Letter A

Training Data
LR - 0.1
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,196,1

```
starting batch 1/10
>epoch=1 error=6.453 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=2 error=4.854 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=3 error=3.015 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=4 error=2.301 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=5 error=2.073 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=6 error=1.973 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=7 error=1.862 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=8 error=1.621 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=9 error=1.152 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=10 error=0.979 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
batch 1 complete with sum error 0.979
starting batch 2/10
>epoch=1 error=2.161 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=2 error=1.508 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=3 error=1.235 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=4 error=1.140 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=5 error=1.104 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=6 error=1.083 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=7 error=1.070 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=8 error=1.060 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=9 error=1.052 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=10 error=1.047 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
batch 2 complete with sum error 1.047
starting batch 3/10
>epoch=1 error=4.194 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=2 error=3.799 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=3 error=2.799 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=4 error=1.669 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=5 error=0.962 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=6 error=0.476 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=7 error=0.304 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=8 error=0.208 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=9 error=0.160 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=10 error=0.132 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
batch 3 complete with sum error 0.132
starting batch 4/10
>epoch=1 error=2.622 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=2 error=1.718 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=3 error=1.053 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=4 error=0.616 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=5 error=0.336 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=6 error=0.207 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=7 error=0.153 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=8 error=0.124 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=9 error=0.105 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=10 error=0.091 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
batch 4 complete with sum error 0.091
starting batch 5/10
>epoch=1 error=3.081 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=2 error=2.613 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=3 error=2.070 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=4 error=1.394 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=5 error=1.145 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=6 error=1.088 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=7 error=1.061 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=8 error=1.044 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=9 error=1.030 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=10 error=1.018 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
batch 5 complete with sum error 1.018
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starting batch 6/10
>epoch=1 error=3.642 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=2 error=2.560 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=3 error=1.945 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=4 error=1.477 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=5 error=1.258 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=6 error=1.152 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=7 error=1.111 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=8 error=1.089 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=9 error=1.075 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=10 error=1.065 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
batch 6 complete with sum error 1.065
starting batch 7/10
>epoch=1 error=3.377 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=2 error=3.126 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=3 error=2.115 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=4 error=0.952 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=5 error=0.461 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=6 error=0.242 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=7 error=0.166 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=8 error=0.132 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=9 error=0.111 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=10 error=0.097 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
batch 7 complete with sum error 0.097
starting batch 8/10
>epoch=1 error=2.001 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=2 error=1.362 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=3 error=0.522 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=4 error=0.271 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=5 error=0.170 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=6 error=0.126 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=7 error=0.102 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=8 error=0.086 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=9 error=0.075 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=10 error=0.066 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
batch 8 complete with sum error 0.066
starting batch 9/10
>epoch=1 error=0.759 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=2 error=0.424 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=3 error=0.175 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=4 error=0.086 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=5 error=0.065 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=6 error=0.053 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=7 error=0.045 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=8 error=0.040 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=9 error=0.036 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=10 error=0.033 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
batch 9 complete with sum error 0.033
starting batch 10/10
>epoch=1 error=1.898 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=2 error=1.718 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=3 error=1.474 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=4 error=0.965 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=5 error=0.416 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=6 error=0.170 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=7 error=0.085 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=8 error=0.064 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=9 error=0.052 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
>epoch=10 error=0.045 -------- letter=A lr=0.10 sample size=20 layers=[784,196,1]
batch 10 complete with sum error 0.045
accuracy: 83.30% correct/total: 833/1000
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Training Data
LR - 0.4
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,196,1

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starting batch 1/10
>epoch=1 error=11.006 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=2 error=9.814 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=3 error=1.184 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=4 error=2.392 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=5 error=1.144 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=6 error=0.732 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=7 error=0.454 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=8 error=0.200 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=9 error=0.008 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=10 error=0.007 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
batch 1 complete with sum error 0.007
starting batch 2/10
>epoch=1 error=3.525 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=2 error=3.710 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=3 error=2.885 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=4 error=1.542 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=5 error=0.462 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=6 error=0.359 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=7 error=0.012 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=8 error=0.009 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=9 error=0.008 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=10 error=0.007 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
batch 2 complete with sum error 0.007
starting batch 3/10
>epoch=1 error=1.792 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=2 error=3.767 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=3 error=1.355 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=4 error=0.638 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=5 error=0.823 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=6 error=1.113 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=7 error=0.443 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=8 error=0.002 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=9 error=0.002 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=10 error=0.001 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
batch 3 complete with sum error 0.001
starting batch 4/10
>epoch=1 error=2.118 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=2 error=2.401 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=3 error=1.068 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=4 error=0.315 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=5 error=0.157 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=6 error=0.008 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=7 error=0.007 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=8 error=0.006 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=9 error=0.006 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=10 error=0.006 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
batch 4 complete with sum error 0.006
starting batch 5/10
>epoch=1 error=1.611 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=2 error=1.190 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=3 error=0.056 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=4 error=0.020 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=5 error=0.014 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=6 error=0.011 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=7 error=0.009 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=8 error=0.008 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=9 error=0.007 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=10 error=0.007 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
batch 5 complete with sum error 0.007
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batch 5 complete with sum error 0.007
starting batch 6/10
>epoch=1 error=2.532 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=2 error=1.587 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=3 error=1.078 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=4 error=1.020 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=5 error=1.015 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=6 error=1.012 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=7 error=1.010 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=8 error=1.009 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=9 error=1.007 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=10 error=1.006 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
batch 6 complete with sum error 1.006
starting batch 7/10
>epoch=1 error=2.489 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=2 error=2.189 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=3 error=1.005 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=4 error=1.004 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=5 error=1.003 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=6 error=1.003 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=7 error=1.002 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=8 error=1.002 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=9 error=1.002 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=10 error=1.002 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
batch 7 complete with sum error 1.002
starting batch 8/10
>epoch=1 error=3.251 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=2 error=1.015 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=3 error=0.227 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=4 error=0.002 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=5 error=0.002 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=6 error=0.002 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=7 error=0.002 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=8 error=0.002 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=9 error=0.002 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=10 error=0.002 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
batch 8 complete with sum error 0.002
starting batch 9/10
>epoch=1 error=2.067 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=2 error=0.522 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=3 error=0.030 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=4 error=0.023 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=5 error=0.019 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=6 error=0.016 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=7 error=0.014 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=8 error=0.013 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=9 error=0.011 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=10 error=0.010 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
batch 9 complete with sum error 0.010
starting batch 10/10
>epoch=1 error=1.293 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=2 error=1.170 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=3 error=0.988 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=4 error=0.981 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=5 error=0.967 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=6 error=0.924 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=7 error=0.638 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=8 error=0.109 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=9 error=0.009 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
>epoch=10 error=0.008 -------- letter=A lr=0.40 sample size=20 layers=[784,196,1]
batch 10 complete with sum error 0.008
accuracy: 73.40% correct/total: 734/1000
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Training Data
LR - 0.2
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,196,1

```
starting batch 1/10
>epoch=1 error=7.366 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=2 error=4.808 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=3 error=3.829 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=4 error=1.882 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=5 error=0.965 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=6 error=0.691 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=7 error=0.104 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=8 error=0.074 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=9 error=0.059 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=10 error=0.050 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
batch 1 complete with sum error 0.050
starting batch 2/10
>epoch=1 error=3.236 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=2 error=2.583 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=3 error=1.578 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=4 error=1.152 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=5 error=1.033 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=6 error=1.018 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=7 error=1.008 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=8 error=0.998 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=9 error=0.988 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=10 error=0.974 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
batch 2 complete with sum error 0.974
starting batch 3/10
>epoch=1 error=2.262 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=2 error=1.731 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=3 error=1.496 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=4 error=1.112 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=5 error=0.972 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=6 error=0.786 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=7 error=0.145 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=8 error=0.050 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=9 error=0.042 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=10 error=0.037 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
batch 3 complete with sum error 0.037
starting batch 4/10
>epoch=1 error=0.875 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=2 error=0.809 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=3 error=0.278 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=4 error=0.083 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=5 error=0.060 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=6 error=0.048 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=7 error=0.041 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=8 error=0.036 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=9 error=0.032 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=10 error=0.029 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
batch 4 complete with sum error 0.029
starting batch 5/10
>epoch=1 error=8.337 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=2 error=3.867 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=3 error=2.656 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=4 error=0.818 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=5 error=0.291 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=6 error=0.110 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=7 error=0.071 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=8 error=0.055 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=9 error=0.046 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=10 error=0.040 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
batch 5 complete with sum error 0.040
```

