CSIP5403

Research Methods and Applications  
Lab Sheet – 7

Aims:

* OpenCV with Python – Keypoints detection, description and matching
* Experiment object detection, image segmentation and pose estimation using YOLOv8.
* Experiment visual tracking using SORT.

# Part 1 – Coding Exercises

1. Detect keypoints and compute descriptors using SIFT and then draw small circles on the locations of the keypoints. You can use any image provided in the ‘OpenCV/samples/data’ folder e.g. home.jpg, box.png, box\_in\_scene.png, etc. You can download the OpenCV folder from https://github.com/opencv/opencv

Also look into: <https://docs.opencv.org/4.x/db/d27/tutorial_py_table_of_contents_feature2d.html>

1. Compute SIFT descriptors from both query image (e.g. box.png) and train image (e.g. box\_in\_scene.png) and then match them. Use different matching methods. Investigate the matching performance, at least qualitatively.
2. Use feature matching along with Homography to find known objects in a complex image. For instance box.png can be an object that needs to be located in the box\_in\_scene.png. RANSAC (or similar algorithm) needs to be used to remove outliers. How is the final feature matching improved?

If you finish the above coding exercises, try to use different methods of feature extraction and compare with SIFT.

1. Experiment the following tasks using YOLOv8 on any test image (ultralytics: <https://github.com/ultralytics/ultralytics>):
   1. Object detection
   2. Image segmentation
   3. Pose estimation
2. Experiment visual tracking task using SORT: <https://github.com/abewley/sort>
   1. Understand how Kalman filter is used for visual tracking applications.
   2. Understand how data association is performed.

# Part 2 – Continue Working on your Mini-Project

Identify one or two group members to work with (this could be your lab group if you have already been working on lab exercises within a group).

After you identify the topic of your **mini-project**, you should continue working on it. Please keep in mind the **deadline** of the project.