

Homework 2

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Get started with Deep Neural Networks

May 16, 2020

Problem 1. Implement LeNet and do image classification with CIFAR10 dataset. Note this part is actually the same as TRAINING A CLASSIFIER section in DEEP LEARNING WITH PYTORCH: A 60 MINUTE BLITZ. The network architecture in the tutorial is actually LeNet. However, please understand the tutorial and write the code again yourself. Report your final testing accuracy and your hyperparameters choice (learning rate, network structure) in your writeup.

Solution 1. (1) Network structure:

```
Net(  
    (conv1) : Conv2d(3, 6, kernel - size = (5, 5), stride = (1, 1))  
    (pool) : MaxPool2d(kernel - size = 2, stride = 2, padding = 0, dilation = 1, ceil - mode=False)  
    (conv2) : Conv2d(6, 16, kernel - size=(5, 5), stride=(1, 1))  
    (fc1) : Linear(in - features = 400, out - features = 120, bias = True)  
    (fc2) : Linear(in - features = 120, out - features = 84, bias = True)  
    (fc3) : Linear(in - features = 84, out - features = 10, bias = True)  
)
```

Network structure is shown in figure 1.

(2) Learning rate is 0.001.

(3) Testing accuracy is shown in table 1.

Problem 2. Use Tensorboard to visualize your LeNet training procedure by following [https : //pytorch.org/tutorials/intermediate/tensorboard_tutorial.html](https://pytorch.org/tutorials/intermediate/tensorboard_tutorial.html) . Include your training step-versus-training loss curve in your writeup.

Solution 2. Loss curve is shown in figure 2.

Problem 3. Implement VGG-Net-16 with CIFAR10 dataset. Report the same results as you did in LeNet and compare the testing results. Analyze the results in the writeup.

Solution 3. Testing accuracy is shown in table 2. Compared with the accuracy of VGG-16 and LeNet, the accuracy of VGG-16 is almost higher than that of LeNet in the same learning rate and two iterations, which shows that the accuracy of the model will be higher as the network deepens.

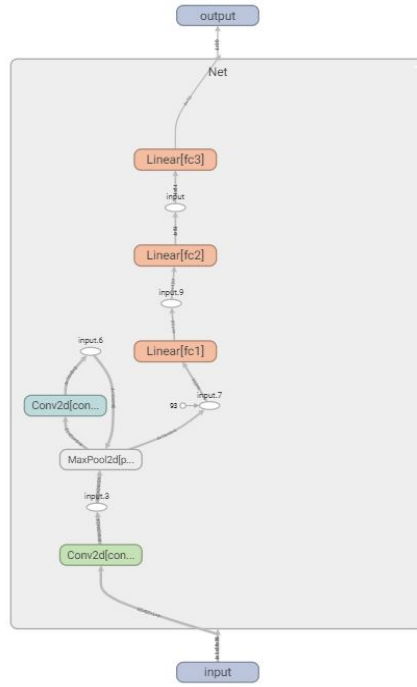


Figure 1: LeNet structure

Table 1: testing accuracy

classes	accuracy
plane	68 %
car	75 %
bird	37 %
cat	49 %
deer	60 %
dog	21 %
forg	82 %
horse	59 %
ship	74 %
truck	70 %

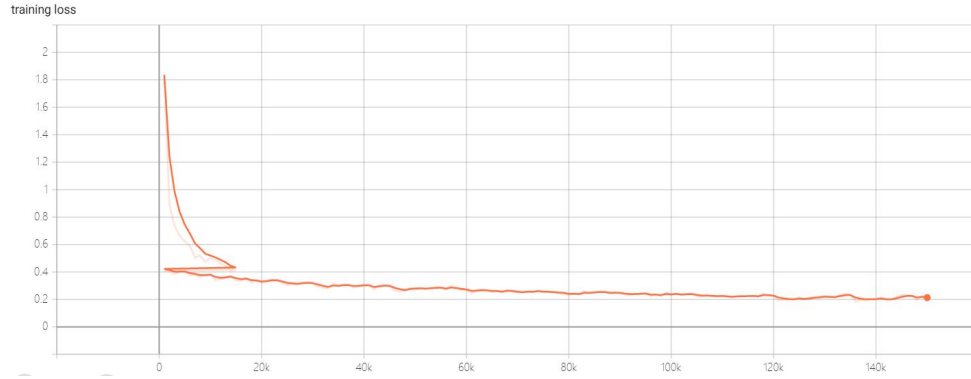


Figure 2: training loss

Table 2: VGG16 testing accuracy

classes	accuracy
plane	87 %
car	82 %
bird	46 %
cat	52 %
deer	71 %
dog	52 %
forg	80 %
horse	61 %
ship	82 %
truck	79 %