Digit Classifier (MNIST Database)

Pulkit Agarwal

July 2021

1 Model Architecture

The model consists of a 2D CNN with 32 filters, ReLU activation and a kernel of size (3,3) convolving over the (28,28) pixel images. This is followed by a batch normalization layer to standardize the output, a 2D max pooling layer and then a layer to flatten the output. Finally I used a dense layer with softmax activation to get the output.

Apart from this, I also implemented a basic neural network with 32 neurons, to compare the results of the two models. In the model.py file, this model has been included in comments.

I used the SGD optimizer for implementing the back propagation step, and the Sparse Categorical Cross Entropy loss function to find out the loss.

2 Observations

2.1 Basic Neural Network

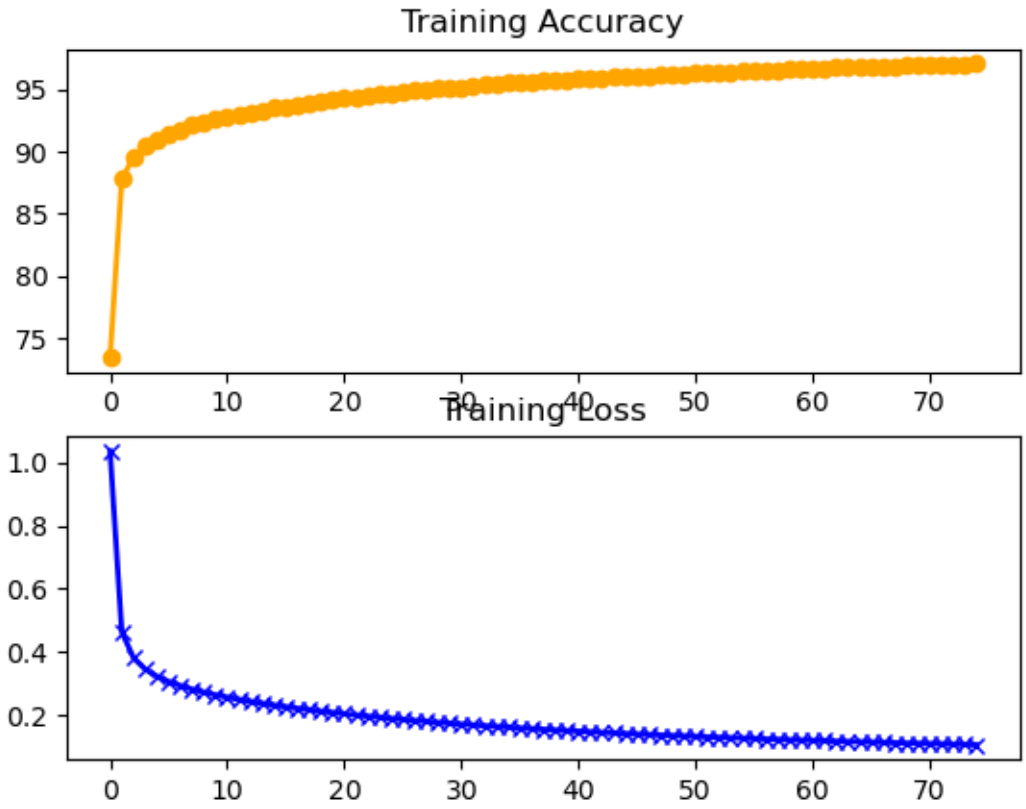
I ran the basic neural network model for 75 epochs, which considerably increased the accuracy, and by which time learning had almost stagnated. After training for 40 epochs, I was getting a test accuracy of around 95.5%, which eventually increased to around 96.4% after training for 75 epochs. Decreasing the learning rate to 0.001 increased the accuracy, but not significantly, while changing the batch size to 32 mainly led to an increase in running time only.

2.2 Convolutional Neural Network

The CNN model had some changes over time. I initially took a kernel size of (2,2) which was giving me an accuracy of around 98.2% on the test set after training for 20 epochs. A kernel size of (3,3) helped in increasing this to 98.47%. I also made similar changes to the learning rate as in the basic neural network model, but that did not increase the test accuracy significantly. I didn't decrease the batch size or increase the number of epochs due to the already high running time of around 30 to 40 seconds per epoch.

3 Results - Basic Neural Network

3.1 Training loss and accuracy

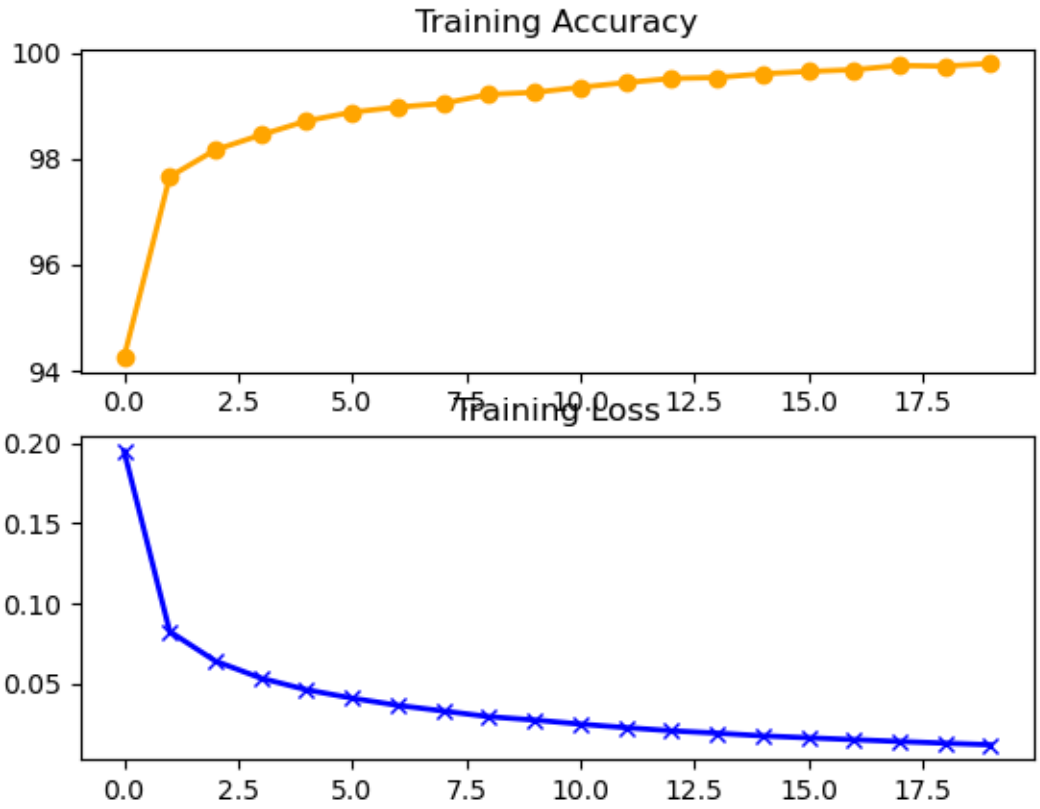


3.2 Test loss and accuracy

```
Running test...
        Test loss: 0.122
        Test accuracy: 96.39%
```

4 Results - Convolutional Neural Network

4.1 Training loss and accuracy



4.2 Test loss and accuracy

```
Running test...
        Test loss: 0.049
        Test accuracy: 98.47%
```