```
starting batch 6/10
>epoch=1 error=3.196 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=2 error=2.274 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=3 error=1.170 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=4 error=0.395 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=5 error=0.201 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=6 error=0.035 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=7 error=0.028 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=8 error=0.024 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=9 error=0.021 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=10 error=0.018 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
batch 6 complete with sum error 0.018
starting batch 7/10
>epoch=1 error=1.148 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=2 error=0.172 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=3 error=0.018 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=4 error=0.016 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=5 error=0.014 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=6 error=0.013 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=7 error=0.011 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=8 error=0.011 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=9 error=0.010 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=10 error=0.009 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
batch 7 complete with sum error 0.009
starting batch 8/10
>epoch=1 error=1.854 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=2 error=1.391 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=3 error=1.155 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=4 error=1.053 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=5 error=1.037 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=6 error=1.030 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=7 error=1.025 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=8 error=1.022 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=9 error=1.019 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=10 error=1.017 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
batch 8 complete with sum error 1.017
starting batch 9/10
>epoch=1 error=1.905 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=2 error=1.590 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=3 error=1.193 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=4 error=1.017 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=5 error=1.005 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=6 error=0.996 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=7 error=0.986 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=8 error=0.972 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=9 error=0.949 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=10 error=0.900 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
batch 9 complete with sum error 0.900
starting batch 10/10
>epoch=1 error=1.893 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=2 error=0.912 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=3 error=0.764 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=4 error=0.103 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=5 error=0.039 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=6 error=0.030 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=7 error=0.024 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=8 error=0.020 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=9 error=0.018 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
>epoch=10 error=0.016 -------- letter=A lr=0.20 sample size=20 layers=[784,196,1]
batch 10 complete with sum error 0.016
accuracy: 88.80% correct/total: 888/1000
```

Training Data
LR - 0.2
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,392,196,98,1

```
starting batch 1/10
>epoch=1 error=3.864 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=2.579 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=1.648 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=1.157 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.531 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.210 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.137 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.101 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.081 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.067 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
batch 1 complete with sum error 0.067
starting batch 2/10
>epoch=1 error=3.472 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=2.935 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=1.433 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.734 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.443 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.279 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.168 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.114 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.088 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.073 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
batch 2 complete with sum error 0.073
starting batch 3/10
>epoch=1 error=1.845 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=1.185 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.412 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.171 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.095 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.072 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.059 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.051 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.045 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.041 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
batch 3 complete with sum error 0.041
starting batch 4/10
>epoch=1 error=1.728 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=1.314 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.564 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.278 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.108 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.076 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.060 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.051 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.044 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.039 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
batch 4 complete with sum error 0.039
starting batch 5/10
>epoch=1 error=1.161 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=0.544 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.228 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.103 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.065 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.050 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.041 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.036 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.031 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.028 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
batch 5 complete with sum error 0.028
```

```
starting batch 6/10
>epoch=1 error=1.111 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=0.838 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.278 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.131 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.074 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.055 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.045 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.038 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.034 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.030 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
batch 6 complete with sum error 0.030
starting batch 7/10
>epoch=1 error=1.643 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=0.827 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.184 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.034 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.025 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.022 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.019 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.017 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.016 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.015 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
batch 7 complete with sum error 0.015
starting batch 8/10
>epoch=1 error=1.537 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=0.284 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.081 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.036 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.029 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.025 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.022 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.019 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.018 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.016 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
batch 8 complete with sum error 0.016
starting batch 9/10
>epoch=1 error=0.670 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=0.204 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.033 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.026 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.022 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.020 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.018 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.016 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.015 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.014 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
batch 9 complete with sum error 0.014
starting batch 10/10
>epoch=1 error=1.095 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=0.452 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.262 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.043 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.036 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.031 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.028 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.025 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.023 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.021 -------- letter=A lr=0.20 sample size=20 layers=[784,392,196,98,1]
batch 10 complete with sum error 0.021
accuracy: 84.70% correct/total: 847/1000
```

Training Data
LR - 0.1
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,392,196,98,1

```
starting batch 1/10
>epoch=1 error=4.092 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=2.085 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=1.200 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.747 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.483 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.331 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.247 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.198 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.166 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.144 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 1 complete with sum error 0.144
starting batch 2/10
>epoch=1 error=2.684 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=1.946 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.889 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.599 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.425 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.319 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.252 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.207 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.176 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.153 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 2 complete with sum error 0.153
starting batch 3/10
>epoch=1 error=4.077 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=3.415 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=2.202 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=1.047 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.654 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.480 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.367 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.292 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.241 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.205 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 3 complete with sum error 0.205
starting batch 4/10
>epoch=1 error=2.565 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=2.105 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=1.215 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.717 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.472 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.337 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.260 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.211 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.178 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.153 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 4 complete with sum error 0.153
starting batch 5/10
>epoch=1 error=1.695 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=1.334 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.778 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.501 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.344 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.261 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.211 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.177 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.152 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.134 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 5 complete with sum error 0.134
```

```
starting batch 6/10
>epoch=1 error=1.730 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=1.373 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.692 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.410 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.264 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.193 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.155 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.131 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.114 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.101 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 6 complete with sum error 0.101
starting batch 7/10
>epoch=1 error=2.837 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=2.936 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=1.601 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.838 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.385 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.266 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.206 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.170 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.146 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.128 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 7 complete with sum error 0.128
starting batch 8/10
>epoch=1 error=0.838 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=0.672 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.374 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.217 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.155 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.124 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.104 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.090 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.080 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.072 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 8 complete with sum error 0.072
starting batch 9/10
>epoch=1 error=1.183 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=0.487 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.269 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.183 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.141 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.117 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.100 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.088 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.079 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.072 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 9 complete with sum error 0.072
starting batch 10/10
>epoch=1 error=1.614 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=1.115 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.470 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.288 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.195 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.150 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.125 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.108 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.095 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.086 -------- letter=A lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 10 complete with sum error 0.086
accuracy: 90.00% correct/total: 900/1000
```

Letter P

Training Data
LR - 0.1
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,392,196,98,1

```
starting batch 1/10
>epoch=1 error=3.736 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=3.670 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=1.747 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=1.180 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.776 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.541 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.389 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.294 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.234 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.194 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 1 complete with sum error 0.194
starting batch 2/10
>epoch=1 error=1.994 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=1.902 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=1.033 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.669 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.433 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.293 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.217 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.173 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.145 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.125 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 2 complete with sum error 0.125
starting batch 3/10
>epoch=1 error=2.590 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=1.952 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=1.287 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.920 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.643 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.446 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.325 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.254 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.210 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.180 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 3 complete with sum error 0.180
starting batch 4/10
>epoch=1 error=1.099 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=0.883 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.528 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.331 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.228 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.174 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.142 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.121 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.106 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.094 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 4 complete with sum error 0.094
starting batch 5/10
>epoch=1 error=2.781 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=1.574 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.707 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.345 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.207 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.157 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.129 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.110 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.097 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.087 --------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 5 complete with sum error 0.087
```

```
starting batch 6/10
>epoch=1 error=0.843 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=0.370 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.195 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.140 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.113 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.096 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.084 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.075 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.068 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.062 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 6 complete with sum error 0.062
starting batch 7/10
>epoch=1 error=2.480 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=1.461 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.664 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.373 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.236 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.170 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.134 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.111 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.095 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.083 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 7 complete with sum error 0.083
starting batch 8/10
>epoch=1 error=2.469 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=1.486 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.689 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.308 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.170 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.133 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.112 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.098 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.087 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.079 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 8 complete with sum error 0.079
starting batch 9/10
>epoch=1 error=0.982 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=0.661 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.176 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.112 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.089 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.075 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.065 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.058 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.053 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.049 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 9 complete with sum error 0.049
starting batch 10/10
>epoch=1 error=1.588 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=0.314 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.151 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.115 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.095 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.081 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.072 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.064 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.058 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.053 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 10 complete with sum error 0.053
accuracy: 91.20% correct/total: 912/1000
```

Training Data
LR - 0.1
Sample size - 20
Epochs - 20
Batches - 5
Layers - 784,392,196,98,1

