B31MV Assignment 1

Due date: 14.02.2025 (midnight)

The mark is 5% of the total mark for the course.

Part A: Image Loading and Basic Processing (50 Marks)

Q1: Image Loading and Conversion (15 Marks)

1. (5 Marks) Load an image using Python or MATLAB. Display the image and provide the code.
2. (5 Marks) Convert the image to grayscale and HSL/HSV color spaces. Display both converted images.
3. (5 Marks) Binarize the grayscale image using a threshold based on intensity or hue. Display the binarized image and explain your threshold selection.

Q2: Geometric Transformations (15 Marks)

1. (7 Marks) Perform a translation on the image using a translation matrix with tx = 50 and ty=30. Display the translated image.
2. (8 Marks) Define a rotation matrix for rotating the image by an angle of 45 degrees. Rotate the image and display the result.

Q3: Smoothing Filters and Edge Detection (20 Marks)

1. (10 Marks) Apply a mean filter to the input image. Change the kernel size and observe its effect on the image. Discuss the results with appropriate visualizations.
2. (5 Marks) Apply a Gaussian filter to the input image. Experiment with different standard deviations (σ) and describe how changing σ influences the result.
3. (5 Marks) Apply a Canny edge detector to the grayscale image. Display the result and analyze the impact of different threshold values on the detected edges.

Part B: Image Analysis Using Peppers.png (50 Marks)

Q4: Intensity Range Adjustment and Histogram Equalization (50 Marks)

1. (5 Marks) Load and display the color image '***peppers.png***' (build-in in MATLAB or download it from online source for Python users) and examine and report the size of the image (width, height, and number of channels).
2. (5 Marks) Convert the color image to grayscale and display the grayscale image in its full intensity range ([0,255]).
3. (15 Marks) Reduce the intensity range of the grayscale image to a lower range ([0,N]) for values of N ranging from 255 to 8. Display the resulting images.
    - (10 Marks) Report: For what value of N do you begin to see noticeable distortions in the image? Provide visual evidence and reasoning.
2. (15 Marks) Apply histogram equalization to the grayscale image. Display the result and compare it to the original grayscale image. Discuss the differences in brightness and contrast.

Instructions for the Report

- Prepare one report for the whole project covering all exercises above. Use consistent numbering and report the results for each sub-question accordingly.
- Include screenshots of results and images where applicable, and paste the relevant parts of the code for each question, or use code screenshots if preferred.
  Upload:
  1. the report (PDF format), and
  2. the codes as a separate zip folder.
- In the part of the report covering these exercises, please show the results of each method tested and answer the questions. Comment on any difficulties and observations that you've made.
- Focus on presenting your results in a clear and understandable manner - length of the report is not important.
- Format the report in such a way, that someone not knowing the assignment could read it and understand, what you've done.