Bauhaus-Universität Weimar

Assignment 5

Submission Deadline: 02.07.25, 11:00 pm

A) K-means clustering

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).

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 `inputEx5_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.

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

Note: For this assignment you are free to choose to complete either Task A or Task B.

Computer Vision in Engineering – Prof. Dr. Rodehorst
M.Sc. Mariya Kaisheva
mariya.kaisheva@uni-weimar.de