```
starting batch 1/5
>epoch=1 error=6.644 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=6.860 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=3.766 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=2.146 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.903 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.595 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.400 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.283 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.216 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.176 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=11 error=0.150 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=12 error=0.130 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=13 error=0.116 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=14 error=0.105 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=15 error=0.095 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=16 error=0.088 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=17 error=0.081 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=18 error=0.076 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=19 error=0.071 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=20 error=0.067 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 1 complete with sum error 0.067
starting batch 2/5
>epoch=1 error=3.060 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=2.346 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=1.137 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.528 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.305 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.205 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.156 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.126 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.107 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.093 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=11 error=0.082 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=12 error=0.074 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=13 error=0.067 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=14 error=0.061 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=15 error=0.057 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=16 error=0.053 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=17 error=0.049 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=18 error=0.046 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=19 error=0.044 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=20 error=0.041 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 2 complete with sum error 0.041
starting batch 3/5
>epoch=1 error=1.065 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=0.347 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.195 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.136 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.108 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.090 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.078 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.069 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.062 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.057 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=11 error=0.052 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=12 error=0.048 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=13 error=0.045 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=14 error=0.042 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=15 error=0.039 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=16 error=0.037 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=17 error=0.035 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=18 error=0.033 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=19 error=0.032 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=20 error=0.030 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
```

```
batch 3 complete with sum error 0.030
starting batch 4/5
>epoch=1 error=3.240 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=1.438 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=0.909 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=0.379 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=0.192 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=0.127 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=0.100 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=0.084 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.073 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.064 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=11 error=0.058 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=12 error=0.053 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=13 error=0.049 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=14 error=0.045 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=15 error=0.042 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=16 error=0.040 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=17 error=0.037 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=18 error=0.035 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=19 error=0.034 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=20 error=0.032 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 4 complete with sum error 0.032
starting batch 5/5
>epoch=1 error=1.253 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=2 error=1.239 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=3 error=1.101 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=4 error=1.065 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=5 error=1.045 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=6 error=1.030 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=7 error=1.017 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=8 error=1.004 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=9 error=0.988 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=10 error=0.968 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=11 error=0.935 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=12 error=0.877 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=13 error=0.745 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=14 error=0.420 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=15 error=0.133 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=16 error=0.082 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=17 error=0.061 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=18 error=0.050 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=19 error=0.042 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
>epoch=20 error=0.037 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,1]
batch 5 complete with sum error 0.037
accuracy: 88.00% correct/total: 880/1000
```

Training Data
LR - 0.1
Sample size - 40
Epochs - 20
Batches - 5
Layers - 784,392,196,98,1

```
starting batch 1/5
>epoch=1 error=20.515 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=2 error=9.137 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=3 error=7.611 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=4 error=4.802 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=5 error=3.213 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=6 error=2.257 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=7 error=1.765 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=8 error=1.448 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=9 error=1.181 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=10 error=0.953 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=11 error=0.765 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=12 error=0.617 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=13 error=0.505 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=14 error=0.421 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=15 error=0.358 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=16 error=0.310 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=17 error=0.273 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=18 error=0.244 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=19 error=0.220 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=20 error=0.201 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
batch 1 complete with sum error 0.201
starting batch 2/5
>epoch=1 error=3.155 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=2 error=2.411 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=3 error=1.504 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=4 error=1.147 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=5 error=0.902 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=6 error=0.712 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=7 error=0.568 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=8 error=0.463 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=9 error=0.386 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=10 error=0.330 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=11 error=0.287 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=12 error=0.254 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=13 error=0.228 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=14 error=0.206 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=15 error=0.188 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=16 error=0.173 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=17 error=0.160 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=18 error=0.149 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=19 error=0.139 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=20 error=0.131 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
batch 2 complete with sum error 0.131
starting batch 3/5
>epoch=1 error=2.981 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=2 error=2.556 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=3 error=1.786 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=4 error=0.997 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=5 error=0.551 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=6 error=0.389 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=7 error=0.294 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=8 error=0.237 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=9 error=0.199 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=10 error=0.172 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=11 error=0.152 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=12 error=0.137 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=13 error=0.124 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=14 error=0.114 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=15 error=0.105 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
```

```
>epoch=16 error=0.098 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=17 error=0.091 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=18 error=0.086 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=19 error=0.081 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=20 error=0.077 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
batch 3 complete with sum error 0.077
starting batch 4/5
>epoch=1 error=4.352 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=2 error=4.598 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=3 error=2.321 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=4 error=1.383 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=5 error=0.980 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=6 error=0.730 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=7 error=0.549 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=8 error=0.415 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=9 error=0.322 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=10 error=0.260 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=11 error=0.219 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=12 error=0.189 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=13 error=0.167 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=14 error=0.150 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=15 error=0.137 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=16 error=0.125 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=17 error=0.116 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=18 error=0.108 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=19 error=0.101 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=20 error=0.095 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
batch 4 complete with sum error 0.095
starting batch 5/5
>epoch=1 error=3.148 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=2 error=2.589 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=3 error=0.972 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=4 error=0.642 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=5 error=0.474 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=6 error=0.351 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=7 error=0.267 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=8 error=0.212 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=9 error=0.176 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=10 error=0.151 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=11 error=0.132 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=12 error=0.118 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=13 error=0.106 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=14 error=0.097 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=15 error=0.090 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=16 error=0.083 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=17 error=0.078 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=18 error=0.073 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=19 error=0.069 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
>epoch=20 error=0.065 -------- letter=P lr=0.10 sample size=40 layers=[784,392,196,98,1]
batch 5 complete with sum error 0.065
accuracy: 86.80% correct/total: 868/1000
```

Training Data
LR - 0.1
Sample size - 20

Epochs - 10
Batches - 10
Layers - 784,392,196,98,32,16,1

```
starting batch 1/10
>epoch=1 error=4.171 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=4.171 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=3.946 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=3.685 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=3.433 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=3.192 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=2.960 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=2.734 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=2.510 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=2.289 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
batch 1 complete with sum error 2.289
starting batch 2/10
>epoch=1 error=3.480 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=3.154 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=2.768 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=2.438 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=2.156 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=1.904 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=1.673 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=1.460 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=1.266 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=1.096 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
batch 2 complete with sum error 1.096
starting batch 3/10
>epoch=1 error=2.255 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.157 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.704 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=1.377 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=1.147 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.976 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.844 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.739 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.655 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.585 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
batch 3 complete with sum error 0.585
starting batch 4/10
>epoch=1 error=1.792 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.534 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.062 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.809 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.658 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.556 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.483 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.427 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.382 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.346 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
batch 4 complete with sum error 0.346
starting batch 5/10
>epoch=1 error=1.569 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.328 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.831 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.596 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.477 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.403 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.351 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.312 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.282 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.257 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
batch 5 complete with sum error 0.257
```

```
batch 5 complete with sum error 0.257
starting batch 6/10
>epoch=1 error=3.684 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.822 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.947 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=1.367 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=1.193 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=1.061 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.940 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.802 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.625 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.440 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
batch 6 complete with sum error 0.440
starting batch 7/10
>epoch=1 error=2.492 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.528 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.873 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.594 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.443 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.356 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.300 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.260 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.230 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.207 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
batch 7 complete with sum error 0.207
starting batch 8/10
>epoch=1 error=1.779 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.937 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.502 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.281 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.224 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.190 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.167 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.149 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.135 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.124 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
batch 8 complete with sum error 0.124
starting batch 9/10
>epoch=1 error=0.482 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.237 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.179 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.152 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.134 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.121 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.111 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.103 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.096 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.091 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
batch 9 complete with sum error 0.091
starting batch 10/10
>epoch=1 error=2.358 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.006 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.199 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.891 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.576 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.248 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.207 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.182 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.164 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.150 -------- letter=P lr=0.10 sample size=20 layers=[784,392,196,98,32,16,1]
batch 10 complete with sum error 0.150
accuracy: 85.60% correct/total: 856/1000
```

Training Data
LR - 0.2
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,392,196,98,32,16,1

