

CS461 Homework 4

LeNet5 Implementations

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Problem 1

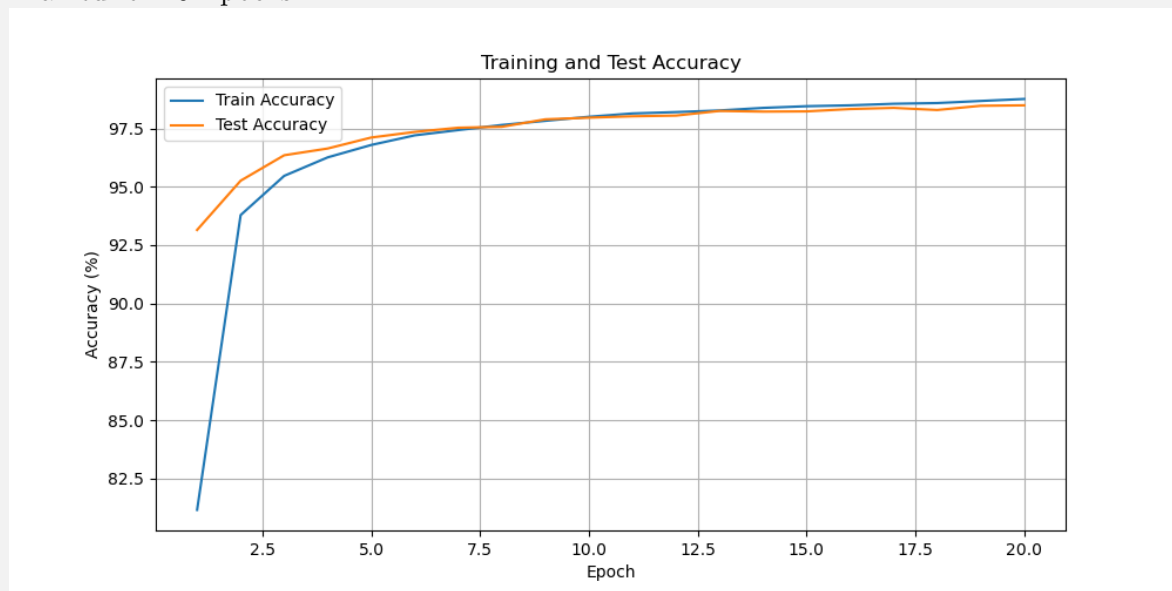
1 Implementation, Training, and Performance

1.1 Architecture for LeNet

Provided in Box File, implemented primarily with PyTorch, and a bit of OpenCV as well as matplotlib for image modification and graph generation. In terms of generating the 7x12 bitmap image for each digit in the data, I utilized openCV for its useful library of image modification and relevant methods to generate the bitmap, using the approach sizing and using some interpolation, the bitmap is generated with openCV methods

1.2 Training

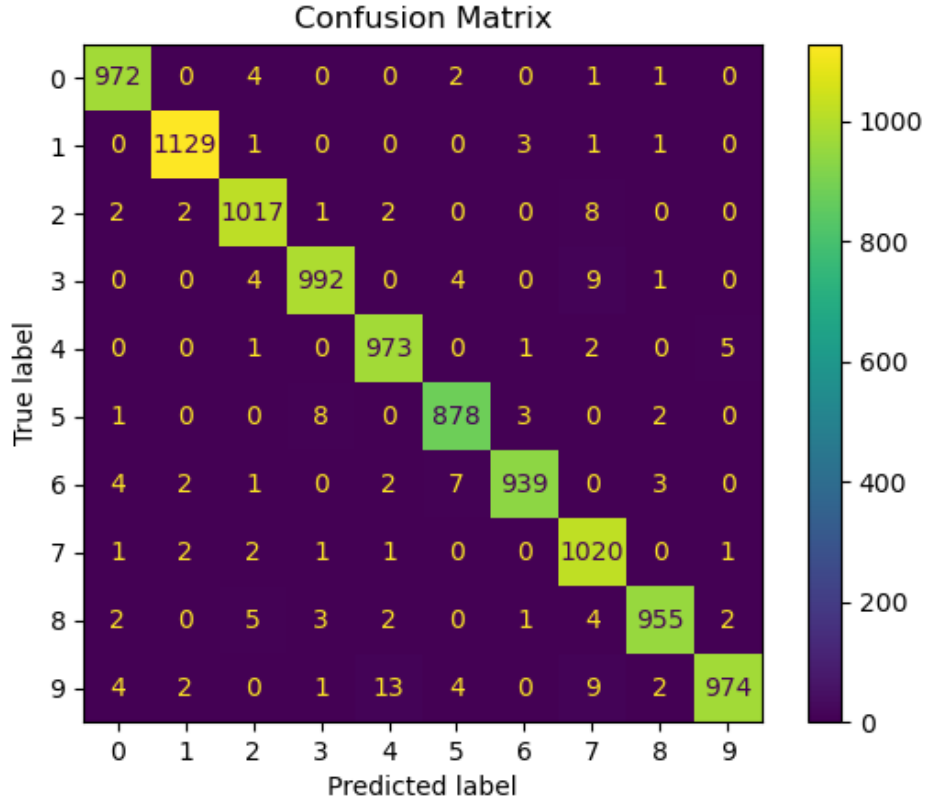
Trained for 20 Epochs:



Training and Test Accuracy for elapsed Epochs in Original LeNet

1.3 Performance

Confusion matrix for LeNet implementation:



Notably, numbers 4 and 9 seem to have a higher than average confusion rate, which is a noticeable trend for some models as 4 and 9 have highly similar features.

Training and Testing Summary for Original LeNet-5:

Final Train Accuracy: 98.76

Final Test Accuracy: 98.49

Final Train Loss: 0.000656

Final Test Loss: 0.050067

Problem 2

2 Modifying LeNet5 to Handle Unseen Data

2.1 Modified Implementation

This modified implementation applies dropout layers, max pooling, and the ReLu activation function to some hidden layers. Dropout layers and max pooling will help to prevent overfitting with the standard data. They will help with data that has been modified with rotation, translation, or other modifications. Using the Adam optimizer is a more modern solution that can improve the stochastic optimization of the original LeNet. The combination of these

modifications should make the model more robust to modifications to the data set.

3 Testing for Inference

Assuming the data (original or TA created) is in the same directory as the provided python file 'lenet5.py', both models may be evaluated for inference simply by running such file; it will produce a testing accuracy and confusion matrix for the original implementation and the modified implementation.