Bauhaus-Universität Weimar

# Assignment 5

Submission Deadline: 26.06.24, 11:00 pm

**Note**: To adjust to the reduced working time, you are free to choose only one of the two tasks (either A or B) and consider the other task optional.

## A) K-means clustering

66 slide in 10th lecture.

a. Read the exemplary color input image `inputEx5_1.jpg` and set up a **three-dimensional RGB feature space** (`reshape`).

b. Implement your **own** *k-means* clustering approach with random initialization (see lecture notes) to group the color features.

c. Select an appropriate number of clusters *k*, apply the algorithm and visualize the detected groups in feature and image space (e.g. with color coding: `colormap`).

d. Extend the three-dimensional feature space with **additional spatial support** using the pixel positions (*x, y*) and test your algorithm on the five-dimensional feature space. Are the results different or significantly better?

## B) Watershed Segmentation

a. Load the provided image `inputEx4_2.jpg`, convert it to grayscale image and compute its gradient magnitude.

b. The starting flooding points, also known as *seeds* or *markers*, can be determined automatically or manually (`ginput`). For noisy images, the automatic approach can lead to *oversegmentation*. Therefore, you should implement a robust version of the algorithm working with **manually chosen markers**. You can implement an interactive user selection for the seed points or use the following pre-selected seed points:

| x | 40 | 140 | 5 | 130 | 70 | 100 |
|---|---|---|---|---|---|---|
| y | 110 | 90 | 60 | 20 | 30 | 130 |

c. Implement the *watershed segmentation* method **by yourself**. Use the seeds selected in step **b**. as the starting points for region growing. It is recommended to apply a *4-neighbor topology* (introduced in lecture number 3).

d. Visualize the final segmentation result, as well as at least **two intermediate steps** during the region growing procedure. Apply an appropriate colormap to the segmented regions (`colormap`).

e. Shortly describe the benefits and drawbacks of the watershed method for the given example image.

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