```
starting batch 1/10
>epoch=1 error=4.936 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=4.974 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=4.791 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=4.575 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=4.345 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=4.086 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=3.784 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=3.436 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=3.058 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=2.672 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 1 complete with sum error 2.672
starting batch 2/10
>epoch=1 error=4.416 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=3.823 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=3.223 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=2.691 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=2.181 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=1.692 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=1.280 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.976 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.753 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.593 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 2 complete with sum error 0.593
starting batch 3/10
>epoch=1 error=3.225 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.317 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.705 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=1.268 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.950 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.689 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.481 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.355 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.283 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.238 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 3 complete with sum error 0.238
starting batch 4/10
>epoch=1 error=1.548 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.295 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.665 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.413 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.280 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.213 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.175 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.149 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.131 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.117 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 4 complete with sum error 0.117
starting batch 5/10
>epoch=1 error=1.368 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.572 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.288 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.175 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.133 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.110 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.095 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.084 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.076 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.069 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 5 complete with sum error 0.069
```

```
starting batch 6/10
>epoch=1 error=1.568 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.316 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.114 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.084 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.071 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.063 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.057 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.052 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.049 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.045 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 6 complete with sum error 0.045
starting batch 7/10
>epoch=1 error=2.979 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.769 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.358 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.479 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.218 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.130 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.105 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.090 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.080 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.072 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 7 complete with sum error 0.072
starting batch 8/10
>epoch=1 error=1.258 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.374 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.126 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.078 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.064 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.055 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.049 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.045 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.042 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.039 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 8 complete with sum error 0.039
starting batch 9/10
>epoch=1 error=2.196 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.752 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.322 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.087 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.059 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.050 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.045 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.041 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.038 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.036 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 9 complete with sum error 0.036
starting batch 10/10
>epoch=1 error=2.910 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.436 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.244 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.907 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.339 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.054 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.048 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.043 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.040 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.037 -------- letter=P lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 10 complete with sum error 0.037
accuracy: 91.90% correct/total: 919/1000
```

Letter L

Training Data
LR - 0.2
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,392,196,98,32,16,1

```
starting batch 1/10
>epoch=1 error=5.434 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=4.499 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=4.761 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=4.710 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=4.584 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=4.441 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=4.282 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=4.104 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=3.900 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=3.669 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 1 complete with sum error 3.669
starting batch 2/10
>epoch=1 error=4.239 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=4.133 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=3.841 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=3.498 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=3.129 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=2.752 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=2.381 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=2.030 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=1.710 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=1.433 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 2 complete with sum error 1.433
starting batch 3/10
>epoch=1 error=2.954 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.759 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=2.272 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=1.821 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=1.430 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=1.163 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.966 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.810 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.683 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.581 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 3 complete with sum error 0.581
starting batch 4/10
>epoch=1 error=1.545 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.815 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.584 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.462 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.382 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.325 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.282 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.248 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.222 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.200 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 4 complete with sum error 0.200
starting batch 5/10
>epoch=1 error=0.945 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.696 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.436 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.299 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.241 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.205 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.179 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.159 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.144 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.132 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 5 complete with sum error 0.132
```

```
starting batch 6/10
>epoch=1 error=0.465 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.488 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.277 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.158 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.123 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.106 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.095 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.086 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.080 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.074 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 6 complete with sum error 0.074
starting batch 7/10
>epoch=1 error=0.748 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.613 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.239 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.121 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.100 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.088 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.080 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.073 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.068 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.064 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 7 complete with sum error 0.064
starting batch 8/10
>epoch=1 error=0.327 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.232 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.113 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.091 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.078 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.069 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.063 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.058 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.054 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.050 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 8 complete with sum error 0.050
starting batch 9/10
>epoch=1 error=2.333 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.762 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.874 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.504 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.296 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.093 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.081 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.073 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.066 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.061 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 9 complete with sum error 0.061
starting batch 10/10
>epoch=1 error=0.330 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.176 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.058 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.049 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.043 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.039 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.036 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.033 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.031 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.030 -------- letter=L lr=0.20 sample size=20 layers=[784,392,196,98,32,16,1]
batch 10 complete with sum error 0.030
accuracy: 91.00% correct/total: 910/1000
```

Training Data
LR - 0.3
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,392,196,98,32,16,1

```
starting batch 1/10
>epoch=1 error=5.698 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=4.199 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=3.925 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=3.213 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=2.510 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=1.897 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=1.411 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=1.050 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.794 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.615 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
batch 1 complete with sum error 0.615
starting batch 2/10
>epoch=1 error=3.097 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.010 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.276 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.862 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.597 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.425 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.318 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.253 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.209 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.179 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
batch 2 complete with sum error 0.179
starting batch 3/10
>epoch=1 error=0.726 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.632 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.348 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.208 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.159 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.132 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.114 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.101 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.091 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.083 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
batch 3 complete with sum error 0.083
starting batch 4/10
>epoch=1 error=1.378 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.063 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.420 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.201 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.129 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.104 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.089 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.078 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.070 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.064 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
batch 4 complete with sum error 0.064
starting batch 5/10
>epoch=1 error=0.920 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.581 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.341 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.171 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.052 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.048 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.044 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.040 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.038 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.035 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
batch 5 complete with sum error 0.035
```

```
batch 5 complete with sum error 0.035
starting batch 6/10
>epoch=1 error=0.223 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.112 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.036 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.031 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.028 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.026 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.024 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.023 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.022 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.021 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
batch 6 complete with sum error 0.021
starting batch 7/10
>epoch=1 error=1.063 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.722 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.053 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.043 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.037 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.033 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.030 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.027 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.025 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.024 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
batch 7 complete with sum error 0.024
starting batch 8/10
>epoch=1 error=0.331 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.149 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.071 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.046 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.038 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.033 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.030 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.028 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.025 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.024 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
batch 8 complete with sum error 0.024
starting batch 9/10
>epoch=1 error=0.136 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.044 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.031 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.026 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.023 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.021 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.020 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.018 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.017 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.016 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
batch 9 complete with sum error 0.016
starting batch 10/10
>epoch=1 error=0.983 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.967 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.916 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.365 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.194 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.016 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.014 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.013 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.013 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.012 -------- letter=L lr=0.30 sample size=20 layers=[784,392,196,98,32,16,1]
batch 10 complete with sum error 0.012
accuracy: 92.40% correct/total: 924/1000
```

Training Data
LR - 0.4
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,392,196,98,32,16,1

```
starting batch 1/10
>epoch=1 error=4.771 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=4.597 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=4.498 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=4.083 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=3.586 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=3.018 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=2.403 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=1.776 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=1.244 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.872 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 1 complete with sum error 0.872
starting batch 2/10
>epoch=1 error=4.605 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.837 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.615 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.895 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.616 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.427 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.296 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.216 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.170 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.140 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 2 complete with sum error 0.140
starting batch 3/10
>epoch=1 error=1.594 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.547 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.760 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.476 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.268 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.147 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.094 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.079 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.069 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.061 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 3 complete with sum error 0.061
starting batch 4/10
>epoch=1 error=1.231 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.275 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.138 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.091 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.073 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.062 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.054 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.048 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.044 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.040 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 4 complete with sum error 0.040
starting batch 5/10
>epoch=1 error=0.604 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.290 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.874 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.190 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.051 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.039 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.034 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.030 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.028 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.026 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 5 complete with sum error 0.026
```

```
starting batch 6/10
>epoch=1 error=0.317 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.030 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.027 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.024 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.022 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.021 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.020 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.019 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.018 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.017 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 6 complete with sum error 0.017
starting batch 7/10
>epoch=1 error=0.260 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.915 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=2.267 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.683 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.132 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.024 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.022 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.021 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.019 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.018 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 7 complete with sum error 0.018
starting batch 8/10
>epoch=1 error=1.111 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.079 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.006 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.995 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.989 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.984 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.979 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.972 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.961 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.944 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 8 complete with sum error 0.944
starting batch 9/10
>epoch=1 error=0.203 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.167 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.029 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.023 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.021 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.019 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.018 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.017 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.016 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.015 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 9 complete with sum error 0.015
starting batch 10/10
>epoch=1 error=2.622 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.960 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.152 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.981 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.980 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.979 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.977 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.975 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.972 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.969 -------- letter=L lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 10 complete with sum error 0.969
accuracy: 94.20% correct/total: 942/1000
```

Training Data
LR - 0.5
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,392,196,98,32,16,1

