21-805-0705: Lab 13: Image and Video Processing Lab

Welcome to the Image and Video Processing Lab

This document outlines the steps to follow for each lab session, with link for sample images, and submitting your work on GitHub.

Labcycle submission on GitHub:

Create a Repository: Create a new repository on your GitHub account for this lab session.

Additional Resources and links to international and national research groups

https://www.imageprocessingplace.com/index.htm

https://www.cs.cmu.edu/~cil/v-groups.html

https://vision.stanford.edu/

https://www.is.mpg.de/

https://www.csail.mit.edu/

https://www.iisc.ac.in/

Submission deadlines

Labcycle 1 :September 15 , 2024

Labcycle 2 :October 30, 2024

Project Presentation deadline: November 15, 2024

Pattern of Evaluation

Continuous Assessment	**25 marks**
Project completion	**25 marks**
External Examination	**50 marks**
Total	**100 marks**

By following these instructions, you'll be well-equipped to successfully complete you Laboratory sessions and showcase your work effectively!

LAB CYCLE 1

A. Image Negative

1. Implement the image negative transformation function and apply it to a grayscale image.
2. Analyze the effect of image negative on different types of images (e.g., low contrast, high contrast).
3. Compare the histogram of an original image with its negative. Explain the observed differences**.**

B. Log Transformation

1. Implement the log transformation function and apply it to an image with a narrow range of low gray-level values.
2. Analyze the effect of the log transformation on enhancing details in dark regions of an image.
3. Experiment with different values of the constant 'c' in the log transformation equation and observe the changes in output image.

C. Power-Law Transformation

1. Implement the power-law transformation function with different values of gamma.
2. Apply the power-law transformation to enhance images with different contrast characteristics.
3. Analyze the effect of gamma values on the image appearance, especially for values less than and greater than 1.
4. Experiment with different image types (e.g., medical, satellite, natural) to observe the impact of transformations.

D. Spatial Filtering

1. **Implement** mean, median, and Gaussian filters. Apply them to images with different noise types (salt-and-pepper, Gaussian) and compare the results.
2. **Design** a custom filter for sharpening edges while preserving image details. Apply it to a natural image and evaluate its performance.
3. **Experiment** with different Laplacian operators (4-connected, 8-connected) and compare their edge detection capabilities.

E. Image Enhancement: Arithmetic/Logic Operations

4. **Implement** image subtraction to detect changes between two images (e.g., before and after an event).
5. **Create** a simple image watermarking system using image addition and subtraction.
6. **Experiment** with image averaging to reduce noise in a sequence of images.

CYCLE 2

A. Image Transform

1. Perform Discrete Fourier Transform, Z- transform KL Transform on a gray scale image.

B. Intensity Transformation and Histogram Processing

1. **Implement** histogram equalization and matching on a grayscale image. Compare the results visually and quantitatively using metrics like entropy.

2. **Design** a contrast enhancement technique for images with low contrast. Apply it to a real-world image and evaluate its effectiveness.

C. Frequency Domain Processing

1. **Implement** the 2D Discrete Fourier Transform (DFT) and its inverse.

2. **Design** low-pass, high-pass, and band-pass filters in the frequency domain. Apply them to an image and analyze the results.

3. **Implement** homomorphic filtering and apply it to an image with uneven illumination.

D. Color Image Processing

1. **Implement** color space conversions between RGB, HSI, and YCbCr color models.

2. **Perform** color histogram equalization on a color image and analyze the results.

3. **Implement** color edge detection using Sobel or Canny operators.

4. Additional Practical Questions

5. **Image Segmentation:** Implement thresholding, region-based, and edge-based segmentation techniques.

6. **Image Morphological Processing:** Perform erosion, dilation, opening, and closing operations on binary images.

7. **Image Registration:** Implement image registration techniques for aligning multiple images.

Note: These questions are meant to provide a foundation for practical work in digital image processing..