

Homework 5

Student Name: _____

AuE 8200: Machine Perception and Intelligence

Instructor: Dr. Bing Li, Clemson University, Department of Automotive Engineering

- * Refer to Syllabus for homework grading, submission and plagiarism policies;
- * Submission files includes (Due March. 31, 2022 11:59 pm):
 - This document file (with answers), and with your program results/visualization;
 - A .zip file of source code (and data if any) with names indicating question number;

Note: You can use any 3rd party libraries and built-in functions

Question 1: find, read and summarize a paper (40 pts)

Find a paper (related to Perception/Vision) that you are interested in from:

<https://openaccess.thecvf.com/CVPR2021?day=all>

<https://openaccess.thecvf.com/ICCV2021?day=all>

<https://paperswithcode.com/>

Requirement: up to 1 page with below info:

(You should never literally copy any sentences from any digital sources for your report)

- The link of this paper.
- In the structure of this paper, where can you find below info?
 - * Background
 - * Motivations
 - * Short Summary of the proposed work
 - * Contribution highlights
 - * Problem formulation
 - * Conclusion
- What problem it is resolving?
- What are the input and output of the proposed method?
- The challenges of this problem?
- What are the purposes for the first and second figures?
- What new concept its method introduced?
- What counterparts it compared to and links of typical counterparts?
- What aspect are included in the Experiment sections?
- What results it concludes?

Option 1: Python

Question 2: train an instance segmentation model with PyTorch [tutorial](#) and Google [Colab](#); or you can deploy it in Palmetto Cluster. (60 pts)

- (1) Show screenshots of successful setup, training, and inference on the colab. (15 points)
- (2) Inference different images in the test set and show screenshots (5 points)
- (3) Inference on your own image (10 points)
- (4) Plot the segmentation metric $AP@[IoU=0.50]$ against the number of training Epochs on a Graph. (15 points)
(TIPS: if you cannot save accuracy during training, you can manually collect it from outputs.)
- (5) Change the batch size, optimizer, learning rate etc... Plot and analyze its influence on accuracy. (15 points)
- (6) Could you improve the network model, train it for better accuracy? (Optional, 5 points)
(This question is optional. Extra 5 points until reach the cap of 100)

Option 2: Matlab

Document your results and discussion in your homework submission report.

Your Clemson credential has fully license to Matlab, for computing platform:

- You can use 'MATLAB Online' <https://matlab.mathworks.com/>

- Or you use Matlab in your local computer.

Reference:

Deep Learning Toolbox

<https://www.mathworks.com/help/deeplearning/index.html>

Deep Learning Onramp

<https://matlabacademy.mathworks.com/details/deep-learning-onramp/deeplearning>

Question 2: 'on pretrained models' (20 pts)

- (1) Select a few (like three) of Pretrained models; Explain what is the input/output, and which paper (if any) it is introduced? Use deepNetworkDesigner to visualize the models.

Reference:

Pretrained Deep Neural Networks

<https://www.mathworks.com/help/deeplearning/ug/pretrained-convolutional-neural-networks.html>

- (2) For the selected pretrained models; Test it using some of the images that you download from the web;

Reference:

Classify Webcam Images Using Deep Learning

<https://www.mathworks.com/help/deeplearning/ug/classify-images-from-webcam-using-deep-learning.html>

Show and discuss your accuracy: like you choose same type of objects with different background, and see their accuracy difference, etc.

Question 3: 'further training a pretrained models' (40 pts)

(1) Apply transfer learning to retrain a model to classify a new set of images.

Demo this example, reference:

Train Deep Learning Network to Classify New Images

<https://www.mathworks.com/help/deeplearning/ug/train-deep-learning-network-to-classify-new-images.html>

Explain its input and output; Explain what are 'Batch', 'Epoch', 'Iteration'?

Try a few different 'miniBatchSize', and discuss its accuracy difference.

(2) For the demo of a selected parameters, select a partial of the testing/validation dataset statistically summarize its results for:

Explain what are:

True positive (TP)

True negative (TN)

False positive (FP)

False negative (FN)

Provide its result of TP, TN, FP, FN and Accuracy, Precision, Recall, F1-score