Computer Vision And Pattern Recognition [B]

Mid-Project Report

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Title: Evaluation of proposed CNN model to classify the MNIST handwritten dataset

Abstract:

Handwritten digits are tough to recognize automatically as it differs from person to person. The main goal of this work is to propose a simple convolutional neural network(CNN) model to classify MNIST as a handwritten dataset.

Introduction:

A convolutional neural network(CNN) is a type of artificial neural network, mostly used in graphical analysis. To analyze image data, labeled sets of particular image classes are fed into a CNN model. The MNIST is a database of labeled images of handwritten digit image class. The train image set of MNIST is consists of 60000 images and a test image set of 10000 images, each image is 28*28 pixels having each pixel value of 0 to 255. Different combinations of CNN can produce different results in a single dataset. I have used CNN models and evaluated Adam, SGD, and RMSprop optimizer. The model has an input layer followed by a one-dimensional convolutional layer and max-pooling layer and flatten layer, after that a dense layer, and finally the output layer. Below is the hyper-parameter of the model.

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv1d (Conv1D)              (None, 24, 32)            4512
_________________________________________________________________
max_pooling1d (MaxPooling1D) (None, 12, 32)            0
_________________________________________________________________
conv1d_1 (Conv1D)            (None, 10, 64)            6208
_________________________________________________________________
max_pooling1d_1 (MaxPooling1 (None, 5, 64)             0
_________________________________________________________________
flatten (Flatten)            (None, 320)               0
_________________________________________________________________
dense (Dense)                (None, 128)               41088
_________________________________________________________________
dense_1 (Dense)              (None, 10)                1290
=================================================================
Total params: 53,098
Trainable params: 53,098
Non-trainable params: 0
```

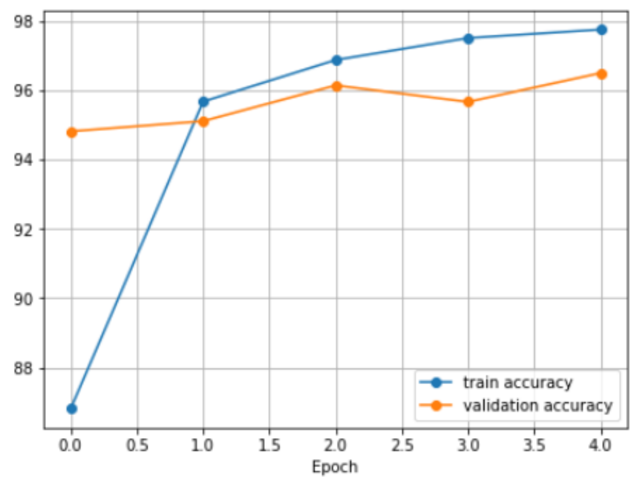
Fig1: Model

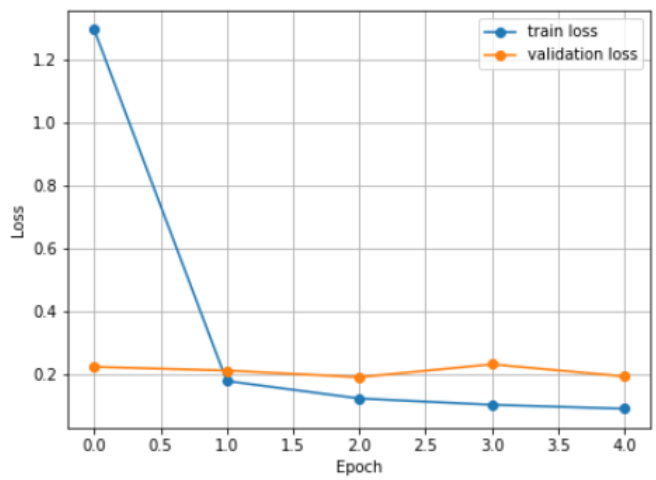
Results:

The result of the CNN model for different optimizers are given below:

Optimizer	Train Accuracy	Validation Accuracy	Test Accuracy
SGD	93.54%	94.82%	95.67%
Adam	94.78%	95.12%	95.03%
RMSprop	97.35%	96.51%	96.64%

Fig2: Result





Discussion:

My proposed ‘Model’ provides the best test accuracy of 98.72% on the RMSprop optimizer and the lowest test accuracy of 93.66% on the SGD optimizer.

But the graph analysis shows a different rate of Train and Validation accuracy, thus indicating the model will not perform consistently in real-life data. The RMSprop optimizer of the ‘Model’ graph indicates the somewhat similar rate of Train and Validation accuracy, thus indicating the model will perform better in real-life data.