```
starting batch 1/10
>epoch=1 error=4.415 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=4.205 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=4.110 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=3.603 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=2.880 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=2.281 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=1.763 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=1.328 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.991 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.741 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 1 complete with sum error 0.741
starting batch 2/10
>epoch=1 error=1.314 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.929 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.668 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.488 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.303 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.199 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.150 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.121 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.102 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.088 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 2 complete with sum error 0.088
starting batch 3/10
>epoch=1 error=0.811 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.154 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.751 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.268 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.095 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.081 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.070 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.062 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.056 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.051 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 3 complete with sum error 0.051
starting batch 4/10
>epoch=1 error=0.763 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.418 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.159 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.080 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.063 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.053 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.047 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.042 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.039 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.036 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 4 complete with sum error 0.036
starting batch 5/10
>epoch=1 error=0.994 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.817 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.361 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.090 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.047 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.039 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.035 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.031 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.029 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.027 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 5 complete with sum error 0.027
```

```
batch 5 complete with sum error 0.027
starting batch 6/10
>epoch=1 error=1.603 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.304 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.069 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.675 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.308 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.225 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.023 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.021 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.019 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.018 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 6 complete with sum error 0.018
starting batch 7/10
>epoch=1 error=0.296 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.182 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.158 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.195 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.014 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.013 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.012 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.012 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.011 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.011 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 7 complete with sum error 0.011
starting batch 8/10
>epoch=1 error=2.380 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.847 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.167 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.064 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.017 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.016 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.015 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.015 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.014 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.014 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 8 complete with sum error 0.014
starting batch 9/10
>epoch=1 error=0.889 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.113 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.021 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.018 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.016 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.015 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.014 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.013 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.012 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.012 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 9 complete with sum error 0.012
starting batch 10/10
>epoch=1 error=0.091 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.023 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.013 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.012 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.011 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.010 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.010 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.009 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.009 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.009 -------- letter=L lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 10 complete with sum error 0.009
accuracy: 95.00% correct/total: 950/1000
```

Training Data
LR - 0.6
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,392,196,98,32,16,1

```
starting batch 1/10
>epoch=1 error=3.598 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=4.286 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=3.950 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=3.455 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=2.805 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=2.042 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=1.356 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.930 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.686 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.514 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 1 complete with sum error 0.514
starting batch 2/10
>epoch=1 error=0.740 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.709 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.044 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.906 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.733 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.255 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.165 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.105 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.071 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.058 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 2 complete with sum error 0.058
starting batch 3/10
>epoch=1 error=1.317 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.818 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.319 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=1.638 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.817 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.573 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.279 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.033 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.029 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.026 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 3 complete with sum error 0.026
starting batch 4/10
>epoch=1 error=1.934 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.454 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.637 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=1.103 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.957 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.769 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.174 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.050 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.021 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.018 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 4 complete with sum error 0.018
starting batch 5/10
>epoch=1 error=0.589 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.243 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.168 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.012 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.011 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.010 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.010 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.009 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.009 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.008 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 5 complete with sum error 0.008
```

```
starting batch 6/10
>epoch=1 error=0.989 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.976 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.954 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.999 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.198 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.124 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.005 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.005 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.005 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.005 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 6 complete with sum error 0.005
starting batch 7/10
>epoch=1 error=6.355 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.165 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.118 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.008 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.007 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.007 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.007 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.006 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.006 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.006 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 7 complete with sum error 0.006
starting batch 8/10
>epoch=1 error=1.905 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.745 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.664 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.406 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.023 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.016 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.014 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.013 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.012 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.011 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 8 complete with sum error 0.011
starting batch 9/10
>epoch=1 error=0.693 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.961 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.900 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.747 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.213 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.010 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.008 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.007 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.007 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.006 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 9 complete with sum error 0.006
starting batch 10/10
>epoch=1 error=1.398 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.727 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.091 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=1.626 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.460 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.032 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.005 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.005 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.005 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.004 -------- letter=L lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 10 complete with sum error 0.004
accuracy: 92.60% correct/total: 926/1000
```

Letter U

Training Data
LR - 0.6
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,392,196,98,32,16,1

```
starting batch 1/10
>epoch=1 error=9.098 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=5.138 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=4.417 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=4.104 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=3.694 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=3.155 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=2.575 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=1.993 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=1.439 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=1.002 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 1 complete with sum error 1.002
starting batch 2/10
>epoch=1 error=3.523 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.630 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.689 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=1.000 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.693 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.490 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.353 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.252 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.180 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.134 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 2 complete with sum error 0.134
starting batch 3/10
>epoch=1 error=2.258 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.326 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.161 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.964 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.566 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.673 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.139 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.084 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.060 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.050 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 3 complete with sum error 0.050
starting batch 4/10
>epoch=1 error=3.676 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.117 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=2.771 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.272 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.124 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.058 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.040 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.034 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.031 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.028 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 4 complete with sum error 0.028
starting batch 5/10
>epoch=1 error=2.707 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.241 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.654 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.831 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.256 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.244 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.156 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.020 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.018 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.017 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 5 complete with sum error 0.017
```

```
starting batch 6/10
>epoch=1 error=2.466 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.711 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.992 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=1.331 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.549 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.183 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.031 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.027 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.024 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.022 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 6 complete with sum error 0.022
starting batch 7/10
>epoch=1 error=1.039 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.596 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.349 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.524 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.229 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.023 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.014 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.012 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.011 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.011 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 7 complete with sum error 0.011
starting batch 8/10
>epoch=1 error=1.169 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.158 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.066 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.011 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.009 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.008 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.008 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.007 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.007 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.007 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 8 complete with sum error 0.007
starting batch 9/10
>epoch=1 error=2.133 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.356 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=9.794 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=6.020 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=4.628 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.894 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.856 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.035 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.024 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.020 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 9 complete with sum error 0.020
starting batch 10/10
>epoch=1 error=0.393 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=5.330 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.841 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.561 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.767 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.140 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.034 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.018 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.016 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.015 -------- letter=U lr=0.60 sample size=20 layers=[784,392,196,98,32,16,1]
batch 10 complete with sum error 0.015
accuracy: 89.60% correct/total: 896/1000
```

Training Data
LR - 0.5
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,392,196,98,32,16,1

```
starting batch 1/10
>epoch=1 error=3.493 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=4.407 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=3.792 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=3.073 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=2.378 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=1.750 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=1.245 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.889 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.637 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.452 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 1 complete with sum error 0.452
starting batch 2/10
>epoch=1 error=1.135 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.093 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.429 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.621 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.396 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.201 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.108 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.088 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.076 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.067 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 2 complete with sum error 0.067
starting batch 3/10
>epoch=1 error=0.592 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.635 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.749 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=1.344 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.444 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.428 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.056 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.035 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.032 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.030 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 3 complete with sum error 0.030
starting batch 4/10
>epoch=1 error=1.641 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.489 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.211 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.082 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.051 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.043 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.037 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.033 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.030 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.027 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 4 complete with sum error 0.027
starting batch 5/10
>epoch=1 error=2.669 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.104 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.042 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.034 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.030 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.027 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.024 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.022 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.021 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.019 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 5 complete with sum error 0.019
```

```
batch 5 complete with sum error 0.019
starting batch 6/10
>epoch=1 error=1.410 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.766 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.405 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.594 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.166 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.039 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.030 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.025 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.022 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.019 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 6 complete with sum error 0.019
starting batch 7/10
>epoch=1 error=0.645 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.153 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.852 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.056 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.010 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.009 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.008 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.008 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.007 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.007 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 7 complete with sum error 0.007
starting batch 8/10
>epoch=1 error=2.890 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.630 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.209 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.977 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.971 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.963 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.948 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.891 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.037 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.023 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 8 complete with sum error 0.023
starting batch 9/10
>epoch=1 error=3.862 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.638 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=2.159 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=1.461 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=1.058 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.828 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.054 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.027 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.024 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.021 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 9 complete with sum error 0.021
starting batch 10/10
>epoch=1 error=0.116 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.205 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.021 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.017 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.015 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.014 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.013 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.012 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.012 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.011 -------- letter=U lr=0.50 sample size=20 layers=[784,392,196,98,32,16,1]
batch 10 complete with sum error 0.011
accuracy: 87.00% correct/total: 870/1000
```

Training Data
LR - 0.4
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,392,196,98,32,16,1

