Abbottabad University of Science and Technology

Project Proposal

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Class : **BS(CS) 7th A**

Subject : **Digital Image Processing**

Submitted to : **Sir Jamal Abdul Ahad**

Semester Project Proposal

Course: Digital Image Processing

Title: Development of an Interactive Image Processing Tool Using Python

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1. Project Title

Interactive Image Processing Application Using Python and OpenCV

2. Project Overview

This project involves creating a user-friendly desktop application that allows users to perform basic image enhancement and analysis tasks. It provides practical exposure to core digital image processing techniques using Python and popular libraries such as OpenCV and Tkinter.

3. Project Objective

The main aim is to design and implement an image processing GUI tool that integrates several fundamental operations including:

- Grayscale conversion

- Edge detection

- Gaussian blurring

- Histogram equalization

The goal is to solidify theoretical understanding through hands-on implementation.

4. Tools and Technologies

- Programming Language: Python 3

- Libraries: OpenCV (cv2), NumPy, PIL (Pillow), Matplotlib

- GUI Framework: Tkinter

- Operating Environment: Windows/Linux

5. Key Features

- Load and display JPEG/PNG images

- Convert images to grayscale

- Detect image edges using Canny algorithm

- Smooth images using Gaussian blur

- Improve image contrast via histogram equalization

- Save processed images to disk

6. Methodology

1. Graphical Interface Design:

A clean and simple GUI was built using Tkinter, with buttons for each image operation.

2. Image Loading and Display:

Images are loaded through a file dialog and resized for display using PIL.

3. Processing Functions:

- Grayscale conversion using cv2.cvtColor

- Edge detection using cv2.Canny

- Blurring via cv2.GaussianBlur

- Contrast enhancement through histogram equalization in the YUV color space

4. Image Saving:

Processed images can be saved in PNG or JPG format.

5. Error Handling:

User feedback is provided using dialog boxes in case of invalid actions (e.g., attempting to process without loading an image).

7. Implementation Summary

The application logic is encapsulated in a class named ImageProcessorApp. This class handles user interaction, image manipulation, and updates the GUI in real-time based on the user's actions. Modular coding practices were used to separate each operation into clearly defined methods.

8. Expected Outcomes

- Users will be able to intuitively perform basic image processing operations.

- The application demonstrates real-time visual feedback.

- Practical knowledge of OpenCV and GUI development is reinforced.

9. Challenges & Resolutions

- Issue: Incompatibility between OpenCV images and Tkinter image formats

Solution: Used PIL to bridge OpenCV and Tkinter display formats.

- Issue: Displaying high-resolution images caused lag

Solution: Images are resized to 400x400 pixels for GUI rendering.

- Issue: User errors like attempting to process without loading an image

Solution: Implemented validation and informative error messages.

10. Future Improvements

- Add thresholding and image segmentation

- Integrate object detection using pre-trained models

- Enable support for real-time webcam processing

11. Conclusion

This project not only served as a hands-on learning tool for digital image processing techniques but also demonstrated how to integrate those techniques into a fully functional, interactive application. It bridges the gap between academic concepts and practical application.

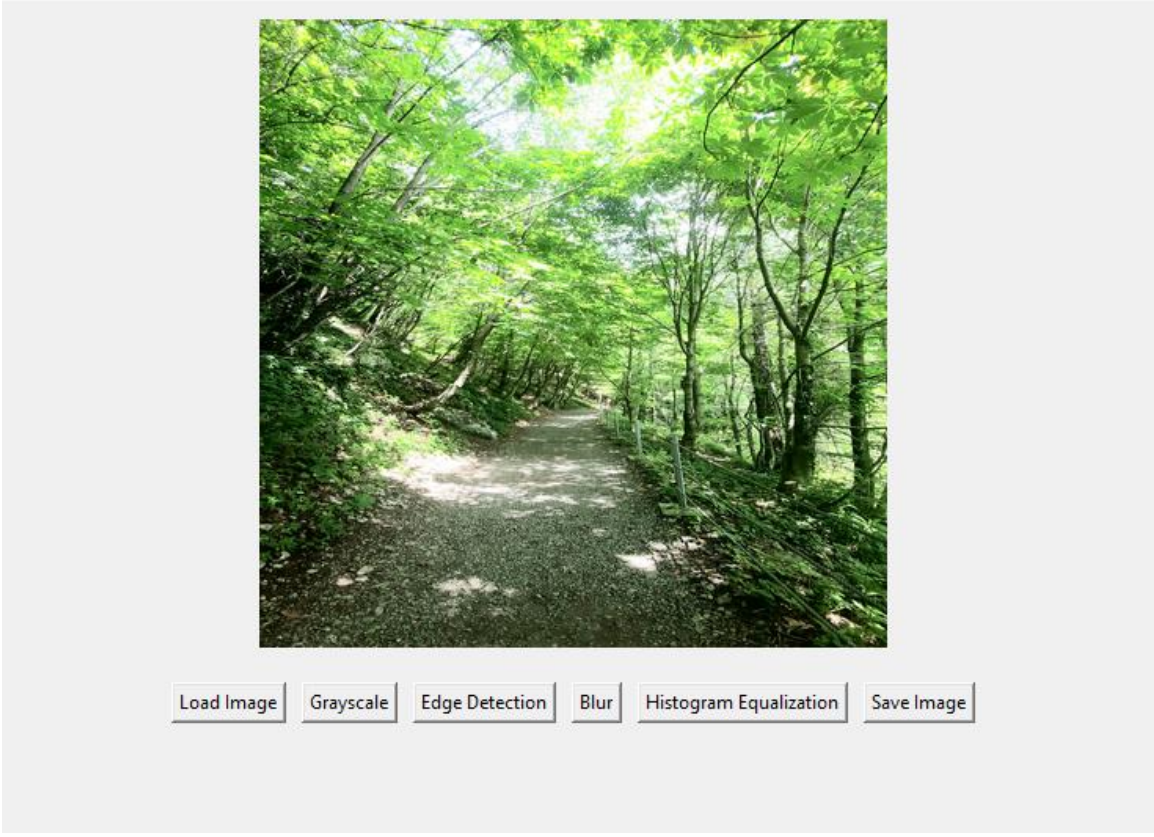
12. Screenshots:

Original image

Gray Scale

Edge Detection

Blur



Histogram Equalization