

Computer Vision 1: Assignment 5

(Due date: 12.02.2021)

Submission instructions:

- For each programming task, submit a .py source code file. Do not include any images or data files you used.
- For each pen & paper task, submit a .pdf file. Type your solution in LaTeX, Word, or another text editor of your choice and convert it to PDF – **do not submit photographs or scans of handwritten solutions!**
- In all files, include at the top names of all students in the group
- Choose exactly one person in your group that submits your solution via Moodle, it will count for the entire group.

Task 2: Undersegmentation error (pen & paper)

We have developed a segmentation algorithm that has partitioned an image into segments S_i , $i = 1, \dots, n$ as described on the lecture slides. For the same image, we have a *ground truth segmentation* G_j , $j = 1, \dots, m$, which specifies how the image ideally should be partitioned.

Intuitively, the *undersegmentation error* for an individual ground truth segment G_j measures the amount of “bleeding” that a segmentation exhibits beyond G_j . The undersegmentation error for a ground truth segment G_j is defined as

$$UE(G_j) = \frac{\left[\sum_{\{S_i | S_i \cap G_j \neq \emptyset\}} \text{Area}(S_i) \right] - \text{Area}(G_j)}{\text{Area}(G_j)} \quad (1)$$

where the summation is over all segments S_i which have any overlap (non-empty intersection) with G_j , and the function Area returns the area, i.e., the number of pixels, of the corresponding segment.

Our image has 12 pixels in it, and our segmentation algorithm produces the segments S_i shown in Figure 1. Calculate the undersegmentation errors $UE(G_1)$ and $UE(G_2)$ of the ground truth segments G_1 and G_2 shown in Figure 2.

1	4	4	4
1	2	4	4
1	2	3	3

Figure 1: A segmentation S_i , $i = 1, 2, 3, 4$, with i indicated on each pixel.

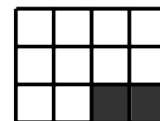
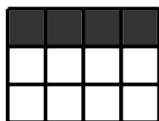


Figure 2: Two ground truth segments G_1 (left) and G_2 (right) highlighted in gray.

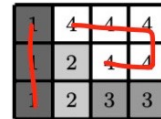
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Solution Undersegmentation Error 1

In our algorithm's output: the overlapping segmentations (i.e. overlapping on the black area of the Ground truth) resulted to be the segmentation nr 1 and 4.

Inserting these areas in the Undersegmentation error formula would result in:

$$UE(G_1) = \frac{(3 + 5) - 4}{4} = 1$$



Solution Under-segmentation Error 2

In our algorithm's output: the overlapping segmentations (i.e. overlapping on the black area of the Ground truth) resulted only in the segmentation nr 3.

$$UE(G_2) = \frac{(2) - 2}{2} = 0$$

