Laboratory Work

Image Segmentation

Objective: the purpose of this laboratory work is to study region-based and clustering-based image segmentation methods.

The submission includes: ipynb and the report file. The report must include step by step description, results, and screenshots. Format the report according to the template.

Task 1. K-means segmentation in color space

Load an RGB image and reshape it into a 2D array of pixels. Apply K-means clustering to segment the image into K regions. For each value of K, reconstruct and display the segmented image. Print the cluster centers and explain how changing K affects segmentation granularity.

Task 2. Color space based segmentation

Convert the image from RGB to HSV color space. Perform segmentation by thresholding only the Hue channel to isolate a specific color region. Display the original image, the Hue channel, and the final segmentation mask. Print the selected Hue range and the number of pixels in the segmented region.

Task 3. Region based segmentation using watershed

Convert the image to grayscale and compute a distance transform. Use markers to apply watershed segmentation. Display the marker image and the final segmentation result with different regions colored. Print the number of segmented regions.

Task 4. Superpixel segmentation

Apply a superpixel segmentation algorithm such as SLIC. Display the original image with superpixel boundaries overlaid. Print the number of superpixels and explain how superpixels differ from pixel-level segmentation.

Task 5. Segmentation result comparison

Select two different segmentation methods from Tasks 1-4. Convert their results to binary masks representing one chosen object or region.