

# Homework 02 MNIST-Recognition

北京大学 2024 春季人工智能基础第二次课程作业

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## 1 NumPy version

## 1.1 1. MLP with SGD

```
arhalls in 🌐 Aurora in Fundamentals-Of-Fundamentals-2024Spring-PKU/Homework/01-MNIST-Recognition on  
└─ main [x!?] via 🐍 v3.11.8 via ⚡ torch at 🔍 Δ ~ 05fe141 "Merge remote-tracking branch 'origin/main'" took 23  
s718ms  
at 22:37:56 › python np_mnist_mlp.py  
loss: 0.7023, acc: 0.8125: 100%|██████████| 782/782 [00:06<00:00, 121.40it/s]  
epoch: 1, val_loss: 0.3694, val_acc: 0.9029  
loss: 0.4986, acc: 0.8750: 100%|██████████| 782/782 [00:01<00:00, 395.11it/s]  
epoch: 2, val_loss: 0.2901, val_acc: 0.9183  
loss: 0.3836, acc: 0.8750: 100%|██████████| 782/782 [00:01<00:00, 402.40it/s]  
epoch: 3, val_loss: 0.2552, val_acc: 0.9274  
loss: 0.3014, acc: 0.8750: 100%|██████████| 782/782 [00:02<00:00, 304.52it/s]  
epoch: 4, val_loss: 0.2315, val_acc: 0.9342  
loss: 0.2437, acc: 0.8750: 100%|██████████| 782/782 [00:01<00:00, 404.31it/s]  
epoch: 5, val_loss: 0.2133, val_acc: 0.9391  
loss: 0.1969, acc: 0.8750: 100%|██████████| 782/782 [00:01<00:00, 500.09it/s]  
epoch: 6, val_loss: 0.1989, val_acc: 0.9425  
loss: 0.1613, acc: 0.9375: 100%|██████████| 782/782 [00:01<00:00, 470.59it/s]  
epoch: 7, val_loss: 0.1868, val_acc: 0.9458  
loss: 0.1359, acc: 1.0000: 100%|██████████| 782/782 [00:01<00:00, 490.60it/s]  
epoch: 8, val_loss: 0.1767, val_acc: 0.9488  
loss: 0.1159, acc: 1.0000: 100%|██████████| 782/782 [00:01<00:00, 483.78it/s]  
epoch: 9, val_loss: 0.1680, val_acc: 0.9515  
loss: 0.0998, acc: 1.0000: 100%|██████████| 782/782 [00:01<00:00, 485.91it/s]  
epoch: 10, val_loss: 0.1605, val_acc: 0.9543
```

epoch: 10, val\_loss: 0.1605, val\_acc: 0.9543

## 1.2 2. MLP with SGD and Momentum

```

main [x!>] via v3.11.8 via torch at 05fe141 "Merge remote-tracking branch 'origin/main'"
● at 22:54:30 python np_mnist_mlp_monentum.py
loss: 0.2991, acc: 0.9375: 100%| 782/782 [00:02<00:00, 362.00it/s]
epoch: 1, val_loss: 0.2418, val_acc: 0.9325
loss: 0.1458, acc: 0.9375: 100%| 782/782 [00:01<00:00, 443.60it/s]
epoch: 2, val_loss: 0.1801, val_acc: 0.9514
loss: 0.0841, acc: 1.0000: 100%| 782/782 [00:01<00:00, 424.73it/s]
epoch: 3, val_loss: 0.1491, val_acc: 0.9588
loss: 0.0562, acc: 1.0000: 100%| 782/782 [00:01<00:00, 453.64it/s]
epoch: 4, val_loss: 0.1296, val_acc: 0.9653
loss: 0.0423, acc: 1.0000: 100%| 782/782 [00:01<00:00, 469.32it/s]
epoch: 5, val_loss: 0.1174, val_acc: 0.9678
loss: 0.0338, acc: 1.0000: 100%| 782/782 [00:01<00:00, 459.88it/s]
epoch: 6, val_loss: 0.1088, val_acc: 0.9697
loss: 0.0268, acc: 1.0000: 100%| 782/782 [00:01<00:00, 470.73it/s]
epoch: 7, val_loss: 0.1028, val_acc: 0.9707
loss: 0.0232, acc: 1.0000: 100%| 782/782 [00:01<00:00, 477.11it/s]
epoch: 8, val_loss: 0.0983, val_acc: 0.9720
loss: 0.0185, acc: 1.0000: 100%| 782/782 [00:01<00:00, 490.47it/s]
epoch: 9, val_loss: 0.0950, val_acc: 0.9725
loss: 0.0161, acc: 1.0000: 100%| 782/782 [00:01<00:00, 470.64it/s]
epoch: 10, val_loss: 0.0923, val_acc: 0.9723

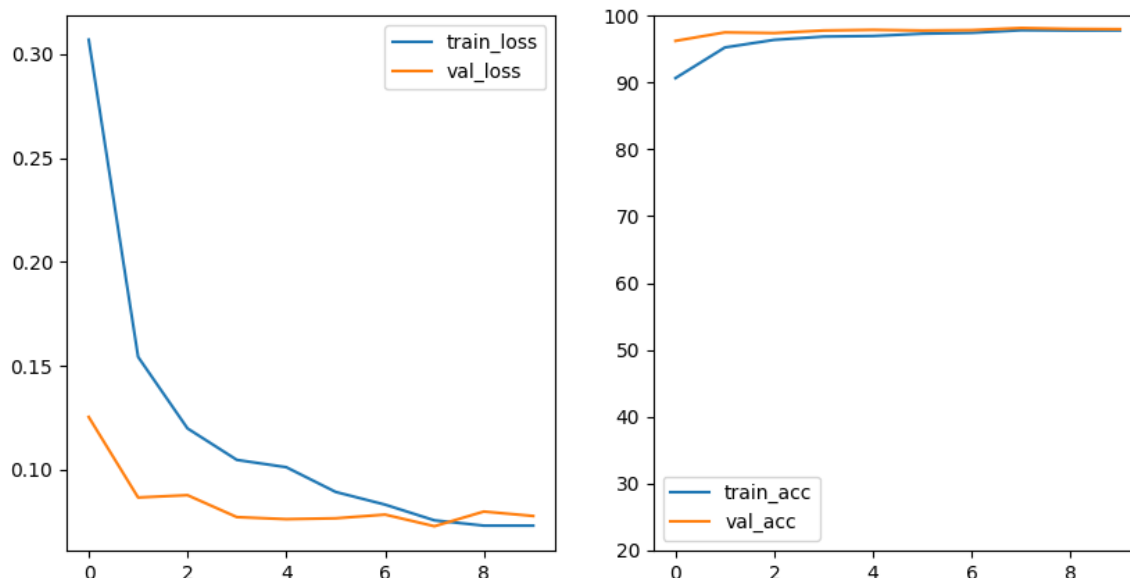
```

