COMPUTER VISION AND PATTERN RECOGNITION

MIDTERM PROJECT

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Section: A

Answer to the question no: 03

Report based on Question no 2.

Abstract:

This report implements the CNN architecture for classifying handwritten MNIST datasets. We use three types of optimizers (ADAM, SGD, RMSProp) to classify the MNIST dataset. This report checks the accuracy of various optimizers (ADAM, SGD, and RMSProp).

Introduction:

An optimizer is an algorithm or method used to change the attributes of a neural network , such as weights and learning rates, to reduce losses. The optimizer helps you get the result faster.

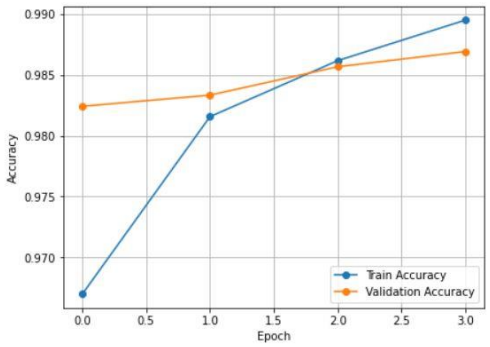
This report uses three types of optimizers. they are:

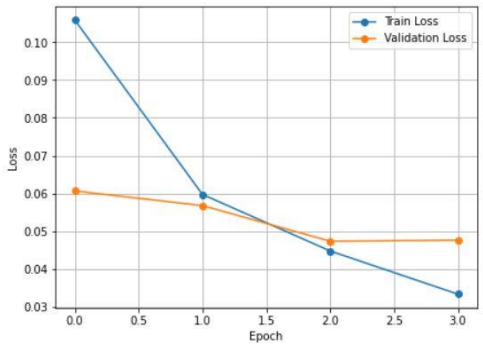
1. Adam: Adam is an alternative stochastic gradient descent optimization algorithm for training deep learning models. This is an extension of stochastic gradient descent, and recently has become widely accepted in computer vision and natural language processing deep learning applications.

2. SGD: Stochastic Gradient Descent (often abbreviated as SGD) is an iterative method for optimization of objective functions with good smoothness properties. Much slower than the ADAM.

3. RMSProp: RMSprop is an abbreviation for root mean square propagation. This is an unpublished, but well-known gradient descent optimization algorithm for mini-batch training of neural networks. RMSprop is a gradient-based optimization technique used in training neural networks.

Results





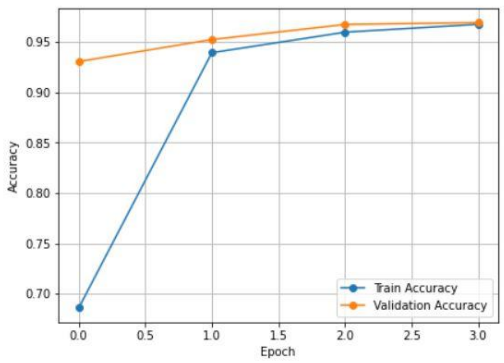

```
test_loss, test_acc = model.evaluate(X_test, Y_test)
print('\nTest Accuracy:', test_acc)
print('\nTest Loss:', test_loss)
```

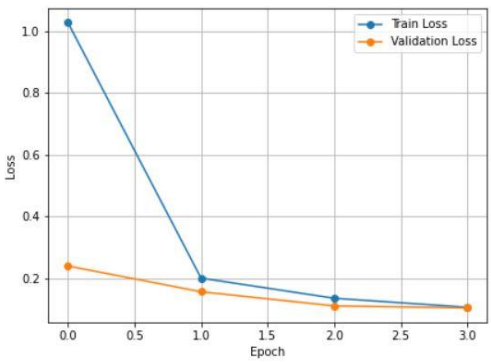
```
313/313 [==============================] - 3s 9ms/step - loss: 0.0433 - accuracy: 0.9879

Test Accuracy: 0.9879000186920166

Test Loss: 0.04332428798079491
```

Here, I use ADAM optimizer and the test accuracy is 0.9879000186920166 that means 98.79%. The test loss is 0.04332428798879491 that means 0.4%.





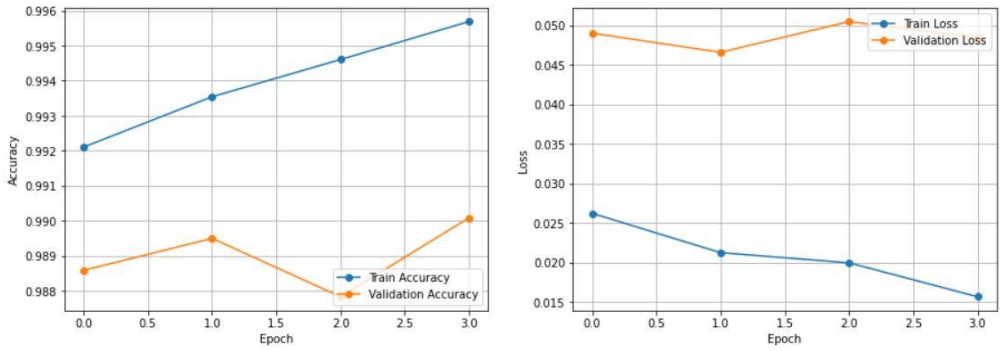

```
test_loss, test_acc = model.evaluate(X_test, Y_test)
print('\nTest Accuracy:', test_acc)
print('\nTest Loss:', test_loss)
```

```
313/313 [==============================] - 3s 9ms/step - loss: 0.0979 - accuracy: 0.9707

Test Accuracy: 0.9707000255584717

Test Loss: 0.09790098667144775
```

Here, I use SGD optimizer and the test accuracy is 0.9707000255584717 that means 97.07%. The test loss is 0.09790098667144775 that means 0.9%.




```
test_loss, test_acc = model.evaluate(X_test, Y_test)
print('\nTest Accuracy:', test_acc)
print('\nTest Loss:', test_loss)
```

```
313/313 [==============================] - 3s 9ms/step - loss: 0.0431 - accuracy: 0.9913

Test Accuracy: 0.9912999868392944

Test Loss: 0.043141648173332214
```

Here I use RMSprop optimizer and the test accuracy is 0.9912999868392944 that means 99.12%. The test loss is 0.043141648173332214 that means 0.4%.

Discussion:

This report uses three types of optimizers: ADAM, SGD, and RMS Drop. So I found a slight difference of between those precisions. ADAM is much faster than SGD and RMS Drop. Built on the strengths of previous models, the Adam Optimizer offers much higher performance than the previously used and far outperforms it by providing an optimized descent gradient. My ADAM accuracy is 98.79%. The second best collaborative optimizer is the SGD, which is also good and my SGD accuracy is 97.07%. The last one is RMSProp, my RMSProp is 99.12%, which is more accurate from ADAM and SGD.