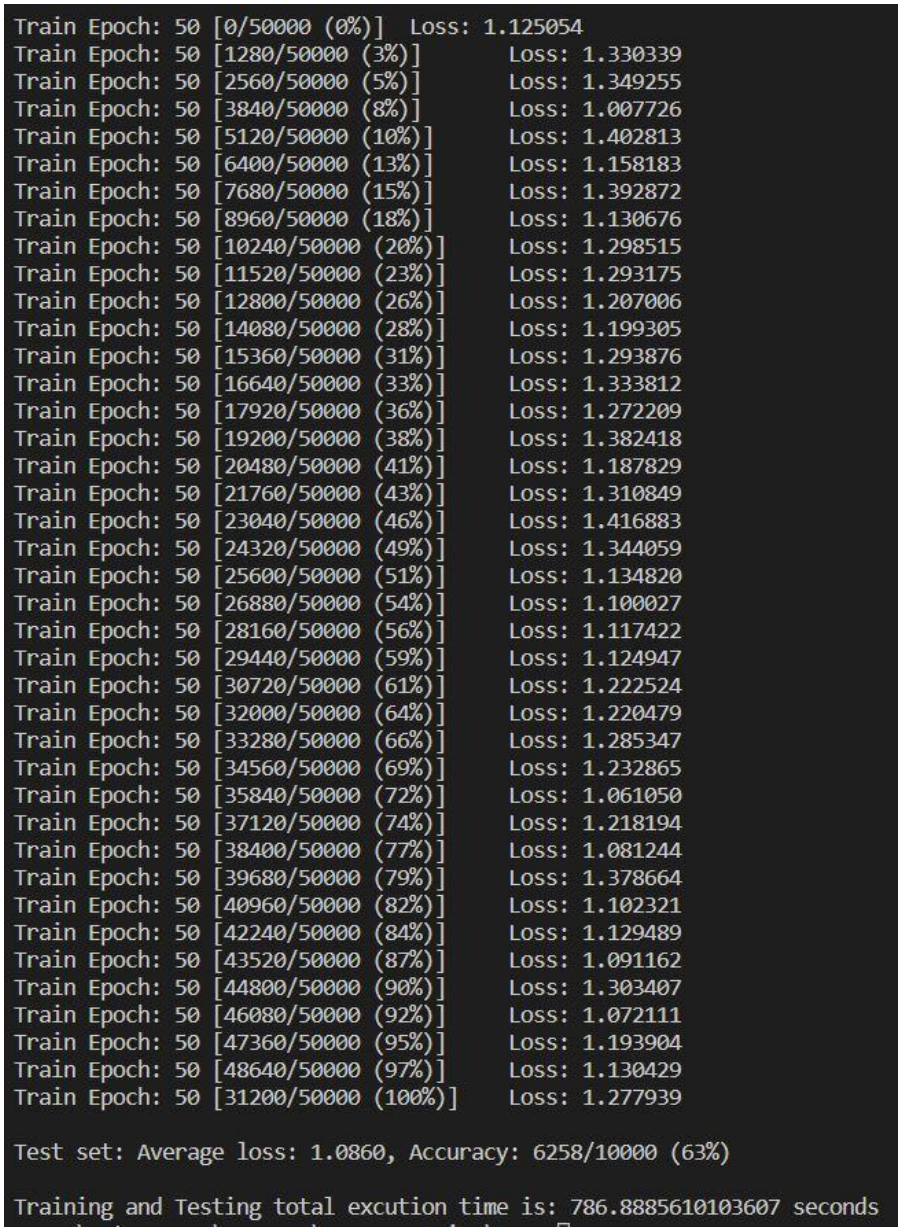
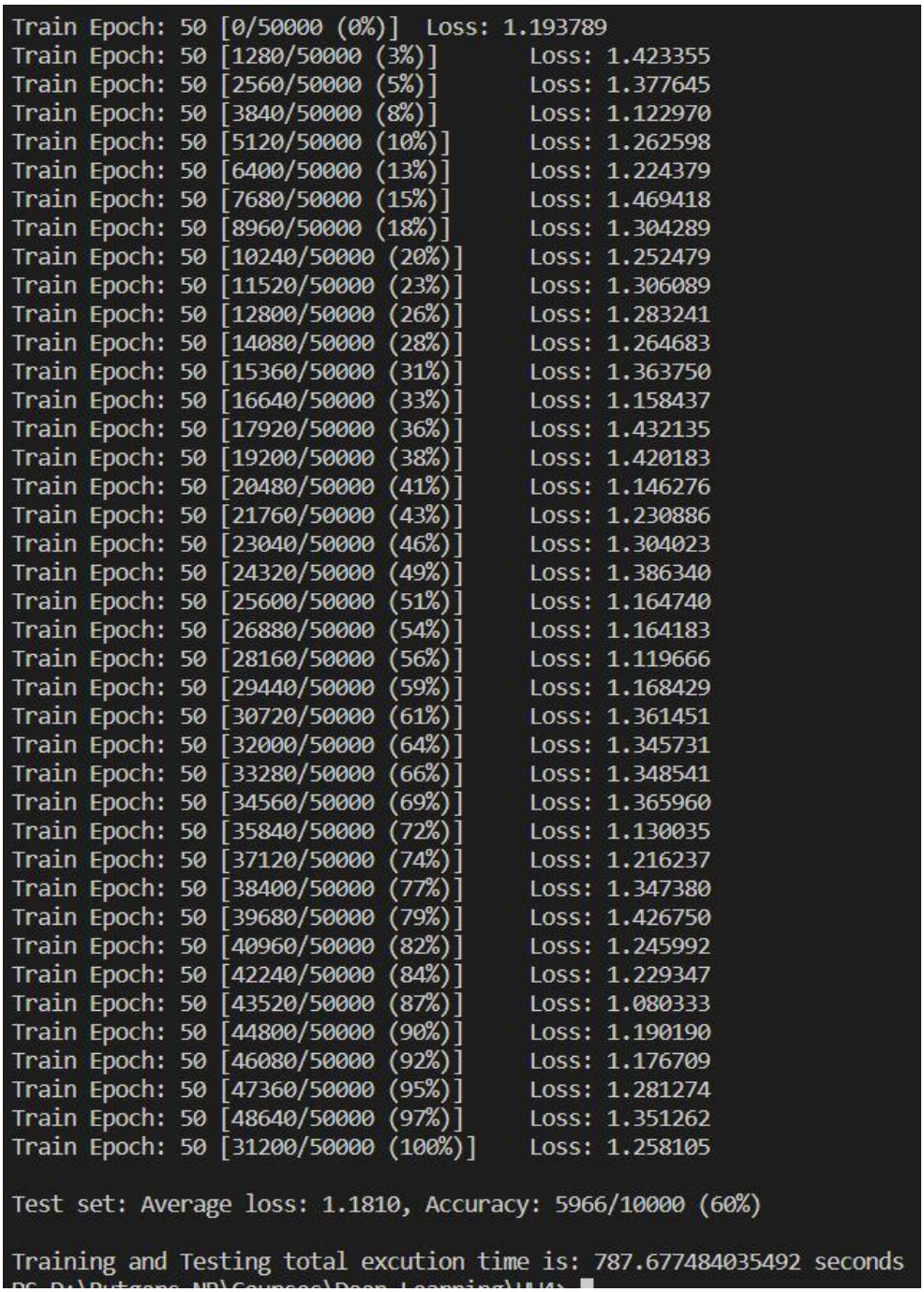
Intro to Deep Learning

