

CSCE4613 – Artificial Intelligence Fall 2021

Assignment 5: Deep Learning Applications

Out Date: Nov. 30, 2021, Due Date: Dec. 7, 2021

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Implementation:

This assignment is implemented in Google Colab with GPU support. I have to upload three files, i.e., Homework5.ipynb, imagenet_class_names.pkl, and dog.jpg, in the folder GoogleColab to the Google Colab.

Image Classification:

I will use a pretrained model specifically, residual network (ResNet) to classify the object in an image.

a) Download randomly 10 pictures of random different objects on Internet and use the ResNet-50 to predict the class names and probabilities. Visualizing your results as Figure 1.

Solution: I have downloaded 10 random pictures from Google and used the ResNet-50 to predict the class names and probabilities of these images and visualized the results as below:

b) With the same 10 pictures, visualizing top-5 predictions of these images. The topK prediction is the K first predicted classes that have highest probabilities.

Solution: I visualized the top-5 predictions of these images as shown below:

c) Using ResNet-101, visualizing top-5 predictions of the same 10 images in the previous question.

Solution:

Here, at first, we need to redefine the model by using ResNet-101 as:

model = torchvision.models.resnet101(pretrained=True) and then we visualize the top-5 predictions of the same images we used before.

d) Using DenseNet-121, visualizing top-5 predictions of the same 10 images in the previous question. (10 points)

solution:

Here, at first, we need to redefine the model by using DenseNet-121 as:

model = torchvision.models.densenet121(pretrained=True) and then we visualize the top-5 predictions of the same images we used before.

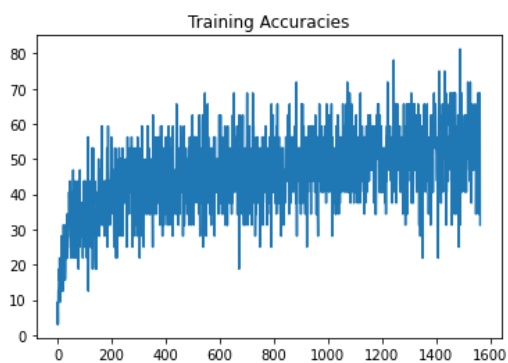
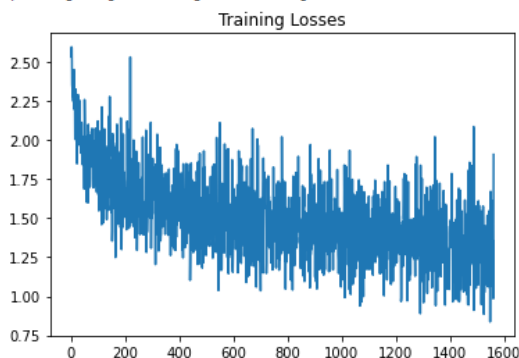
2) Training Image Classification Model (40 points)

CIFAR-10 is an established computer-vision dataset used for object recognition. It is a subset of the 80 million tiny images dataset and consists of 60,000 32x32 color images containing one of 10 object classes, with 6000 images per class. First, we will define the training data loader of CIFAR-10 and then we will define model and training framework to train the ResNet-18 model on the training set of CIFAR dataset. Finally, we load the trained model and evaluate its model on the testing set of CIFAR-10 dataset.

a) Configure the number of epochs, learning rate, training batch size; then, train your model on CIFAR-10. Report the training losses and training accuracies in the curve graphs.

Solution: We used the number of epochs = 1, learning rate = 0.0001 and training batch size = 32 and then trained the model on CIFAR 10 dataset.

```
Epoch [1/1]. Iter [1/1563]. Loss: 2.5744. Accuracy: 3.12
Epoch [1/1]. Iter [201/1563]. Loss: 1.6097. Accuracy: 40.62
Epoch [1/1]. Iter [401/1563]. Loss: 1.5488. Accuracy: 46.88
Epoch [1/1]. Iter [601/1563]. Loss: 1.6151. Accuracy: 40.62
Epoch [1/1]. Iter [801/1563]. Loss: 1.3077. Accuracy: 40.62
Epoch [1/1]. Iter [1001/1563]. Loss: 1.1983. Accuracy: 50.00
Epoch [1/1]. Iter [1201/1563]. Loss: 1.4002. Accuracy: 53.12
Epoch [1/1]. Iter [1401/1563]. Loss: 1.4492. Accuracy: 53.12
```



b) Test your model on the testing set of CIFAR-10. Report the final accuracy and top-5 accuracy on the testing on the testing set.

Solution: We tested our model on testing set of CIFAR-10 and got the final accuracy = 53.48 and top-5 accuracy on the testing set is equal to 100.00.

c) Visualize the confusion matrix of the testing results.

