Exercise Sheet 3

Very Deep Learning WS 2019/2020

Deadline: December 17th, midnight

1 Semantic Segmentation

1.1 Theory

1. How can a fully connected layer be realized using a convolutional layer?
2. What is the importance of skip connections in a CNN for image segmentation and object detection problems?
3. What does the ground truth look like in semantic segmentation and which loss function is typically used for training?
4. Why is accuracy not a good measure to evaluate semantic segmentation networks? Which measure is better-suited?

Submission format: plain text file or pdf

1.2 Practice

1. Download and extract the bags dataset:
   `https://drive.google.com/file/d/1P4bdP6nSUOqQLhGXvZ1z4z3hNncJFrCs`
2. Write a pytorch Dataset class which can iterate over the dataset
   - Hint: get inspiration from the pytorch tutorials
3. Train a fully-convolutional network on the training dataset
   - Hint: You can either define your own FCN or use an already implemented model (e.g. `https://github.com/wkentaro/pytorch-fcn`)
4. Report the mean IoU score after each epoch for both training dataset and validation dataset
5. Visualize your network output on one image of the validation set

Submission format: single notebook file with outputs generated

2 Visualizing Convolutional Neural Networks

2.1 Theory

1. What is the receptive field of a convolution layer?
2. What is the effective receptive field of a convolution layer?
3. How can the effective receptive field of a convolution layer be computed? (Formula, no closed-form)
4. What is the receptive field of a fully-connected layer?

Submission format: plain text file or pdf

2.2 Practice

Download a pretrained AlexNet model and plot the weights of the first convolutional layer

Submission format: single notebook file with outputs generated