Part-1:

Datasets:

Dataset used: https://www.dropbox.com/s/pan6mutc5xj5kj0/trainPart1.zip

It consists of images that belong to 62 classes with each class having 40 images totalling to 2480 images.

Data Preprocessing:

The dataset consists of 10 digits (0-9) , 26 small letters (a-z) and 26 capital letters (A-Z)

Original Images (Size 900 X 1200) were first rotated by 30 degrees randomly both clockwise and anti-clockwise to introduce some variation and Resize was applied such that aspect ratio is maintained (3:4) .Center Crop was done to focus more on the Image area that contained digits and letters(210 X 280 is the final images size).

Model Architecture:

ResNet based model with identity connections was used.

The idea was to have a deep layer so that a dataset with many images can be trained without any problems.

Paper Link: https://arxiv.org/abs/1512.03385

A modified version of ResNet50 was used.

The four intermediate blocks in the original version consist of 3,4,4,4 layers respectively.Whereas here intermediate blocks consist of 1,2,2,2 layers.

The dataset used here is not as complex as the images used in ImageNet challenge so I reduced no. of layers.

Training:

The preprocessed dataset was split into train and validation sets of size 2200,280 respectively.

Cross Entropy Loss Function was used because this problem involves multi-class classification.

Adam optimizer was used with a learning rate set at 3e-5 and training was done for 60 epochs.

Step Learning rate scheduler was used such that for every two epochs the learning rate gets multiplied by a factor of 0.9

Based on accuracy on the Validation set, model weights were saved in checkpoints.

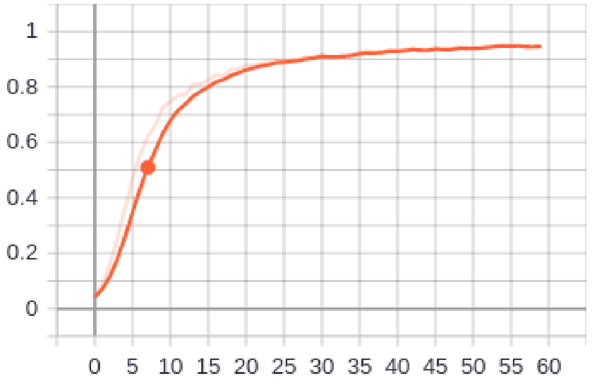
Learning rates of 3e-3,3e-4,3e-6 were also tried but best results were obtained for the above mentioned values

Results:

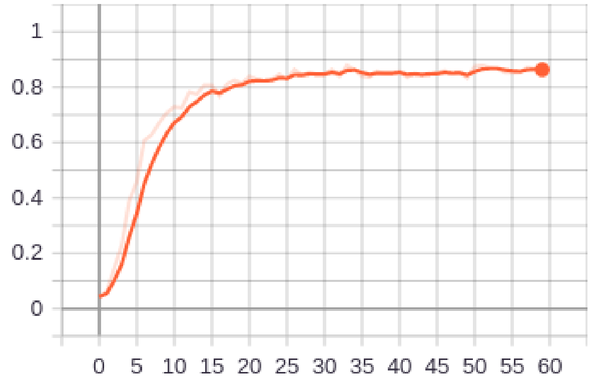
The best validation accuracy was 87.86 %. At that point training accuracy was 91.7%.

