ADVANCED TO DIGITAL IMAGE PROCESSING

ASSIGNMENT 2

Due date: Feb. 29, 2024, by 11:55 pm Eastern Time.

Total marks: 8

Late penalty: 0.5 marks per day overdue. Late assignments will not be accepted after 11:55 pm on Friday (Eastern Time), March. 2, 2023, and a mark of zero will be given.

All assignments will be done **individually or in a group (up to two students)**, and the final mark for the assignment will be assigned to each of you by myself. If the assignment has been conducted in a group, every student in the group will be assigned the same mark.

If you are in a group, please submit only ONE assignment document in OWL but includes ALL team members name. Otherwise, one of your team member will not receive marks.

Note that I allow you to keep resubmitting until the deadline. Please get in touch with TA if you are unable to resubmit your files.

OBJECTIVES

Using Matlab or Tensorflow/Keras/PyTorch to conduct basic Image Classification task with Recent Deep Learning Technology

Regulation.

1) Implement our algorithms in GPU-based (or CPU) Keras, Tensorflow, Pytorch, or Matlab environments.

Description

The course projects focus on the following two aspects.

1) Implement the basic deep convolutional neural networks to an advanced GPU/CPU-based environment (Keras, Tensorflow, Pytorch and Matlab).
2) Compare the performance differences between different network architecture/parameter settings.
3) Understanding how to set training parameters, using optimizers, etc efficiently.

Section I: Used datasets

Use one of the following datasets. The datasets have been shared in Owl site.

- Caltech101 (http://www.vision.caltech.edu/Image_Datasets/Caltech101/)
- Caltech256(https://data.caltech.edu/records/nyy15-4j048)
- CIFAR10(https://www.cs.toronto.edu/~kriz/cifar.html)
- CIFAR100(https://www.cs.toronto.edu/~kriz/cifar.html)

How to construct the training and testing dataset

1) For CIFAR10/100 (inputs shape 32*32*3), the training set, and testing set were organized.
2) For Caltech101/256(you could resize it to any dimension, however, I suggest using 224*224*3 or 112*112*3) to keep more information fed to the network), the method to generate the training and testing dataset could be found in http://places2.csail.mit.edu/PAMI_places.pdf. (Training set: For Caltech101/256, 30 images per class). (Remaining images in the datasets will be put as testing set);

Section II: Select your deep convolutional neural networks (DCNN)

Designed your own deep convolutional neural network which contains at least 5 convolutional layers with 1 fully connected layer. Select the training parameters, number of filters, filter size, etc. based on your own/group's preference.

Project requirements

Training the given datasets (shown in Section I) with the selected Deep Convolutional Neural Networks (shown in Section II). Compare the performance gap with different training parameters or/and different network architecture/parameters. Explain why you obtained such results, and give a brief discussion about it.

Useful resource:

Caltech101 in Tensorflow: https://www.tensorflow.org/datasets/catalog/caltech101

Cifar10 in Tensorflow: https://www.tensorflow.org/datasets/catalog/cifar10

Cifar100 in Tensorflow: https://www.tensorflow.org/datasets/catalog/cifar100

Submission

please submit script files to owl.

(1) It includes the following features (as mentioned above):

- Organizing and loading the dataset.
- Design your deep convolutional neural network
- Display the performance of the network on your selected dataset.

(2) A PDF report to indicates all the information including dataset you selected, network architecture, and testing/training performance.

All code and answers requested below must be submitted using OWL. To provide answers via OWL:

1. **You should log into OWL and access the course web site accordingly.**
2. **Select the "Assignments" tool.**
3. **From the page that comes up, select "Assignment 2".**
4. **You will now reach the submission page for Assignment 2. Attach the m files you did.**