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Course: Computer Vision and Pattern Recognition

Section: A

Title:

Evaluation of proposed CNN model to classify the MNIST handwritten dataset

Abstract:

The automatic detection of handwritten digit from image data can be difficult as handwritten information depends on person to person. In this project our aim is to propose a simple Convolutional Neural Network(CNN) model to classify MNIST handwritten dataset and It will give output more than 98% where we evaluate different optimizer.

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.

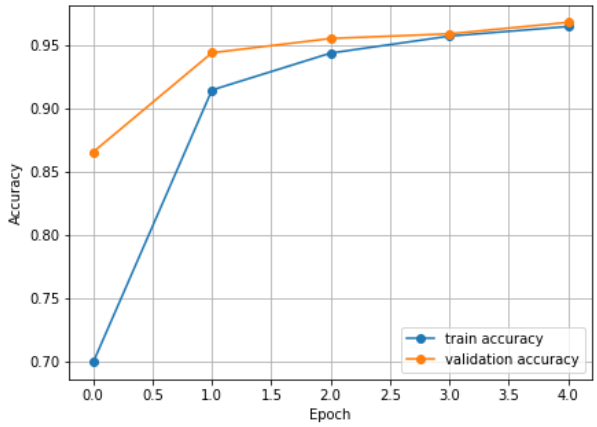
```
Model: "sequential_7"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_18 (Conv2D)           (None, 24, 24, 32)        832
_________________________________________________________________
max_pooling2d_18 (MaxPooling (None, 12, 12, 32)        0
_________________________________________________________________
conv2d_19 (Conv2D)           (None, 10, 10, 64)        18496
_________________________________________________________________
max_pooling2d_19 (MaxPooling (None, 5, 5, 64)          0
_________________________________________________________________
flatten_7 (Flatten)          (None, 1600)              0
_________________________________________________________________
dense_14 (Dense)             (None, 64)                102464
_________________________________________________________________
dense_15 (Dense)             (None, 10)                650
=================================================================
Total params: 122,442
Trainable params: 122,442
Non-trainable params: 0
```

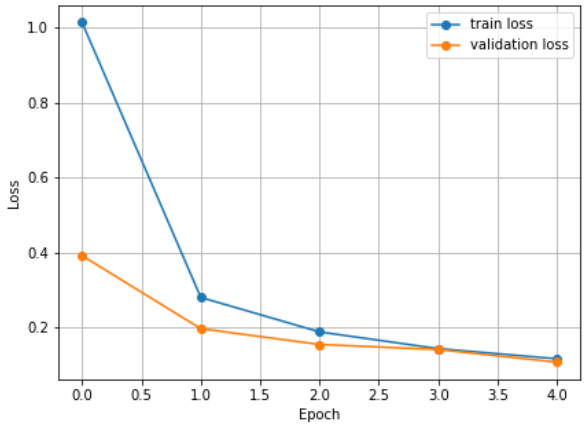
Fig1: Model 1

Results:

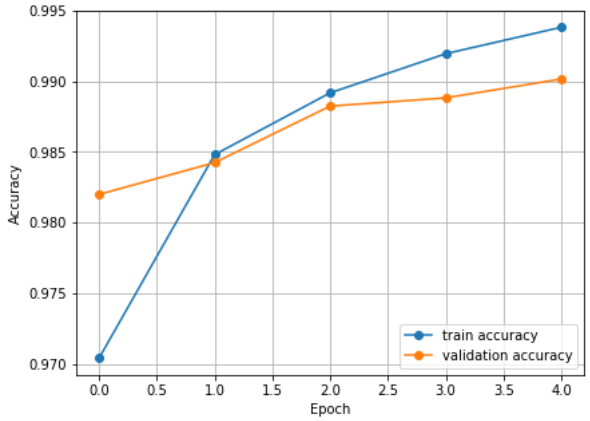
Result of the CNN ''Model 1'' for different optimizer are given below

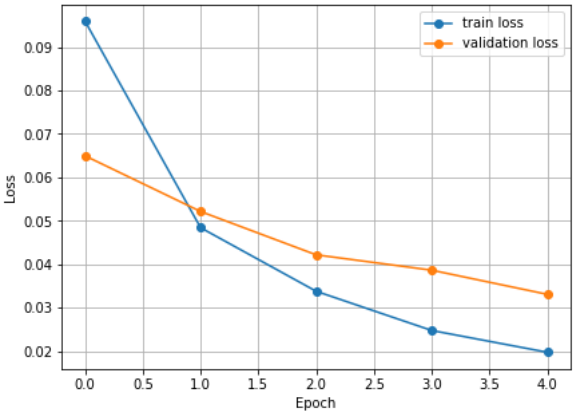
Optimizer	Train Accuracy	Validation Accuracy	Test Accuracy	Test Loss
SGD	99.80%	99.01%	97.28%	09.40%
ADAM	97.04%	98.20%	99.15%	02.72%
RMSProp	99.50%	99.08%	99.30%	03.14%



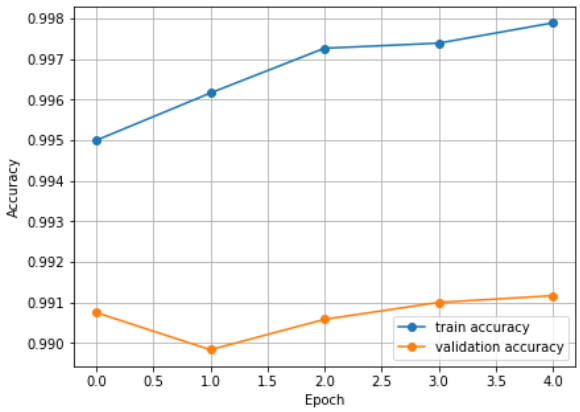


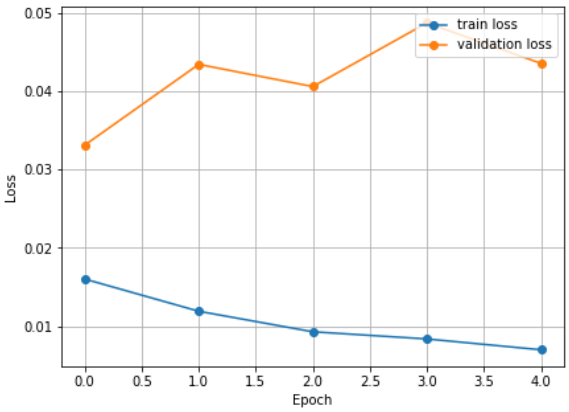
Model-1 Loss for SGD





Model-1 Loss for ADAM





Model-1 Loss for RMSProp

Discussion:

Proposed Model-1 test accuracy is 99.30% on RMSProp optimizer and least accuracy is SGD optimizer 97.28%. Considering the graph analysis shows a different rate of Train and Validation accuracy, thus indicating the model will not perform consistent in real life data. The RMSprop optimizer of “Model-1” graph indicates somewhat similar rate of Train and Validation accuracy, thus indicates the model will perform better in real life data.