```
starting batch 1/10
>epoch=1 error=4.288 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=4.676 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=4.552 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=4.359 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=4.100 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=3.764 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=3.353 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=2.884 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=2.390 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=1.921 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 1 complete with sum error 1.921
starting batch 2/10
>epoch=1 error=3.724 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.862 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.984 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=1.351 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.961 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.687 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.494 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.360 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.273 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.217 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 2 complete with sum error 0.217
starting batch 3/10
>epoch=1 error=1.180 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.250 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.909 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.748 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.620 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.524 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.417 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.216 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.095 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.081 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 3 complete with sum error 0.081
starting batch 4/10
>epoch=1 error=2.014 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=1.522 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.202 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=1.566 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.285 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.115 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.079 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.068 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.060 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.055 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 4 complete with sum error 0.055
starting batch 5/10
>epoch=1 error=6.726 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.642 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.062 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.742 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=1.218 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.223 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.083 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.056 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.049 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.043 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 5 complete with sum error 0.043
```

```
batch 5 complete with sum error 0.043
starting batch 6/10
>epoch=1 error=6.290 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=2.842 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=1.980 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=1.108 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.398 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.236 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.105 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.076 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.063 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.054 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 6 complete with sum error 0.054
starting batch 7/10
>epoch=1 error=1.358 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.966 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.251 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.102 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.051 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.038 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.033 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.029 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.026 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.024 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 7 complete with sum error 0.024
starting batch 8/10
>epoch=1 error=0.250 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.461 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.197 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.035 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.018 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.014 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.013 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.012 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.011 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.010 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 8 complete with sum error 0.010
starting batch 9/10
>epoch=1 error=1.430 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.860 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.198 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.168 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.045 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.018 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.016 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.015 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.014 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.013 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 9 complete with sum error 0.013
starting batch 10/10
>epoch=1 error=2.422 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=2 error=0.271 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=3 error=0.243 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=4 error=0.013 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=5 error=0.012 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=6 error=0.012 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=7 error=0.011 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=8 error=0.011 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=9 error=0.010 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
>epoch=10 error=0.010 -------- letter=U lr=0.40 sample size=20 layers=[784,392,196,98,32,16,1]
batch 10 complete with sum error 0.010
accuracy: 89.50% correct/total: 895/1000
```

Training Data
LR - 0.4
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,196,49,16,4,1

```
starting batch 1/10
>epoch=1 error=5.406 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=5.277 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=5.203 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=5.157 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=5.127 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=5.105 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=5.087 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=5.071 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=5.056 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=5.042 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 1 complete with sum error 5.042
starting batch 2/10
>epoch=1 error=5.099 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=5.086 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=5.071 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=5.054 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=5.034 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=5.010 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=4.979 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=4.942 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=4.898 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=4.846 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 2 complete with sum error 4.846
starting batch 3/10
>epoch=1 error=4.893 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=4.843 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=4.785 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=4.715 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=4.630 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=4.524 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=4.392 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=4.225 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=4.014 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=3.755 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 3 complete with sum error 3.755
starting batch 4/10
>epoch=1 error=4.350 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=4.092 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=3.808 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=3.496 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=3.160 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=2.806 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=2.442 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=2.077 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=1.723 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=1.397 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 4 complete with sum error 1.397
starting batch 5/10
>epoch=1 error=3.044 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=2.350 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=1.676 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=1.251 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=0.960 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=0.763 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=0.626 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=0.528 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=0.454 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=0.397 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 5 complete with sum error 0.397
```

```
starting batch 6/10
>epoch=1 error=2.974 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=2.093 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=1.148 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=0.722 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=0.524 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=0.406 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=0.335 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=0.288 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=0.254 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=0.227 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 6 complete with sum error 0.227
starting batch 7/10
>epoch=1 error=1.421 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=1.389 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=0.456 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=0.260 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=0.202 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=0.173 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=0.155 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=0.141 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=0.130 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=0.122 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 7 complete with sum error 0.122
starting batch 8/10
>epoch=1 error=1.975 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=1.831 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=1.070 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=0.544 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=0.189 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=0.163 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=0.144 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=0.129 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=0.118 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=0.108 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 8 complete with sum error 0.108
starting batch 9/10
>epoch=1 error=1.305 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=0.804 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=0.789 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=0.096 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=0.084 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=0.078 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=0.073 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=0.069 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=0.066 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=0.063 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 9 complete with sum error 0.063
starting batch 10/10
>epoch=1 error=3.473 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=1.425 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=0.932 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=0.518 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=0.271 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=0.077 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=0.071 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=0.067 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=0.064 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=0.061 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 10 complete with sum error 0.061
accuracy: 88.20% correct/total: 882/1000
```

Training Data
LR - 0.4
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,196,49,1

```
starting batch 1/10
>epoch=1 error=3.112 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=2.480 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=1.295 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.859 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.554 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.392 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.283 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.212 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.167 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.137 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
batch 1 complete with sum error 0.137
starting batch 2/10
>epoch=1 error=3.149 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=2.066 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=1.133 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.589 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.290 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.176 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.131 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.105 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.088 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.076 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
batch 2 complete with sum error 0.076
starting batch 3/10
>epoch=1 error=1.861 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=1.588 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=0.716 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.365 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.192 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.125 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.097 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.081 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.069 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.061 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
batch 3 complete with sum error 0.061
starting batch 4/10
>epoch=1 error=1.919 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=0.722 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=0.287 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.124 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.077 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.062 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.053 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.046 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.041 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.038 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
batch 4 complete with sum error 0.038
starting batch 5/10
>epoch=1 error=2.682 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=2.345 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=1.286 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.512 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.201 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.121 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.095 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.079 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.069 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.061 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
batch 5 complete with sum error 0.061
```

```
starting batch 6/10
>epoch=1 error=2.552 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=1.607 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=1.218 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=1.072 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.930 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.718 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.419 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.202 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.124 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.093 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
batch 6 complete with sum error 0.093
starting batch 7/10
>epoch=1 error=0.871 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=0.539 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=0.262 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.111 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.077 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.062 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.053 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.047 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.042 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.038 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
batch 7 complete with sum error 0.038
starting batch 8/10
>epoch=1 error=1.774 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=1.170 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=0.823 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.538 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.185 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.068 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.048 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.039 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.034 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.030 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
batch 8 complete with sum error 0.030
starting batch 9/10
>epoch=1 error=1.612 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=0.509 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=0.065 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.044 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.036 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.031 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.027 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.025 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.022 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.021 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
batch 9 complete with sum error 0.021
starting batch 10/10
>epoch=1 error=0.520 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=0.043 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=0.017 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.013 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.011 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.010 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.009 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.009 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.008 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.008 -------- letter=U lr=0.40 sample size=20 layers=[784,196,49,1]
batch 10 complete with sum error 0.008
accuracy: 89.10% correct/total: 891/1000
```

Letter S

Training Data
LR - 0.4
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,196,49,1

```
starting batch 1/10
>epoch=1 error=2.567 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=2.045 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=1.374 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=1.082 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.844 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.617 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.424 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.272 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.175 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.124 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
batch 1 complete with sum error 0.124
starting batch 2/10
>epoch=1 error=1.343 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=1.584 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=0.624 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.351 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.222 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.153 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.118 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.096 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.082 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.072 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
batch 2 complete with sum error 0.072
starting batch 3/10
>epoch=1 error=1.524 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=2.057 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=0.813 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.301 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.123 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.087 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.069 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.057 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.049 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.044 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
batch 3 complete with sum error 0.044
starting batch 4/10
>epoch=1 error=2.488 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=2.046 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=0.993 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.230 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.080 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.050 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.040 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.034 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.030 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.027 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
batch 4 complete with sum error 0.027
starting batch 5/10
>epoch=1 error=1.654 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=0.865 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=0.327 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.082 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.045 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.038 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.033 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.029 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.026 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.024 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
batch 5 complete with sum error 0.024
```

```
starting batch 6/10
>epoch=1 error=1.682 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=1.602 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=1.356 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=1.079 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=1.038 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=1.025 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=1.015 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=1.007 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.999 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.988 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
batch 6 complete with sum error 0.988
starting batch 7/10
>epoch=1 error=2.203 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=1.562 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=0.783 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.358 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.113 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.063 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.045 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.034 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.028 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.024 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
batch 7 complete with sum error 0.024
starting batch 8/10
>epoch=1 error=2.887 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=2.456 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=0.591 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.213 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.121 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.084 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.066 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.054 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.047 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.041 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
batch 8 complete with sum error 0.041
starting batch 9/10
>epoch=1 error=1.720 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=0.785 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=0.121 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.035 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.027 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.023 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.020 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.018 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.017 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.015 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
batch 9 complete with sum error 0.015
starting batch 10/10
>epoch=1 error=3.110 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=2 error=1.241 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=3 error=0.544 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=4 error=0.150 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=5 error=0.049 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=6 error=0.041 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=7 error=0.036 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=8 error=0.033 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=9 error=0.030 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
>epoch=10 error=0.027 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,1]
batch 10 complete with sum error 0.027
accuracy: 90.90% correct/total: 909/1000
```

Training Data
LR - 0.4
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,196,49,16,1

