	9	48
5	1	2	0	32	1	729	17	0	26	15
6	7	4	19	6	12	17	894	0	12	0
7	1	0	21	15	1	10	1	914	14	25
8	7	19	43	22	8	41	4	4	837	6
9	0	0	8	12	46	10	0	43	15	875

MLP:

	0	1	2	3	4	5	6	7	8	9
0	958	0	11	4	1	12	14	4	8	11
1	0	1107	5	1	3	3	3	13	8	8
2	4	2	909	22	5	3	4	27	8	4
3	2	3	16	911	1	42	1	5	26	11
4	0	1	15	0	914	12	16	9	10	41
5	4	2	2	26	1	759	15	0	27	13
6	7	4	13	3	11	17	902	0	12	0
7	1	1	15	15	2	9	1	935	12	19
8	4	15	39	23	7	28	2	4	852	5
9	0	0	7	5	37	7	0	31	11	897

CNN:

	0	1	2	3	4	5	6	7	8	9
0	972	0	3	1	1	3	5	1	7	5
1	0	1125	5	0	0	0	3	4	0	7
2	1	4	1009	0	2	0	0	15	3	0
3	0	0	3	993	0	5	1	3	4	4
4	0	0	2	0	966	0	3	1	3	6
5	0	0	0	4	0	879	2	0	1	4
6	2	0	0	0	1	3	941	0	3	0
7	1	0	2	5	1	1	0	996	2	4
8	4	6	8	6	4	1	3	1	946	3
9	0	0	0	1	7	0	0	7	5	976

In conclusion, I found that the CNN has a much higher accuracy and lower loss than the MLP and even more so than the SLP.