Computer Vision and Pattern Recognition

Mid Project Report

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Abstract:

It can be quite difficult to detect the human handwritten digits from images as handwritings often varies from person to person. The aim of this project is to propose CNN (Convolutional Neural Network) model to classify the MNIST dataset that is hand written whilst getting an accuracy of over 98%. The evaluation is done using 3 different optimizers i.e adam, rmsprop and sgd.

Introduction:

Convolutional Neural Network is a type of artificial neural network that's used to analyze images and is used in image processing and segmentation. CNN has been the go-to for many visual based image segmentation projects. MNIST dataset is a large database of handwritten digits. There are two sets of images in MNIST, one is train image set which consists of 6000 images and test images which consists of 10000 images where each image consists f 28*28. The value of each pixel ranges from 0-255. In this report, I've used CNN models and evaluated ADAM, RMSPROP and SGD. These models have an input layer, a 2D convolutional layer, max pooling layer and flatten layer followed by a dense layer ending with the output layer.

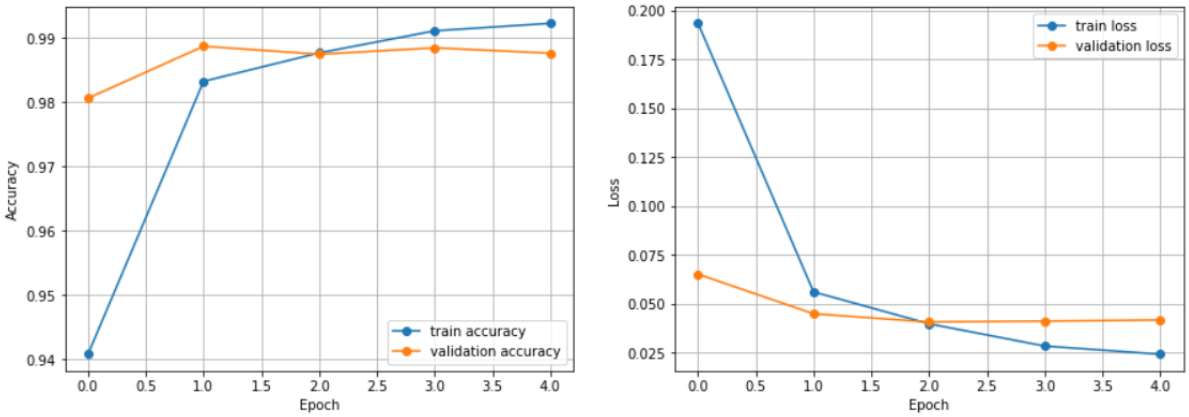
```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_2 (Conv2D)            (None, 24, 24, 32)        832
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 12, 12, 32)        0
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 10, 10, 64)        18496
_________________________________________________________________
max_pooling2d_3 (MaxPooling2 (None, 5, 5, 64)          0
_________________________________________________________________
flatten_1 (Flatten)          (None, 1600)              0
_________________________________________________________________
dense_2 (Dense)              (None, 64)                102464
_________________________________________________________________
dense_3 (Dense)              (None, 10)                650
=================================================================
Total params: 122,442
Trainable params: 122,442
Non-trainable params: 0
```

Figure of Model

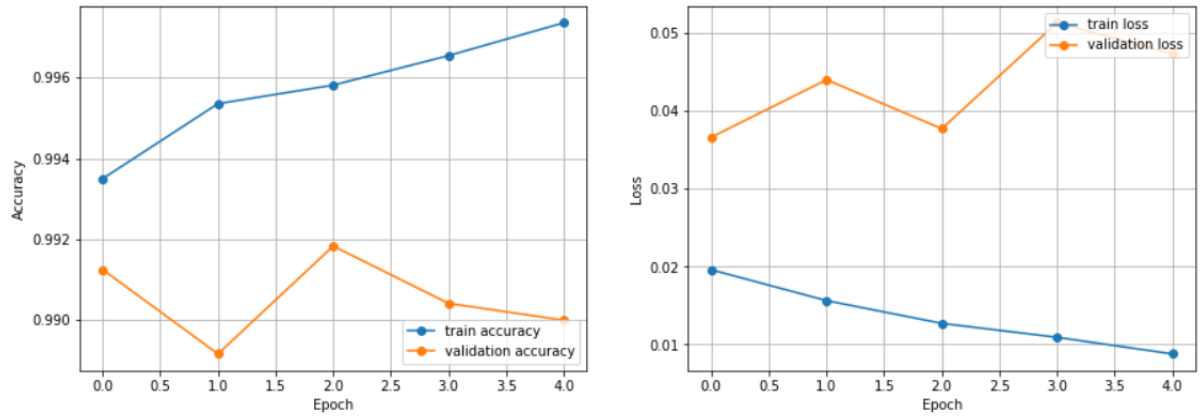
Results:

The results of the models using different optimizer:

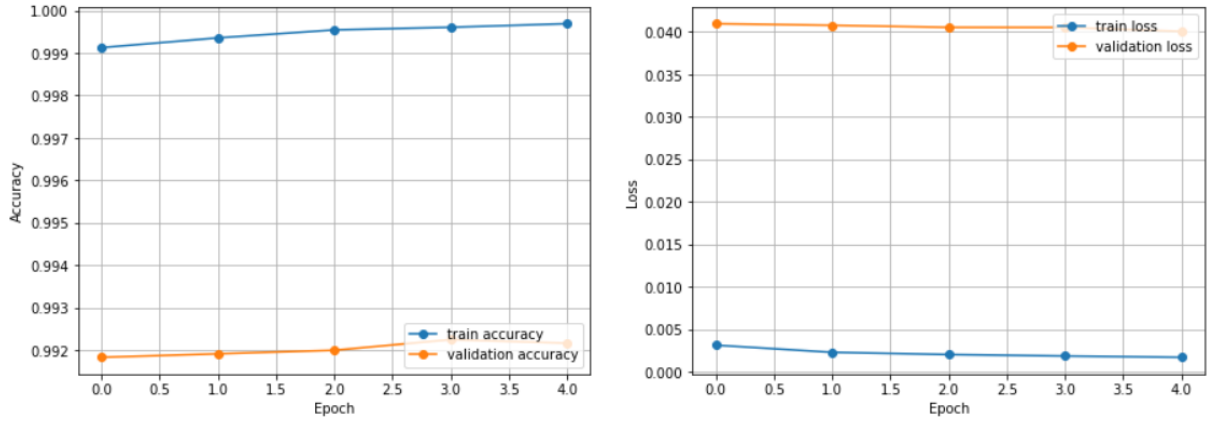
Optimizer	Train Accuracy	Validation Accuracy	Test Accuracy	Test Loss
ADAM	94.08%	98.06%	98.78%	3.36%
RMSprop	99.35%	99.12%	99.21%	3.26%
SGD	99.91%	99.18%	99.30%	2.57%



Graph Plot for Adam



Graph Plot for RMSprop



Graph Plot for SGD

Discussion:

The ADAM optimizer gives a test accuracy of 98.78%, the RMSprop gives 99.21% and SGD gives 99.30%. From the test accuracy results it shows that SGD gives the value of the highest accuracy. The test loss in ADAM, RMSprop and SGD is 3.36%, 3.26% and 2.57% respectively. So as a result the best optimizer to go for is SGD as it has the highest train and test accuracy with the lowest test loss.