COMPUTER VISION AND PATTERN RECOGNISION

Midterm Project Report

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SECTION: A

Abstract:

A convolutional neural network (CNN, or ConvNet) is a type of artificial neural network used to perform visual imagery in deep knowledge. Based on the shared-weight structure of the convolution kernels or filters that slide along input features and give translation equivariant acknowledgments known as feature maps, they are also known as shift invariant or term invariant synthetic neural networks (SIANN). Surprisingly, most convolutional neural networks are only equivariant under translation, rather than invariant. They're used in image and video perception, recommender schemes, image sizing, and picture segmentation, among other things.

This report contains the following information.I've published a detailed description of how I used CNN architecture to categorize the MNIST handwritten dataset that was previously uploaded. I utilized three types of optimizers to categorize the MNIST dataset:

ADAM, SGD, and RMSProp.

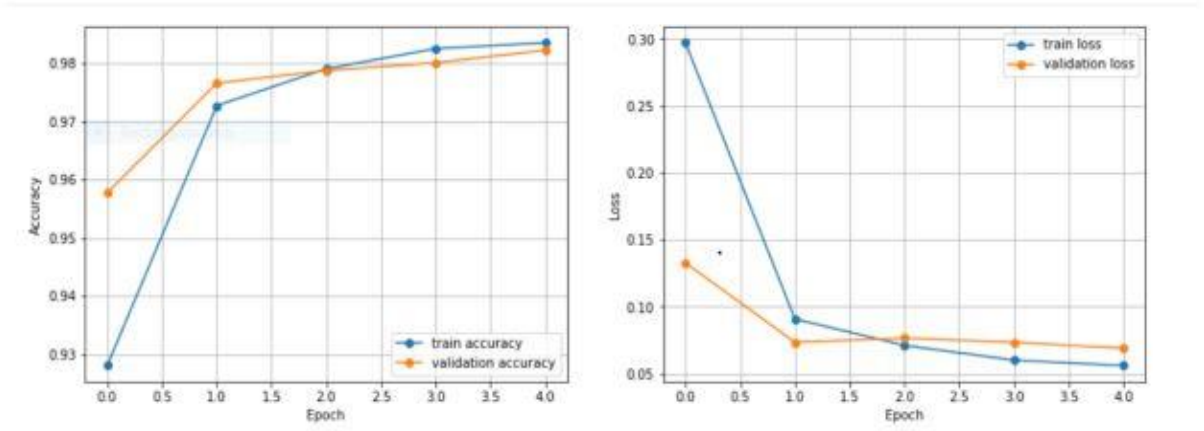
Introduction:

Adam is a deep learning model training algorithm that replaces stochastic gradient descent. Adam combines the finest features of the AdaGrad and RMSProp methods to create an optimization technique for noisy issues with sparse gradients. Adam is simple to set up, and the default configuration parameters work well for the majority of problems.

The iterative method stochastic gradient descent (commonly abbreviated SGD) is used to optimize an objective function with sufficient smoothness qualities (e.g. differentiable or subdifferentiable). It is possible to think of it as a stochastic approximation of gradient descent optimization.because it substitutes an estimate of the gradient (derived from a randomly selected portion of the data) for the actual gradient (estimated from the complete data set). This minimizes the computing cost, especially in high-dimensional optimization problems, allowing for faster iterations in exchange for a reduced convergence rate.

Root Mean Squared Propagation, or RMSProp, is a variation of gradient descent and the AdaGrad version of gradient descent that adapts the step size for each parameter using a declining average of partial gradients.

Results: For the results , I used ADAM optimizer and got 98.40% accuracy and loss 5.5%.

