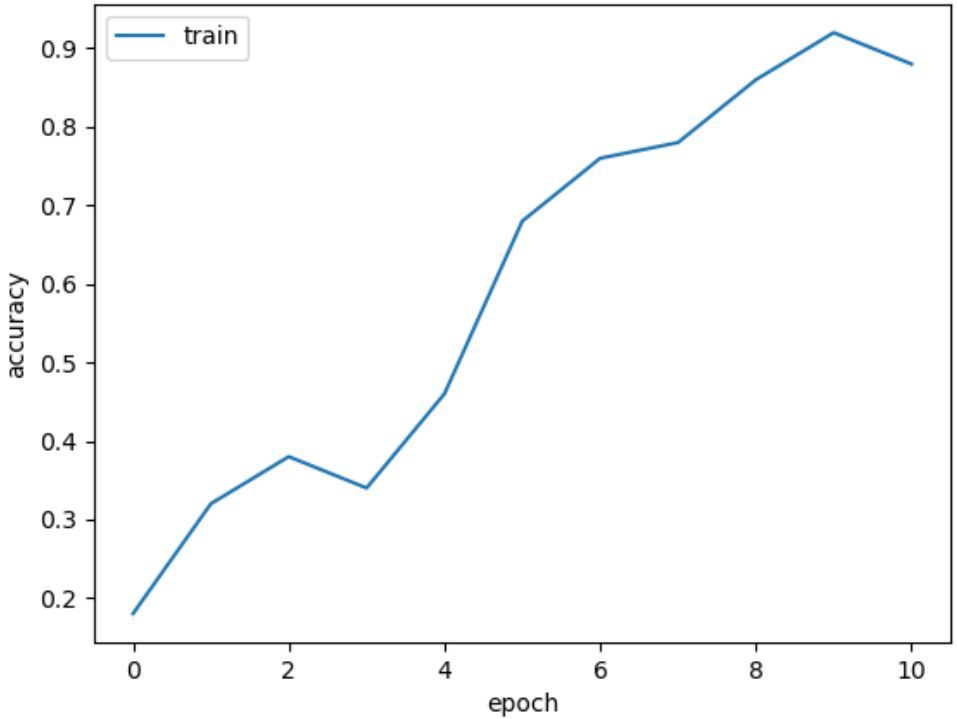
Assignment 2 Writeup

Name: Peng, Chen
GT Email: c.peng@gatech.edu
GT ID: 903646937

Part-1 ConvNet

Put your learning curve here:



My CNN Model

Describe your model design in plain text here:

- Architecture: The model constructed with 3 convolutional layer groups, each group includes 2 convolutional layers. Each convolutional layer follows with a ReLU layer and a batch normalization layer. Each convolutional group follows with a max pooling layer and a dropout layer. After the 3 groups of convolutional layers, the two fully connected layers was implemented to connect the conv layer and output layer. There are also a ReLU, a batch norm, and a dropout layer between the two fully connected layer.
- All of the convolutional layers have 3*3 kernels with 1 replicate padding and 1 stride. The output channel number is from 32 to 128
- All of the maxpooling layer have the 2*2 kernel with stride equals 2.
- The dropout ratio is from 0.2 to 0.5

Describe your choice of hyper-parameters:

- The model run with batch size 16
- The learning rate is 0.01
- The regularization factor is 0.001
- The total training epoch is 35
- The scheduler steps S[e1, e2, e3], where e1 = 20, e2 = 27 with learning rate decay [1, 0.1, 0.01]
- The warmup epoch number is 5
- The momentum for SGD is 0.9
- The loss function is cross entropy loss.

What’s your final accuracy on validation set?

- Best Prec @1 Acccuracy: 0.8220
  - Accuracy of Class 0: 0.8430
  - Accuracy of Class 1: 0.9000
  - Accuracy of Class 2: 0.7370
  - Accuracy of Class 3: 0.7140
  - Accuracy of Class 4: 0.8230
  - Accuracy of Class 5: 0.6790
  - Accuracy of Class 6: 0.8580
  - Accuracy of Class 7: 0.8590
  - Accuracy of Class 8: 0.9160
  - Accuracy of Class 9: 0.8910

Data Wrangling

What’s your result of training with regular CE loss on imbalanced CIFAR-10?

Fill in your per-class accuracy in the table

	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9
CE Loss	0.940	0.918	0.516	0.376	0.162	0.075	0.132	0.045	0.000	0.000

What’s your result of training with CB-Focal loss on imbalanced CIFAR-10?

Tune the hyper-parameter beta and fill in your per-class accuracy in the table

	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9
beta=0.9999	0.594	0.646	0.262	0.309	0.232	0.306	0.518	0.452	0.515	0.442
beta=0.9	0.722	0.756	0.354	0.326	0.258	0.267	0.482	0.422	0.460	0.177

Put your results of CE loss and CB-Focal Loss(best) together:

	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9
CE Loss	0.940	0.918	0.516	0.376	0.162	0.075	0.132	0.045	0.000	0.000
CB-Focal	0.594	0.646	0.262	0.309	0.232	0.306	0.518	0.452	0.515	0.442

Describe and explain your observation on the result:

- The CE loss cannot work well on imbalanced data. The model will tend to classify the instance to the classes with high frequency in training set.
- The CB-Focal loss can balance the data by reweighting the loss function. It gives more weight to the uncommon cases on the loss function.
- The balance factor β has the range (0, 1). The larger β makes the sample more balance.