Programming Exercise

Problem 2

Note: To run/train the model please run **p2_train.py**

To check/test the model please **run p2_test.py**

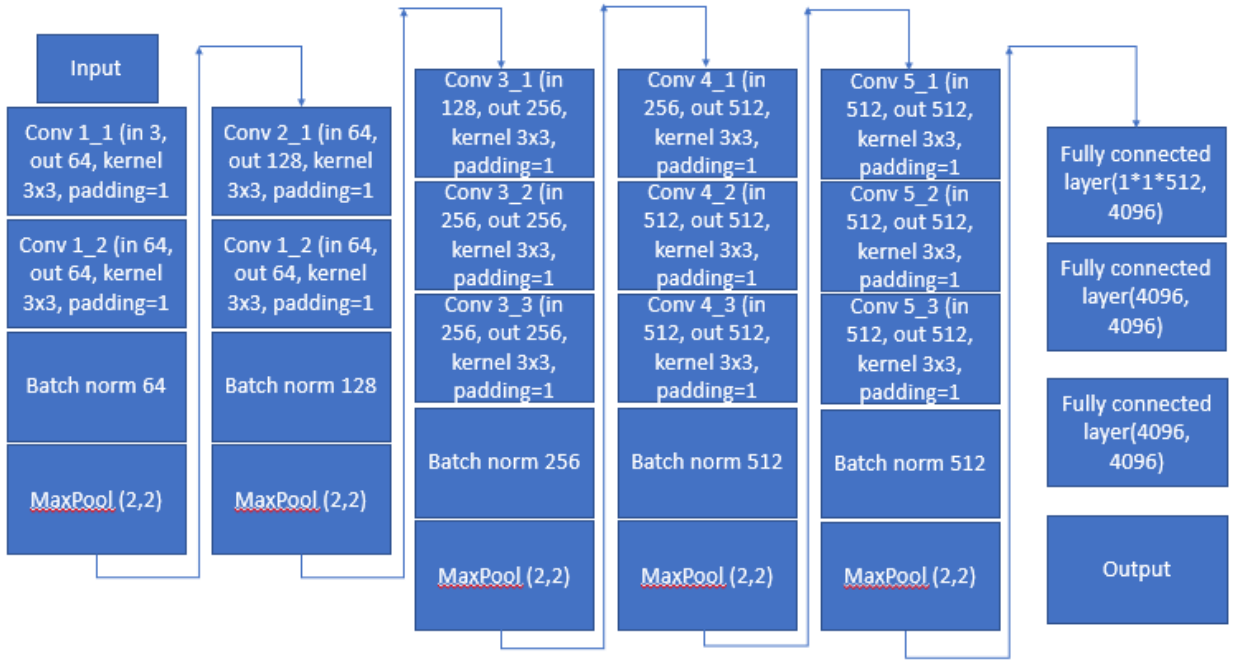
Due to large size (>100MB of .pkl file) I was not able to upload it on gradescope.

PLEASE USE THE FOLLOWING LINK TO THE GOOGLE DRIVE WITH ALL THE CODE FILES AND .PKL FILES:

https://drive.google.com/open?id=1xE6MEumQ070EmSJcowQ9pIw4dCpYf2yC

If for some reason .py doesnot work the drive also has a python notebook which will surely work

Model Architecture: VGG 16 as per the image below



```
Net(
  (conv1_1): Conv2d(3, 64, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (conv1_2): Conv2d(64, 64, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (bn1): BatchNorm2d(64, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
  (conv2_1): Conv2d(64, 128, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (conv2_2): Conv2d(128, 128, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (bn2): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
  (conv3_1): Conv2d(128, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (conv3_2): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (conv3_3): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (bn3): BatchNorm2d(256, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
  (conv4_1): Conv2d(256, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (conv4_2): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (conv4_3): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (bn4): BatchNorm2d(512, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
  (conv5_1): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (conv5_2): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (conv5_3): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (bn5): BatchNorm2d(512, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
  (pool): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
  (fc6): Linear(in_features=512, out_features=4096, bias=True)
  (fc7): Linear(in_features=4096, out_features=4096, bias=True)
  (fc8): Linear(in_features=4096, out_features=1000, bias=True)
)
```

Hyperparameters:

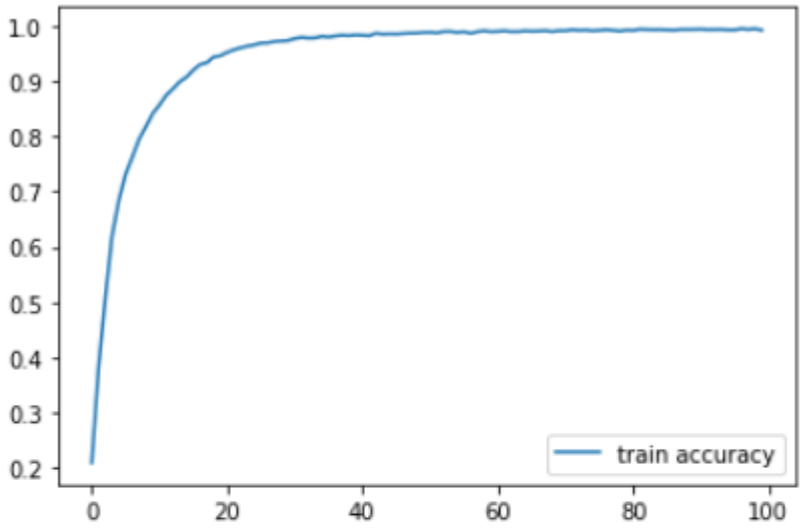
Number of epochs: 100

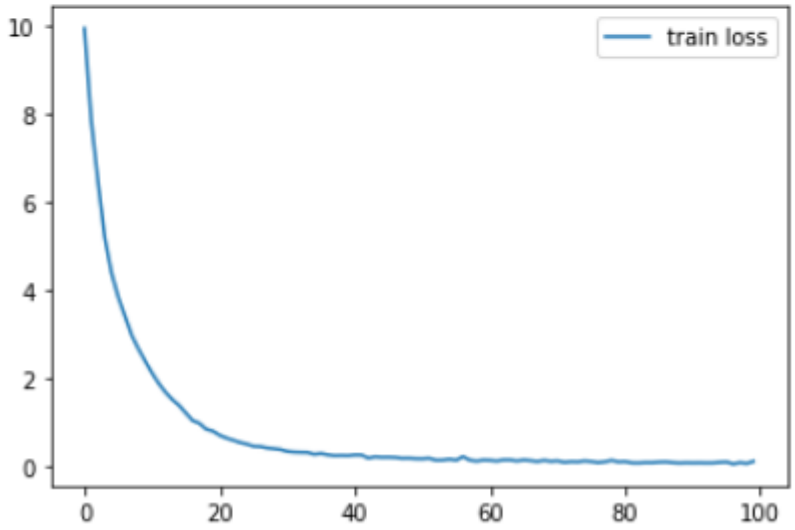
Learning rate = 0.001

Optimizer = Adam optimizer (betas=(0.9,0.999), esp(1e-8))

Criterion = cross entropy

Result:






```
Train accuracy: 0.9925
```

```
/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:80: UserWarning:
Accuracy of the network on the 10000 test images: 86 %
```

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