

Part 1

ResNet (Residual Neural Network) is a deep learning architecture used to classify images. Most deep learning architecture run into constraints as adding more layers in the network lead to degraded performance. This is due to vanishing or exploding gradients. ResNet was able to overcome this by using skip connections. Skip connection directly connect two separate layers, allowing few layers to be skipped. The ResNet model varies based on number of layers, but is usually made up of convolution layers, and has a fully connected layer at the end for 1000 classes. ResNet outputs 1000 classes as it was trained on ImageNet which has 1000 classes.

Part 2

We had to classify MNIST dataset, which is made up of handwritten number from zero (0) to nine (9). One of the most important to classify this data was to understand the size of the data and what type of input ResNet18 takes. Our data is single channel 8x8 picture. However, ResNet18 takes three channel input and spits out 1000 outputs (we only need 10: 0-9). Thus, we must change the first and last layer of the net to match our specifications. The model started with a 11.350% match on the test data without training. For training, I used SGD as an optimizer and cross entropy as a loss function of the batch. My batch size is 128 and model trains 10 times on the training data. After the training the model had 97.450% match on test data. The average precision, recall, f-score, and accuracy are 97.4268%, 97.4222 %, 97.4231% and 97.4222% respectively.

Part 3

As I was running the training locally on my machine. I was running out of GPU memory to load several models at same time. Thus, I had to manually del tensors and models that were loaded on to GPU. This led to longer execution time, and it might also lead to some wasted performance in training the model. I tested two models on cat vs dog dataset: ResNet18 and ResNet50. To my surprise ResNet18 started with higher match percentage of 60.507%. On the other hand, ResNet50 had 26.547%.

However, after 3 run of training ResNet18 ended at the match percentage of 98.173% after training. While ResNet50 had match percentage of 98.133%.

The precision, recall, f-score, and accuracy of ResNet18 are 98.1802 %, 98.1691 %, 98.173%, and 98.1691% respectively.

The precision, recall, f-score, and accuracy of ResNet50 are 98.1539 %, 98.125 %, 98.1327%, and 98.125% respectively.

We see that even tough ResNet50 has more layers it performs worse than ResNet18. This proves our point from part1 that after certain number of layers we see drop in performance.