

CENG 391 Introduction to Image Understanding

22 December, 2017

Homework 4

Due Date: 30 December 2017, 23:55

Programming Assignment — Object Detection with RANSAC and keypoints

In this assignment, you should write Python code for object detection with keypoints by using RANSAC algorithm and necessary comments about the specific steps that are indicated with **COMMENT** sign.

1. Read given two input images.
2. Determine keypoint detector and descriptor extractor algorithm.(ORB or SIFT).
COMMENT-1: Briefly explain methodology of the two algorithms(both their keypoint detection and descriptor computation methods) and make comment on their recognition performance under image deformations such as scale, rotation etc.
3. As a first, detect keypoints and compute their descriptors in both images.
4. Find correspondences between images based on descriptors by assigning the nearest neighbour as a correspondence.
COMMENT-2: Comment on how you can find the nearest neighbour for each correspondence. Which distance metric is used for finding SIFT and ORB correspondences ?

5. Implement RANSAC algorithm manually which is explained in LAB-9 (Step[3-10]) and find the homography and its inliers.

COMMENT-3: In RANSAC, what happens if we set Euclidean distance threshold(inlier threshold) to smaller than the 3 pixels?

6. Then with these inliers, by applying normalized Direct Linear Transform(DLT) estimate homography again and update the inliers.

COMMENT-4: In DLT, why do we normalize point coordinates as it is shown in step-3 of LAB-8 ?

7. Run step 6 until the number of inliers converges.
8. Transform corners of the object to the second image by converged homography and draw red rectangle that belongs to transformed corners and save the output image as "object_detection.png".

NOTE: Please make your comments(**COMMENT-1 and COMMENT-2**) on both algorithms(SIFT and ORB). For implementation, you are free to select one of them.