Computer Vision 1: Homework 12

Deadline 31.01. 12:15

Important: Submit your programming solutions through Moodle. The deadline for submitting your work is always on Thursday, at 12.15, the week after handing out the homework.
For other, non-programming homework, bring your solution with you to the exercise class. For each homework problem, one student will be chosen at random to present their solution.

Programming tasks.

Evaluation of segmentation quality by undersegmentation error. An example input image and a desired segmentation are shown in Figure 1.

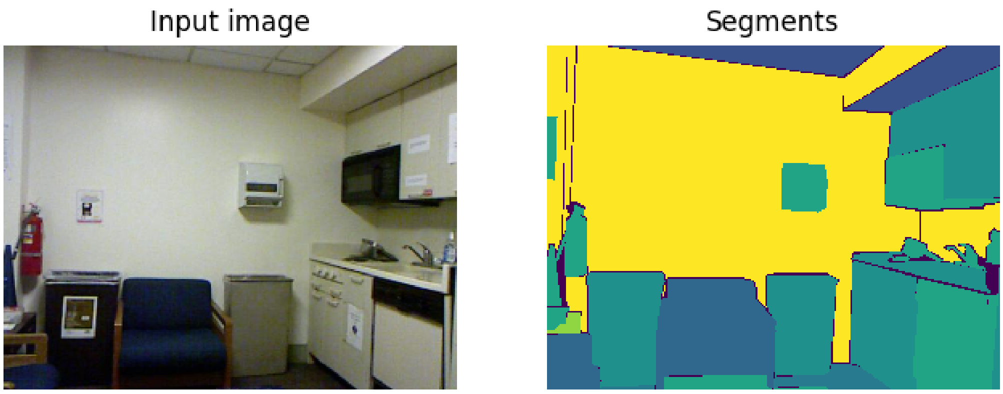

Figure 1: Input image (left), and a desired segmentation result (right), where the colors indicate the segments. Images from the NYUv2 dataset: `https://cs.nyu.edu/~silberman/datasets/nyu_depth_v2.html`.

- Download the input image `0001_rgb.png` and the ground truth segmentation `0001_label.png` from Moodle. In the label image, the pixel intensity values indicate which ground truth segment the pixel belongs to. For example, if in the label image L the pixel (x, y) has a value of i, it belongs to the ith segment.
- Use SLIC to generate an oversegmentation of the input image. Pick the values for n and c yourself.
- Calculate the undersegmentation error as defined in last week's homework problems for each ground truth segment found in L. Print out the undersegmentation error for every ground truth segment.
- How does the undersegmentation error change when you increase the desired number of superpixels n? Why? Answer in 1-2 sentences as a comment in your code.

Hints:

- Use comparisons such as `L==i` to find binary masks areas of label image L that belong to segment i.
- Use logical indexing with binary masks to extract corresponding areas of the segmentation result.
- Use `np.unique` and `np.count_nonzero` to find overlapping superpixels and to calculate their areas, respectively. You may also use `np.unique` to discover all labels that are present in L.

Other tasks.

1. Explain why $k = 1$ in k-Nearest Neighbor classification often does not work well on real datasets. What is the technical term in machine learning for this phenomenon?
2. In 2017, Flickr launched a feature called Similarity Search which allows users search for similar images. This feature is temporarily disabled at the moment for migrating from Yahoo to AWS, but its demo and technical description can still be found in an article at `http://code.flickr.net/2017/03/07/introducing-similarity-search-at-flickr/`. Based on this article, describe briefly how classification and clustering algorithms work together to make large-scale nearest neighbor image search possible.