

**Department of Artificial Intelligence**

**College of Computer Science and Information Technology**

**Review Lab Exercise**

**Due Date: Tuesday December 3, 2024 @ 11:59 PM**

**Late Submissions:**

* Q: Can I skip the lab and submit the solution?
  + You will receive a mark of **zero** if you do not attend the lab, even if you complete the exercise. Attending the labs is compulsory for evaluation. If you have a justified excuse, you may receive a partial mark depending on the circumstances. See the next question for information on late submissions.
* **Q:** If I submit it at 12:00am, you’ll still mark it, right?
  + **A:** 11:59pm and earlier is on time. Anything after 11:59pm is late. Anything late will **NOT** be probably marked. If I find you have a legitimate cause, you will be graded according to the following rules (24 hours after deadline 🡪 assignment is marked out of 75% only, 48 hours after deadline 🡪 assignment is marked out of 50% only, 72 hours after deadline 🡪 assignment is marked out of 25% only)

**Objective**

This lab will reinforce key image processing concepts in preparation for the lab test. Students will:

* Practice filtering and noise removal techniques.
* Apply image segmentation methods.
* Experiment with morphological operations.
* Enhance image contrast and explore color space transformations.

**Instructions**

1. Load the necessary Python libraries, including numpy, skimage, and matplotlib.
2. Use the provided images from the course resources or any suitable substitutes.
3. Answer the embedded questions by implementing solutions and explaining your process.

**Tasks:**

**Task 1: Noise Removal**

* Load an image with salt-and-pepper noise (e.g., an X-ray image of a circuit board).
* Apply a **median filter** to remove the noise.
* Compare the results with a **mean filter**.

**Question:**

* Which filter performs better at retaining image details while removing noise? Why?

**Task 2: Image Segmentation**

* Load a grayscale image with varying intensity regions.
* Perform threshold-based segmentation using Otsu’s method (skimage.filters.threshold\_otsu).
* Highlight the segmented regions using a binary mask.

**Question:**

* How does thresholding impact the clarity of the region of interest? Provide a side-by-side comparison of the original and segmented images.

**Task 3: Morphological Operations**

* **Start with a binary image containing irregular shapes.**
* **Perform the following operations:**
  + Erosion and dilation using a 3x3 structuring element.
  + Opening and closing for noise removal and shape refinement.
  + Extract the skeleton of the objects in the image.

**Question:**

* Explain how each operation affects the image. Include visualizations for each step.

**Assessment**

1. Each student will demonstrate their solutions to the instructor before the end of the lab.
2. Marks are distributed as follows:

|  |  |
| --- | --- |
| Task(s) | Marks (demo + report) |
| Task 1 | 4 |
| Task 2 | 3 |
| Task 3 | 3 |
| Total | 10 |

1. Students will prepare a report in which they will submit the snapshots taken while they worked on each part. They will explain the figures to make sure that they understood what they did.