```
starting batch 1/10
>epoch=1 error=3.428 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=3.885 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=3.206 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=2.577 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=2.023 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=6 error=1.546 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=7 error=1.157 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=8 error=0.861 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=9 error=0.646 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=10 error=0.491 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 1 complete with sum error 0.491
starting batch 2/10
>epoch=1 error=3.191 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=2.101 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=1.398 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.881 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.566 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=6 error=0.401 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=7 error=0.299 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=8 error=0.234 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=9 error=0.191 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=10 error=0.162 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 2 complete with sum error 0.162
starting batch 3/10
>epoch=1 error=2.431 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=2.404 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=1.510 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=1.021 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.555 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=6 error=0.379 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=7 error=0.268 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=8 error=0.202 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=9 error=0.161 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=10 error=0.134 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 3 complete with sum error 0.134
starting batch 4/10
>epoch=1 error=1.092 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=0.806 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=0.415 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.255 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.169 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=6 error=0.127 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=7 error=0.102 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=8 error=0.085 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=9 error=0.074 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=10 error=0.065 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 4 complete with sum error 0.065
starting batch 5/10
>epoch=1 error=1.161 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=1.638 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=0.197 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.064 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.036 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=6 error=0.031 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=7 error=0.027 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=8 error=0.025 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=9 error=0.023 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=10 error=0.022 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 5 complete with sum error 0.022
```

```
batch 5 complete with sum error 0.022
starting batch 6/10
>epoch=1 error=0.832 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=0.206 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=0.043 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.037 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.033 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=6 error=0.029 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=7 error=0.027 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=8 error=0.025 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=9 error=0.023 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=10 error=0.022 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 6 complete with sum error 0.022
starting batch 7/10
>epoch=1 error=0.115 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=0.082 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=0.056 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.045 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.039 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=6 error=0.034 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=7 error=0.031 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=8 error=0.028 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=9 error=0.026 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=10 error=0.024 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 7 complete with sum error 0.024
starting batch 8/10
>epoch=1 error=0.601 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=0.049 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=0.021 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.017 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.015 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=6 error=0.014 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=7 error=0.013 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=8 error=0.012 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=9 error=0.012 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=10 error=0.011 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 8 complete with sum error 0.011
starting batch 9/10
>epoch=1 error=2.761 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=2.552 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=1.044 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.397 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.160 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=6 error=0.067 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=7 error=0.053 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=8 error=0.046 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=9 error=0.040 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=10 error=0.036 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 9 complete with sum error 0.036
starting batch 10/10
>epoch=1 error=3.148 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=1.934 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=1.606 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=1.043 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=1.029 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=6 error=1.022 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=7 error=1.017 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=8 error=1.013 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=9 error=1.011 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=10 error=1.008 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 10 complete with sum error 1.008
accuracy: 94.10% correct/total: 941/1000
```

Training Data
LR - 0.4
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,196,49,4,1

```
starting batch 1/10
>epoch=1 error=5.276 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=2 error=4.960 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=3 error=4.849 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=4 error=4.614 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=5 error=4.166 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=6 error=3.576 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=7 error=3.000 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=8 error=2.464 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=9 error=1.981 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=10 error=1.568 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
batch 1 complete with sum error 1.568
starting batch 2/10
>epoch=1 error=2.473 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=2 error=2.563 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=3 error=1.968 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=4 error=1.545 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=5 error=1.213 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=6 error=0.945 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=7 error=0.731 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=8 error=0.570 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=9 error=0.456 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=10 error=0.376 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
batch 2 complete with sum error 0.376
starting batch 3/10
>epoch=1 error=2.979 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=2 error=1.906 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=3 error=1.251 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=4 error=0.837 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=5 error=0.569 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=6 error=0.381 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=7 error=0.288 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=8 error=0.238 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=9 error=0.205 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=10 error=0.181 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
batch 3 complete with sum error 0.181
starting batch 4/10
>epoch=1 error=1.764 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=2 error=1.647 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=3 error=0.717 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=4 error=0.414 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=5 error=0.270 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=6 error=0.206 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=7 error=0.173 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=8 error=0.151 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=9 error=0.134 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=10 error=0.121 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
batch 4 complete with sum error 0.121
starting batch 5/10
>epoch=1 error=2.872 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=2 error=2.584 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=3 error=0.442 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=4 error=0.211 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=5 error=0.160 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=6 error=0.133 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=7 error=0.116 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=8 error=0.103 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=9 error=0.094 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=10 error=0.086 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
batch 5 complete with sum error 0.086
```

```
starting batch 6/10
>epoch=1 error=2.001 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=2 error=1.315 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=3 error=0.756 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=4 error=0.259 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=5 error=0.145 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=6 error=0.116 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=7 error=0.100 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=8 error=0.089 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=9 error=0.081 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=10 error=0.074 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
batch 6 complete with sum error 0.074
starting batch 7/10
>epoch=1 error=1.283 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=2 error=0.725 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=3 error=0.445 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=4 error=0.176 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=5 error=0.095 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=6 error=0.081 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=7 error=0.071 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=8 error=0.064 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=9 error=0.059 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=10 error=0.055 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
batch 7 complete with sum error 0.055
starting batch 8/10
>epoch=1 error=0.870 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=2 error=0.290 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=3 error=0.096 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=4 error=0.068 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=5 error=0.060 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=6 error=0.054 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=7 error=0.050 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=8 error=0.046 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=9 error=0.043 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=10 error=0.040 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
batch 8 complete with sum error 0.040
starting batch 9/10
>epoch=1 error=1.243 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=2 error=1.014 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=3 error=0.625 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=4 error=0.210 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=5 error=0.076 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=6 error=0.058 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=7 error=0.049 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=8 error=0.043 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=9 error=0.038 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=10 error=0.035 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
batch 9 complete with sum error 0.035
starting batch 10/10
>epoch=1 error=2.468 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=2 error=2.147 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=3 error=1.924 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=4 error=1.903 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=5 error=1.875 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=6 error=1.833 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=7 error=1.748 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=8 error=1.481 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=9 error=1.081 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
>epoch=10 error=1.021 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,4,1]
batch 10 complete with sum error 1.021
accuracy: 91.40% correct/total: 914/1000
```

Training Data
LR - 0.4
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,196,49,16,4,1

```
starting batch 1/10
>epoch=1 error=5.600 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=5.330 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=5.183 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=5.094 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=5.032 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=4.982 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=4.935 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=4.885 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=4.828 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=4.758 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 1 complete with sum error 4.758
starting batch 2/10
>epoch=1 error=5.076 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=4.980 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=4.892 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=4.800 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=4.693 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=4.561 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=4.394 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=4.181 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=3.913 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=3.584 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 2 complete with sum error 3.584
starting batch 3/10
>epoch=1 error=4.308 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=4.015 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=3.592 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=3.135 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=2.675 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=2.231 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=1.819 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=1.461 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=1.167 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=0.937 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 3 complete with sum error 0.937
starting batch 4/10
>epoch=1 error=3.497 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=3.019 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=2.328 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=1.826 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=1.356 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=1.019 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=0.790 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=0.626 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=0.499 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=0.410 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 4 complete with sum error 0.410
starting batch 5/10
>epoch=1 error=1.360 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=2.445 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=1.258 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=0.639 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=0.374 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=0.247 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=0.203 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=0.178 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=0.160 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=0.146 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 5 complete with sum error 0.146
```

