

ECE 520.438 & 520.638: Deep Learning
Homework 3: Fine-tuning
Spring 2024

1 Part 1

Answer the following questions.

1. Briefly describe the idea behind a DenseNet? Discuss its advantages and disadvantages.
2. Briefly describe the idea behind an inception module? Discuss its advantages and disadvantages.
3. Describe at least three loss functions that can be used to train an autoencoder network.
4. Briefly describe a sparse autoencoder.
5. Briefly describe a de-noising autoencoder.
6. What are the differences among segmentation, semantic segmentation and instance segmentation?
7. Describe at least three approaches that we discussed in class for object detection.
8. Briefly describe non-max suppression.
9. Describe the differences among RCNN, Fast-RCNN and Faster-RCNN.
10. Briefly describe the YOLO framework for object detection.
11. How can we measure the performance of an object detector?

2 Part 2

Objective: In this part of the homework, you will fine-tune and evaluate the performance of Alexnet and VGG-16 pre-trained networks on the Labeled Faces in the Wild (LFW) dataset.

You can download the LFW dataset from the following website:

<http://vis-www.cs.umass.edu/lfw/>

The Alexnet pre-trained models can be downloaded from the following link:

https://github.com/BVLC/caffe/tree/master/models/bvlc_alexnet

The VGG-16 pre-trained models can be downloaded from the following link:

http://www.robots.ox.ac.uk/~vgg/research/very_deep/

The LFW protocol is a verification protocol. Extract features using the Alexnet and VGG networks with and without fine-tuning. You may use any matching algorithm of your choice (i.e. Euclidean distance, cosine angle, L1-norm, etc.) to produce scores. Plot the ROC curves and summarize your findings. Note that you may have to resize the images to an appropriate size before feeding them into the Alexnet or VGG network.

Grading: You will be graded based on the code you develop, plus your project report summarizing your findings. If possible, please write your report using LaTeX.