1. **Part 2 results:**
   1. **Conv pool Conv pool flatten fc1 fc2 fc3**

*#Computes the activation of the first convolution*

*#Size changes from (3, 32, 32) to (16, 32, 32)*

x = F.relu(*self*.conv1(x))

*#Size changes from (16, 32, 32) to (16, 16, 16)*

x = *self*.pool(x)

*#Size changes from (16, 16, 16) to (32, 16, 16)*

x = F.relu(*self*.conv2(x))

*#Size changes from (32, 16, 16) to (32, 8, 8)*

x = *self*.pool(x)

*#Reshape data to input to the input layer of the neural net*

*#Size changes from (32, 8, 8) to (1, 2048)*

*#Recall that the -1 infers this dimension from the othergiven dimension*

x = x.view(-1, 32 \* 8 \*8)

*#Computes the activation of the first fully connected layer*

*#Size changes from (1, 2084) to (1, 64)*

x = F.relu(*self*.fc1(x))

*#Computes the activation of the first fully connected layer*

*#Size changes from (1, 64) to (1, 2)*

x = F.relu(*self*.fc2(x))

x = *self*.fc3(x)

*lr*=0.01, *wd*=0.0000)

*momentum*=0.9,

op = chain([

type\_cast(np.float32),

add(-127.5),

mul(1/127.5),

hwc2chw(),

])

epoch 100

train loss: 0.000 +- 0.000

val acc: 0.726

Best Accuracy of 0.7300342969132778 at epoch 74

1. **Conv Conv pool Conv Conv pool flatten fc1 fc2 –fc3> not much better**

epoch 100

train loss: 0.000 +- 0.000

val acc: 0.730

Best Accuracy of 0.7315041646251838 at epoch 87

1. **Conv pool conv pool conv pool flatten fc1 fc2 fc3**

*#Computes the activation of the first convolution*

*#Size changes from (3, 32, 32) to (16, 32, 32)*

x = F.relu(*self*.conv1(x))

*#Size changes from (16, 32, 32) to (16, 16, 16)*

x = *self*.pool(x)

*#Size changes from (16, 16, 16) to (32, 16, 16)*

x = F.relu(*self*.conv2(x))

*#Size changes from (32, 16, 16) to (32, 8, 8)*

x = *self*.pool(x)

*#Size changes from (32, 8, 8) to (64, 8, 8)*

x = F.relu(*self*.conv3(x))

*#Size changes from (64, 8, 8) to (64, 4, 4)*

x = *self*.pool(x)

*#Reshape data to input to the input layer of the neural net*

*#Size changes from (32, 8, 8) to (1, 2048)*

*#Recall that the -1 infers this dimension from the other given dimension*

x = x.view(-1, 64 \* 4 \* 4)

*#Computes the activation of the first fully connected layer*

*#Size changes from (1, 2084) to (1, 64)*

x = F.relu(*self*.fc1(x))

*#Computes the activation of the first fully connected layer*

*#Size changes from (1, 64) to (1, 2)*

x = F.relu(*self*.fc2(x))

x = *self*.fc3(x)

*lr*=0.01, *wd*=0.0000

*momentung = 0.9*

epoch 100

train loss: 0.000 +- 0.000

val acc: 0.736

Best Accuracy of 0.7491425771680549 at epoch 39

1. **Discuss how individual techniques of overfitting affect performance(5 combinations)**
2. **Same as part 1.c but new image augmentation:**

op = chain([

hflip(),

rcrop(32,5,"constant"),

type\_cast(np.float32),

add(-127.5),

mul(1/127.5),

hwc2chw(),

])

epoch 100

train loss: 0.297 +- 0.051

val acc: 0.826

Best Accuracy of 0.8280254777070064 at epoch 92

1. **Weight decay 0.0001 (weight decay of 0.001 -> worse result)**

epoch 100

train loss: 0.309 +- 0.053

val acc: 0.825

Best Accuracy of 0.8358647721705047 at epoch 93

1. **Dropout 0.3 before second conv layer -> worsen**

epoch 100

train loss: 0.402 +- 0.054

val acc: 0.805

Best Accuracy of 0.8054875061244487 at epoch 100

1. **Dropout as first layer -> wooorst. 0.78 acc, dropout before fc layers like b. -> no dropout**
2. **Batchnorm2d after each conv did not augment the accuracy**
3. **Implementation of additional augmentation through blurring did not improve.**
4. **Transfer learning with pretrained densenet121, but trained whole network with trainingset, no weights freezed 95% val acc (and test acc)**
5. Questions to answer:
   1. How does SGD work? What are your findings on the example data (part1)?
   2. Which network architecture did you choose for part 2 and why? Did you have problems reaching a low training error?
   3. What are the goals of data augmentation, regularization, and early stopping? How exactly did you use these techniques (hyperparameters, combinations) and what were your results (train and val performance)? List all experiments and results, even if they did not work well, and discuss them.
   4. If you utilized transfer learning, explain what you did and your results.