epoch: 10, val\_loss: 0.0923, val\_acc: 0.9723

## 2 PyTorch version

### 2.1 MLP with Adam and Dropout





## 2.2 CNN

```
arthals in Aurora in Fundamentals-Of-Artificial-Intelligence-2024Spring-PKU/Homework/01-MNIST-Recognition on
main [x!?] via v3.11.8 via torch at 05fe141 "Merge remote-tracking branch 'origin/main'" took 14
s929ms
at 23:03:18 ) python mnist_cnn.py
```

```
Training Epoch:1
Loss: 0.050561 : 100%|          | 782/782 [00:01<00:00, 399.78it/s]
Val acc: 97.90% : 100%|          | 157/157 [00:00<00:00, 1368.59it/s]

Training Epoch:2
Loss: 0.002329 : 100%|          | 782/782 [00:01<00:00, 660.20it/s]
Val acc: 98.67% : 100%|          | 157/157 [00:00<00:00, 1386.85it/s]

Training Epoch:3
Loss: 0.010118 : 100%|          | 782/782 [00:01<00:00, 664.97it/s]
Val acc: 98.92% : 100%|          | 157/157 [00:00<00:00, 1387.35it/s]

Training Epoch:4
Loss: 0.000159 : 100%|          | 782/782 [00:01<00:00, 653.78it/s]
Val acc: 98.93% : 100%|          | 157/157 [00:00<00:00, 1338.58it/s]

Training Epoch:5
Loss: 0.063421 : 100%|          | 782/782 [00:01<00:00, 660.50it/s]
Val acc: 98.81% : 100%|          | 157/157 [00:00<00:00, 1345.57it/s]

Training Epoch:6
Loss: 0.001316 : 100%|          | 782/782 [00:01<00:00, 659.77it/s]
Val acc: 99.14% : 100%|          | 157/157 [00:00<00:00, 1380.91it/s]

Training Epoch:7
Loss: 0.000052 : 100%|          | 782/782 [00:01<00:00, 661.03it/s]
Val acc: 99.13% : 100%|          | 157/157 [00:00<00:00, 1379.11it/s]

Training Epoch:8
Loss: 0.000140 : 100%|          | 782/782 [00:01<00:00, 656.05it/s]
Val acc: 99.06% : 100%|          | 157/157 [00:00<00:00, 1379.91it/s]

Training Epoch:9
Loss: 0.001122 : 100%|          | 782/782 [00:01<00:00, 649.86it/s]
Val acc: 99.22% : 100%|          | 157/157 [00:00<00:00, 1386.72it/s]

Training Epoch:10
Loss: 0.001387 : 100%|          | 782/782 [00:01<00:00, 664.51it/s]
Val acc: 99.08% : 100%|          | 157/157 [00:00<00:00, 1388.28it/s]
```

- Training Epoch:10
- Loss: 0.001387
- Val acc: 99.08%