Plots of Training Accuracy, Validation Accuracy, Training Loss, Validation Loss over epochs

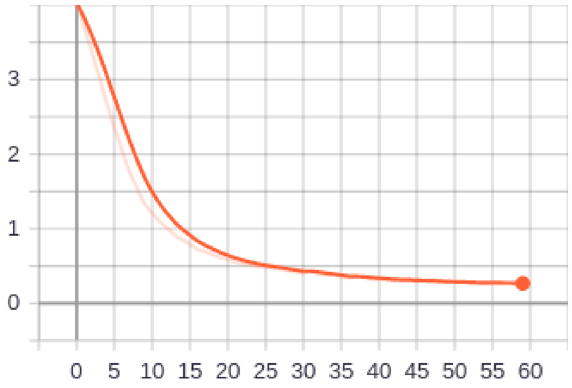
Train
tag: Acc/Train



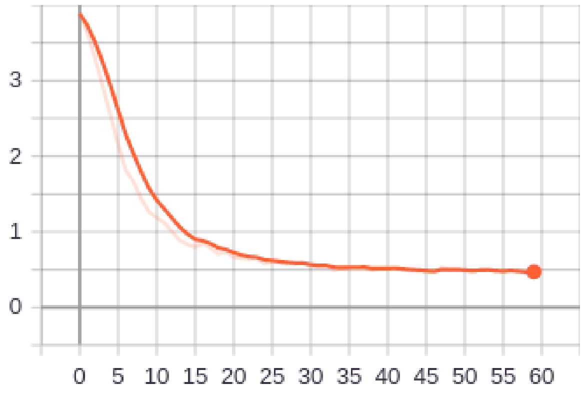
Val
tag: Acc/Val



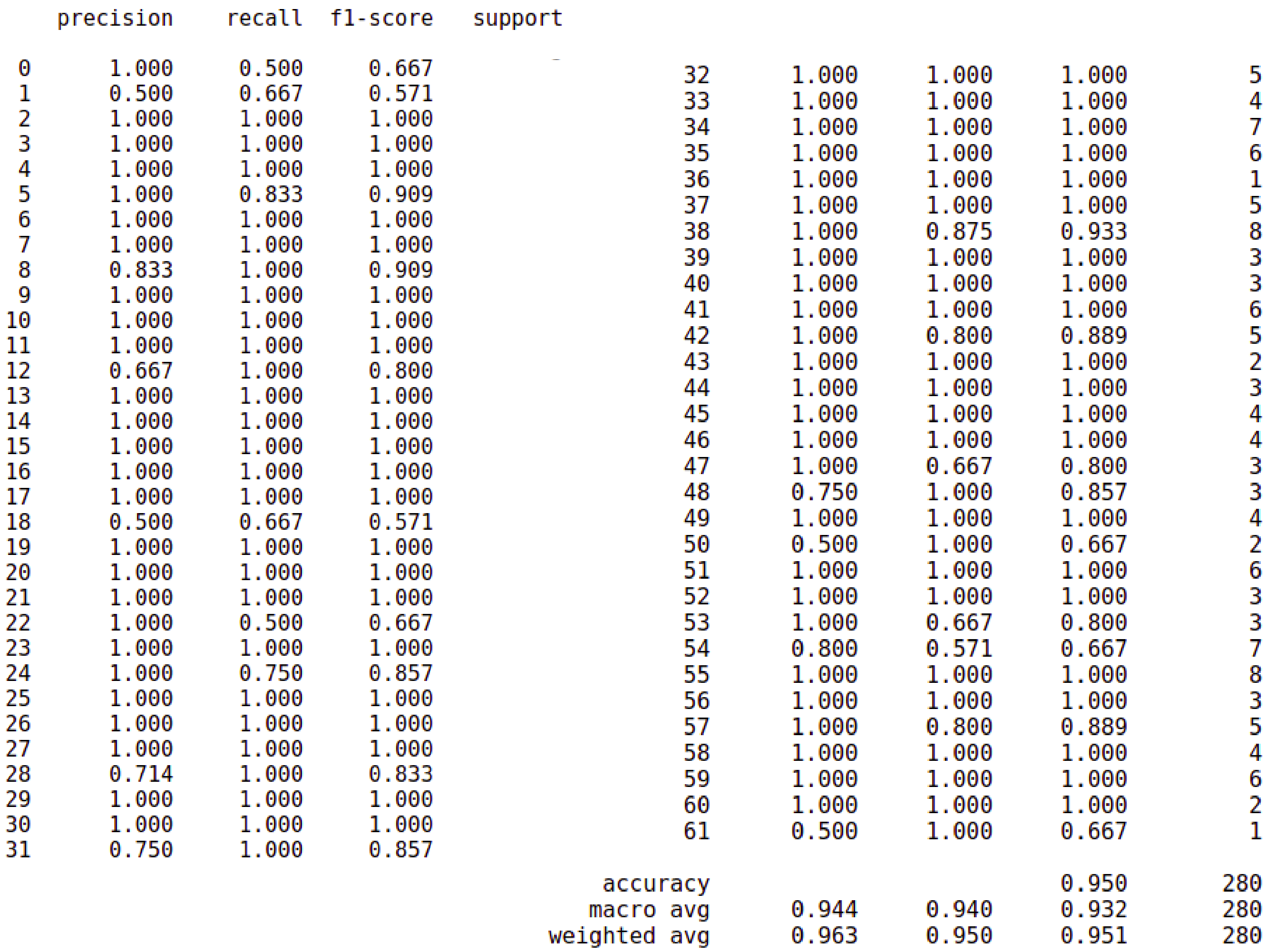
Train
tag: Loss/Train



Val
tag: Loss/Val



Precision , Recall and f1-scores on Validation data



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   precision    recall  f1-score   support

 0     1.000     0.500     0.667             32     1.000     1.000     1.000       5
 1     0.500     0.667     0.571             33     1.000     1.000     1.000       4
 2     1.000     1.000     1.000             34     1.000     1.000     1.000       7
 3     1.000     1.000     1.000             35     1.000     1.000     1.000       6
 4     1.000     1.000     1.000             36     1.000     1.000     1.000       1
 5     1.000     0.833     0.909             37     1.000     1.000     1.000       5
 6     1.000     1.000     1.000             38     1.000     0.875     0.933       8
 7     1.000     1.000     1.000             39     1.000     1.000     1.000       3
 8     0.833     1.000     0.909             40     1.000     1.000     1.000       3
 9     1.000     1.000     1.000             41     1.000     1.000     1.000       6
10     1.000     1.000     1.000             42     1.000     0.800     0.889       5
11     1.000     1.000     1.000             43     1.000     1.000     1.000       2
12     0.667     1.000     0.800             44     1.000     1.000     1.000       3
13     1.000     1.000     1.000             45     1.000     1.000     1.000       4