```
starting batch 6/10
>epoch=1 error=2.988 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=1.291 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=0.781 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=0.337 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=0.229 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=0.190 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=0.165 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=0.147 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=0.133 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=0.122 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 6 complete with sum error 0.122
starting batch 7/10
>epoch=1 error=1.408 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=1.170 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=0.520 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=0.358 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=0.129 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=0.098 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=0.087 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=0.079 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=0.073 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=0.068 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 7 complete with sum error 0.068
starting batch 8/10
>epoch=1 error=1.281 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=1.004 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=0.675 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=0.231 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=0.045 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=0.041 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=0.038 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=0.036 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=0.035 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=0.033 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 8 complete with sum error 0.033
starting batch 9/10
>epoch=1 error=2.874 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=2.056 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=0.737 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=0.075 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=0.069 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=0.064 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=0.059 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=0.056 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=0.052 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=0.049 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 9 complete with sum error 0.049
starting batch 10/10
>epoch=1 error=1.407 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=2 error=0.159 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=3 error=0.039 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=4 error=0.036 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=5 error=0.034 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=6 error=0.032 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=7 error=0.031 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=8 error=0.029 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=9 error=0.029 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
>epoch=10 error=0.028 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,4,1]
batch 10 complete with sum error 0.028
accuracy: 90.70% correct/total: 907/1000
```

Training Data
LR - 0.4
Sample size - 20
Epochs - 5
Batches - 20
Layers - 784,196,49,16,1

```
starting batch 1/20
>epoch=1 error=5.645 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=4.720 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=4.198 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=3.723 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=3.237 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 1 complete with sum error 3.237
starting batch 2/20
>epoch=1 error=4.473 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=4.131 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=3.480 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=2.951 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=2.471 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 2 complete with sum error 2.471
starting batch 3/20
>epoch=1 error=2.768 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=2.060 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=1.621 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=1.236 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.931 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 3 complete with sum error 0.931
starting batch 4/20
>epoch=1 error=2.795 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=2.586 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=2.243 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=1.814 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=1.255 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 4 complete with sum error 1.255
starting batch 5/20
>epoch=1 error=2.174 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=1.497 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=1.093 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.751 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.478 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 5 complete with sum error 0.478
starting batch 6/20
>epoch=1 error=1.721 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=1.892 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=1.049 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.579 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.405 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 6 complete with sum error 0.405
starting batch 7/20
>epoch=1 error=1.432 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=1.009 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=0.533 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.332 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.238 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 7 complete with sum error 0.238
starting batch 8/20
>epoch=1 error=2.195 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=1.601 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=0.867 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.387 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.232 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 8 complete with sum error 0.232
starting batch 9/20
>epoch=1 error=1.506 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=0.702 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=0.350 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.215 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.156 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 9 complete with sum error 0.156
```

```
>epoch=5 error=1.086 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 11 complete with sum error 1.086
starting batch 12/20
>epoch=1 error=2.278 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=1.860 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=1.765 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=1.512 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.841 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 12 complete with sum error 0.841
starting batch 13/20
>epoch=1 error=1.604 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=0.452 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=0.189 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.066 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.060 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 13 complete with sum error 0.060
starting batch 14/20
>epoch=1 error=1.378 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=1.096 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=0.632 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.318 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.149 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 14 complete with sum error 0.149
starting batch 15/20
>epoch=1 error=0.273 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=0.108 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=0.053 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.047 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.043 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 15 complete with sum error 0.043
starting batch 16/20
>epoch=1 error=2.068 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=1.832 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=0.907 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.533 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.073 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 16 complete with sum error 0.073
starting batch 17/20
>epoch=1 error=1.955 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=1.346 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=1.004 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.961 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.923 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 17 complete with sum error 0.923
starting batch 18/20
>epoch=1 error=3.055 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=0.763 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=0.252 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.096 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.061 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 18 complete with sum error 0.061
starting batch 19/20
>epoch=1 error=2.346 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=1.266 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=0.235 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.104 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.085 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 19 complete with sum error 0.085
starting batch 20/20
>epoch=1 error=1.215 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=2 error=0.802 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=3 error=0.173 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=4 error=0.084 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
>epoch=5 error=0.073 -------- letter=S lr=0.40 sample size=20 layers=[784,196,49,16,1]
batch 20 complete with sum error 0.073
accuracy: 91.40% correct/total: 914/1000
```

A-Z Model

LR - 0.4
Sample size - 20
Epochs - 10
Batches - 10
Layers - 784,196,49,16,26

Repeated training, save trained weights into .txt file
Load trained weights from .txt file and change hyperparameters
Repeat training with new training data sample

```
starting batch 1/1
>epoch=1/20 error=5.778 -------- lr=0.40 sample size=20
>epoch=2/20 error=2.192 -------- lr=0.40 sample size=20
>epoch=3/20 error=2.201 -------- lr=0.40 sample size=20
>epoch=4/20 error=0.603 -------- lr=0.40 sample size=20
>epoch=5/20 error=0.353 -------- lr=0.40 sample size=20
>epoch=6/20 error=0.157 -------- lr=0.40 sample size=20
>epoch=7/20 error=0.129 -------- lr=0.40 sample size=20
>epoch=8/20 error=0.116 -------- lr=0.40 sample size=20
>epoch=9/20 error=0.107 -------- lr=0.40 sample size=20
>epoch=10/20 error=0.100 -------- lr=0.40 sample size=20
>epoch=11/20 error=0.094 -------- lr=0.40 sample size=20
>epoch=12/20 error=0.089 -------- lr=0.40 sample size=20
>epoch=13/20 error=0.085 -------- lr=0.40 sample size=20
>epoch=14/20 error=0.081 -------- lr=0.40 sample size=20
>epoch=15/20 error=0.078 -------- lr=0.40 sample size=20
>epoch=16/20 error=0.075 -------- lr=0.40 sample size=20
>epoch=17/20 error=0.072 -------- lr=0.40 sample size=20
>epoch=18/20 error=0.070 -------- lr=0.40 sample size=20
>epoch=19/20 error=0.068 -------- lr=0.40 sample size=20
>epoch=20/20 error=0.066 -------- lr=0.40 sample size=20
batch 1 complete with sum error 0.066
row 1 - expected letter: H output letter: M
row 2 - expected letter: O output letter: O
row 3 - expected letter: Q output letter: Q
row 4 - expected letter: O output letter: O
row 5 - expected letter: S output letter: D
row 6 - expected letter: P output letter: P
row 7 - expected letter: L output letter: L
row 8 - expected letter: S output letter: S
row 9 - expected letter: H output letter: H
row 10 - expected letter: P output letter: P
row 11 - expected letter: L output letter: L
row 12 - expected letter: S output letter: S
row 13 - expected letter: M output letter: M
row 14 - expected letter: P output letter: P
row 15 - expected letter: P output letter: P
row 16 - expected letter: S output letter: S
row 17 - expected letter: U output letter: U
row 18 - expected letter: B output letter: M
row 19 - expected letter: Y output letter: Y
row 20 - expected letter: S output letter: S
row 21 - expected letter: B output letter: B
row 22 - expected letter: O output letter: O
row 23 - expected letter: H output letter: H
row 24 - expected letter: L output letter: L
```

```
row 41 - expected letter: M output letter: M
row 42 - expected letter: N output letter: N
row 43 - expected letter: E output letter: B
row 44 - expected letter: S output letter: S
row 45 - expected letter: O output letter: O
row 46 - expected letter: E output letter: E
row 47 - expected letter: G output letter: G
row 48 - expected letter: C output letter: C
row 49 - expected letter: T output letter: T
row 50 - expected letter: O output letter: O
row 51 - expected letter: O output letter: O
row 52 - expected letter: X output letter: X
row 53 - expected letter: C output letter: C
row 54 - expected letter: O output letter: O
row 55 - expected letter: B output letter: Y
row 56 - expected letter: Y output letter: Y
row 57 - expected letter: O output letter: O
row 58 - expected letter: W output letter: W
row 59 - expected letter: S output letter: S
row 60 - expected letter: A output letter: A
row 61 - expected letter: S output letter: S
row 62 - expected letter: O output letter: O
row 63 - expected letter: T output letter: T
row 64 - expected letter: M output letter: M
row 65 - expected letter: V output letter: W
row 66 - expected letter: U output letter: U
row 67 - expected letter: O output letter: O
row 68 - expected letter: A output letter: A
row 69 - expected letter: O output letter: O
row 70 - expected letter: Y output letter: Y
row 71 - expected letter: S output letter: S
row 72 - expected letter: M output letter: M
row 73 - expected letter: A output letter: H
row 74 - expected letter: P output letter: P
row 75 - expected letter: R output letter: B
row 76 - expected letter: J output letter: J
row 77 - expected letter: O output letter: O
row 78 - expected letter: Y output letter: Y
```