Solution: The confusion matrix of these testing results is:

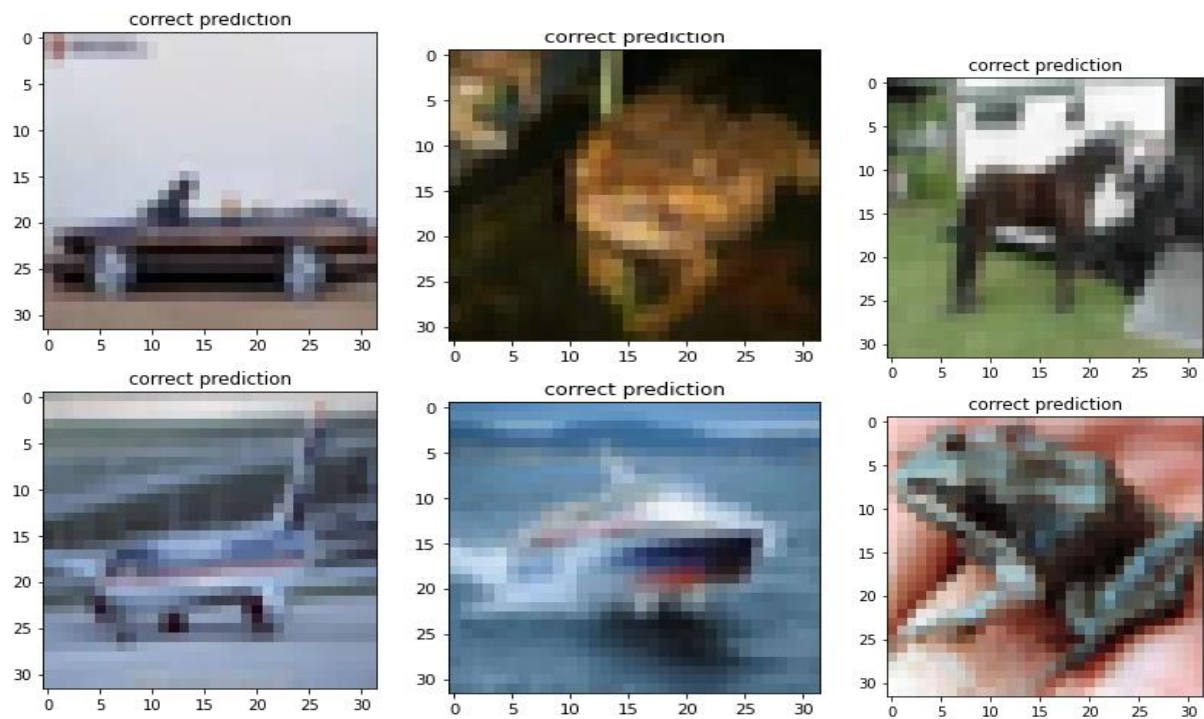
```

[[661 26 32 15 61 5 23 31 82 64]
 [ 50 652 6 10 9 4 19 14 36 200]
 [ 79 20 154 86 380 89 65 78 24 25]
 [ 22 26 33 296 176 183 102 93 21 48]
 [ 31 8 25 43 632 32 66 133 18 12]
 [ 15 13 24 154 167 438 49 109 12 19]
 [ 7 17 17 52 213 27 593 33 12 29]
 [ 12 18 5 30 112 76 22 679 7 39]
 [169 58 9 13 36 3 6 14 623 69]
 [ 57 166 5 14 14 7 16 33 68 620]]

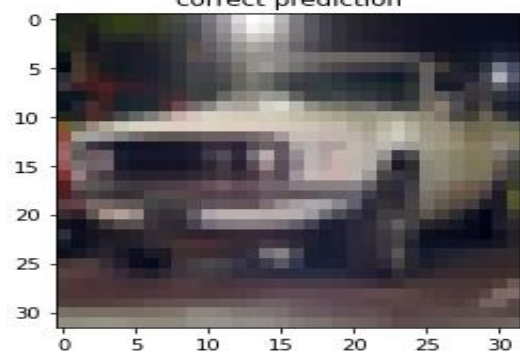
```

d) Visualize 10 correctly predicted samples of the testing set. The outputs should look Figure 1 in the Question 1.

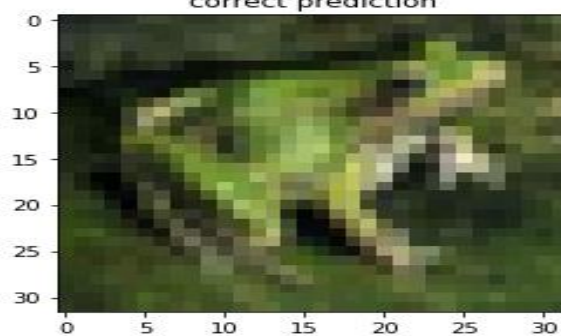
Solution: The top 10 correctly predicted samples on the testing set are shown below:



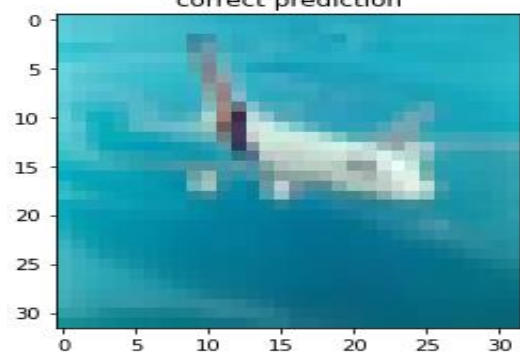
correct prediction



correct prediction



correct prediction



correct prediction