Assignment 4

The results obtained for training and testing the LeNet model on the CIFAR10 dataset is shown below:



On adding a dropout layer to the model, the results obtained on training and testing the model is shown below:



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Train Epoch: 50 [0/50000 (0%)]  Loss: 1.193789
Train Epoch: 50 [1280/50000 (3%)]       Loss: 1.423355
Train Epoch: 50 [2560/50000 (5%)]       Loss: 1.377645
Train Epoch: 50 [3840/50000 (8%)]       Loss: 1.122970
Train Epoch: 50 [5120/50000 (10%)]      Loss: 1.262598
Train Epoch: 50 [6400/50000 (13%)]      Loss: 1.224379
Train Epoch: 50 [7680/50000 (15%)]      Loss: 1.469418
Train Epoch: 50 [8960/50000 (18%)]      Loss: 1.304289
Train Epoch: 50 [10240/50000 (20%)]     Loss: 1.252479
Train Epoch: 50 [11520/50000 (23%)]     Loss: 1.306089
Train Epoch: 50 [12800/50000 (26%)]     Loss: 1.283241
Train Epoch: 50 [14080/50000 (28%)]     Loss: 1.264683
Train Epoch: 50 [15360/50000 (31%)]     Loss: 1.363750
Train Epoch: 50 [16640/50000 (33%)]     Loss: 1.158437
Train Epoch: 50 [17920/50000 (36%)]     Loss: 1.432135
Train Epoch: 50 [19200/50000 (38%)]     Loss: 1.420183
Train Epoch: 50 [20480/50000 (41%)]     Loss: 1.146276
Train Epoch: 50 [21760/50000 (43%)]     Loss: 1.230886
Train Epoch: 50 [23040/50000 (46%)]     Loss: 1.304023
Train Epoch: 50 [24320/50000 (49%)]     Loss: 1.386340
Train Epoch: 50 [25600/50000 (51%)]     Loss: 1.164740
Train Epoch: 50 [26880/50000 (54%)]     Loss: 1.164183
Train Epoch: 50 [28160/50000 (56%)]     Loss: 1.119666
Train Epoch: 50 [29440/50000 (59%)]     Loss: 1.168429
Train Epoch: 50 [30720/50000 (61%)]     Loss: 1.361451
Train Epoch: 50 [32000/50000 (64%)]     Loss: 1.345731
Train Epoch: 50 [33280/50000 (66%)]     Loss: 1.348541
Train Epoch: 50 [34560/50000 (69%)]     Loss: 1.365960
Train Epoch: 50 [35840/50000 (72%)]     Loss: 1.130035
Train Epoch: 50 [37120/50000 (74%)]     Loss: 1.216237
Train Epoch: 50 [38400/50000 (77%)]     Loss: 1.347380
Train Epoch: 50 [39680/50000 (79%)]     Loss: 1.426750
Train Epoch: 50 [40960/50000 (82%)]     Loss: 1.245992
Train Epoch: 50 [42240/50000 (84%)]     Loss: 1.229347
Train Epoch: 50 [43520/50000 (87%)]     Loss: 1.080333
Train Epoch: 50 [44800/50000 (90%)]     Loss: 1.190190
Train Epoch: 50 [46080/50000 (92%)]     Loss: 1.176709
Train Epoch: 50 [47360/50000 (95%)]     Loss: 1.281274
Train Epoch: 50 [48640/50000 (97%)]     Loss: 1.351262
Train Epoch: 50 [31200/50000 (100%)]    Loss: 1.258105