14     1.000     1.000     1.000             46     1.000     1.000     1.000       4
15     1.000     1.000     1.000             47     1.000     0.667     0.800       3
16     1.000     1.000     1.000             48     0.750     1.000     0.857       3
17     1.000     1.000     1.000             49     1.000     1.000     1.000       4
18     0.500     0.667     0.571             50     0.500     1.000     0.667       2
19     1.000     1.000     1.000             51     1.000     1.000     1.000       6
20     1.000     1.000     1.000             52     1.000     1.000     1.000       3
21     1.000     1.000     1.000             53     1.000     0.667     0.800       3
22     1.000     0.500     0.667             54     0.800     0.571     0.667       7
23     1.000     1.000     1.000             55     1.000     1.000     1.000       8
24     1.000     0.750     0.857             56     1.000     1.000     1.000       3
25     1.000     1.000     1.000             57     1.000     0.800     0.889       5
26     1.000     1.000     1.000             58     1.000     1.000     1.000       4
27     1.000     1.000     1.000             59     1.000     1.000     1.000       6
28     0.714     1.000     0.833             60     1.000     1.000     1.000       2
29     1.000     1.000     1.000             61     0.500     1.000     0.667       1
30     1.000     1.000     1.000
31     0.750     1.000     0.857
                                       accuracy                         0.950     280
                                      macro avg     0.944     0.940     0.932     280
                                   weighted avg     0.963     0.950     0.951     280
```