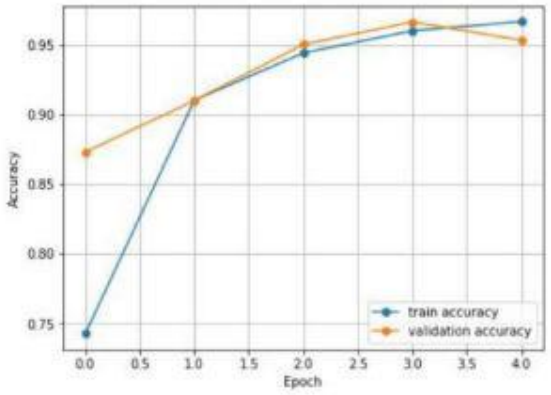


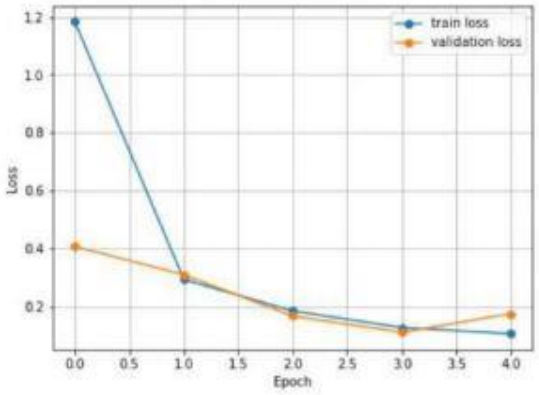

```
test_loss, test_acc = model_1.evaluate(X_test, Y_test)
print('\nTest Loss:', test_loss)
print('\nTest Accuracy:', test_acc)
```

```
313/313 [==============================] - 3s 9ms/step - loss: 0.0555 - accuracy: 0.9840

Test Loss: 0.05552656203508377
```

Then I Used SGD Optimizer with 95.37% accuracy.





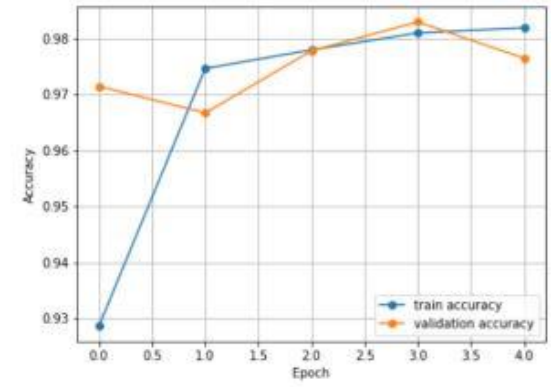

```
test_loss, test_acc = model_2.evaluate(X_test, Y_test)
print('\nTest Loss:', test_loss)
print('\nTest Accuracy:', test_acc)
```

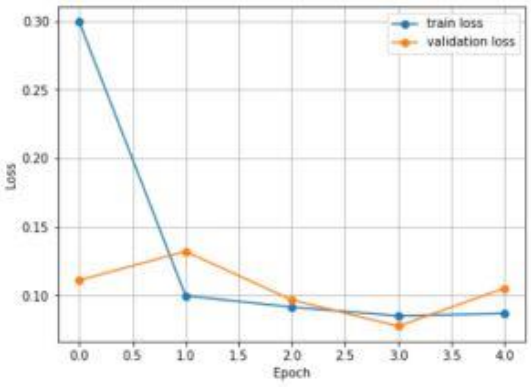
```
313/313 [==============================] - 1s 4ms/step - loss: 0.1590 - accuracy: 0.9537

Test Loss: 0.15898685157299042

Test Accuracy: 0.9537000060081482
```

At last RGBProp and the accuracy is 97.70%.






```
test_loss, test_acc = model_3.evaluate(X_test, Y_test)
print('\nTest Loss:', test_loss)
print('\nTest Accuracy:', test_acc)
```

```
313/313 [==============================] - 3s 9ms/step - loss: 0.0964 - accuracy: 0.9770

Test Loss: 0.09640488028526306

Test Accuracy: 0.9769999980926514
```

Discussion:

For optimization, I utilized ADAM, SGD, and RMSProp in this project. I'm experimenting with networks utilizing RMSProp, Adam, and SGD on the EMNIST validation set. With SGD, I'm getting 95.37 percent accuracy. When testing the same exact configuration

using RMSProp, the accuracy is 97.70%, and when testing with Adam, the accuracy is 98.40%. I had several difficulties at first. The project was then restarted,

and the results were obtained.

References:

1. https://machinelearningmastery.com/adam-optimizationalgorithm-for deep-learning/\

2. https://ruder.io/optimizing-gradient-descent/

3. https://medium.com/analytics-vidhya/a-complete-guide-to-adamand rmsprop-optimizer 75f4502d83b

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