Test set: Average loss: 1.1810, Accuracy: 5966/10000 (60%)

Training and Testing total excution time is: 787.677484035492 seconds
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Finally, on adding a batch normalization layer to the model, the results obtained on training and testing the model is shown below:

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Train Epoch: 50 [0/50000 (0%)]  Loss: 1.142463
Train Epoch: 50 [1280/50000 (3%)]       Loss: 1.146262
Train Epoch: 50 [2560/50000 (5%)]       Loss: 1.048293
Train Epoch: 50 [3840/50000 (8%)]       Loss: 0.928892
Train Epoch: 50 [5120/50000 (10%)]      Loss: 1.040171
Train Epoch: 50 [6400/50000 (13%)]      Loss: 0.982272
Train Epoch: 50 [7680/50000 (15%)]      Loss: 1.118113
Train Epoch: 50 [8960/50000 (18%)]      Loss: 0.971418
Train Epoch: 50 [10240/50000 (20%)]     Loss: 1.073143
Train Epoch: 50 [11520/50000 (23%)]     Loss: 1.162706
Train Epoch: 50 [12800/50000 (26%)]     Loss: 1.008039
Train Epoch: 50 [14080/50000 (28%)]     Loss: 1.085289
Train Epoch: 50 [15360/50000 (31%)]     Loss: 1.049511
Train Epoch: 50 [16640/50000 (33%)]     Loss: 1.024291
Train Epoch: 50 [17920/50000 (36%)]     Loss: 1.093595
Train Epoch: 50 [19200/50000 (38%)]     Loss: 1.101349
Train Epoch: 50 [20480/50000 (41%)]     Loss: 1.018378
Train Epoch: 50 [21760/50000 (43%)]     Loss: 1.071448
Train Epoch: 50 [23040/50000 (46%)]     Loss: 1.143653
Train Epoch: 50 [24320/50000 (49%)]     Loss: 1.202225
Train Epoch: 50 [25600/50000 (51%)]     Loss: 1.106310
Train Epoch: 50 [26880/50000 (54%)]     Loss: 0.965923
Train Epoch: 50 [28160/50000 (56%)]     Loss: 0.987512
Train Epoch: 50 [29440/50000 (59%)]     Loss: 0.971635
Train Epoch: 50 [30720/50000 (61%)]     Loss: 1.231806
Train Epoch: 50 [32000/50000 (64%)]     Loss: 1.087970
Train Epoch: 50 [33280/50000 (66%)]     Loss: 0.988973
Train Epoch: 50 [34560/50000 (69%)]     Loss: 1.243155
Train Epoch: 50 [35840/50000 (72%)]     Loss: 1.048290
Train Epoch: 50 [37120/50000 (74%)]     Loss: 1.010018
Train Epoch: 50 [38400/50000 (77%)]     Loss: 0.978833
Train Epoch: 50 [39680/50000 (79%)]     Loss: 1.221609
Train Epoch: 50 [40960/50000 (82%)]     Loss: 1.060551
Train Epoch: 50 [42240/50000 (84%)]     Loss: 1.035741
Train Epoch: 50 [43520/50000 (87%)]     Loss: 1.048177
Train Epoch: 50 [44800/50000 (90%)]     Loss: 1.019008
Train Epoch: 50 [46080/50000 (92%)]     Loss: 1.024051
Train Epoch: 50 [47360/50000 (95%)]     Loss: 0.989189
Train Epoch: 50 [48640/50000 (97%)]     Loss: 1.005365
Train Epoch: 50 [31200/50000 (100%)]    Loss: 1.035578

Test set: Average loss: 0.9556, Accuracy: 6700/10000 (67%)

Training and Testing total excution time is: 909.3889510631561 seconds
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