User Guide for MATLAB Image Processing Application

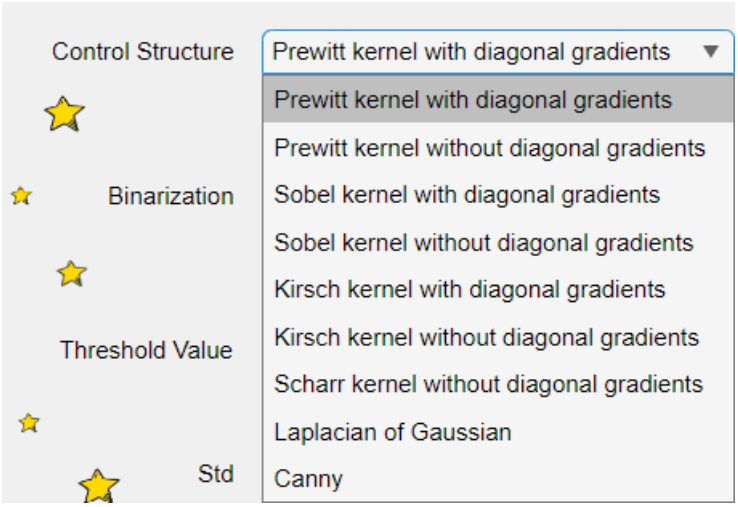
1. Introduction

This guide provides instructions for using the MATLAB Image Processing Application developed for CMPE 490. The application is equipped with advanced image processing techniques including edge detection, binarization, and color space adjustments.

2. Control Structure

In this section, the user can select from different edge detection algorithms. Each algorithm determines how edges are detected in the image and varies according to the user's need.

- **Prewitt Kernel with Diagonal Gradients**: This option uses the Prewitt method to detect horizontal, vertical, and diagonal edges.
- **Sobel Kernel with Diagonal Gradients:** The Sobel method provides high precision in edge detection, including diagonal edges.
- **Kirsch Kernel with Diagonal Gradients:** The Kirsch method detects edges in various directions of the image, producing a more detailed edge map.
- **Scharr Kernel without Diagonal Gradients:** The Scharr method focuses on more straight-line edges, excluding diagonal ones.
- **Laplacian of Gaussian:** This option applies a Gaussian blur before accentuating edges in the image.
- **Canny:** The Canny algorithm offers a wide range of edge detection criteria and is one of the most popular edge detection methods.



Binarization: The binarization section contains methods for converting the image into a binary form.

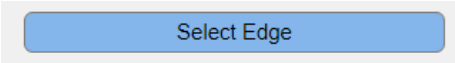
Basic Global Thresholding: Uses a single threshold value for the entire image.

Optimal Global Thresholding: Automatically calculates the threshold value to provide the best binarization result.

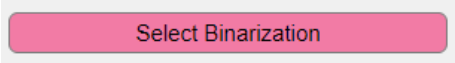
Threshold Value: This field allows the user to manually enter the threshold value for binarization. An error message indicates that the value must be between 1 and 254 if an invalid range is entered.

3. Process Buttons

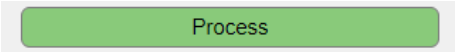
Select Edge Button: Click to apply the selected edge detection method to the image.



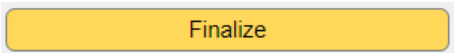
Select Binarization Button: Click to apply the selected binarization method to the image.



Process Button: Click to start image processing with the selected settings.



Finalize Button: Completes the image processing operation and solidifies the results.



4. Color Selection

This dropdown menu is used to select the color map for the processed images. Different color maps are useful for highlighting different image data.

Jet: Represents a color temperature map and is often used to show measurements like altitude or intensity.

Hot: Contains warm color transitions, highlighting high values in red.

Cool: Contains cool color transitions, highlighting low values in blue.

Summer: Contains summer-themed colors and provides a softer color transition.

Winter: Contains winter-themed colors and emphasizes cool tones.

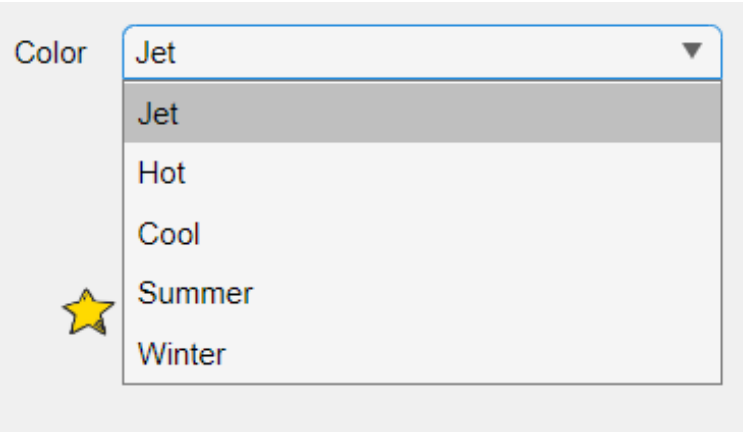
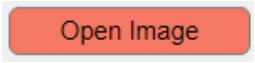


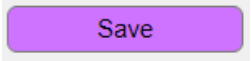
Figure 1

5. Image Operations

Open Image: Used to load a new image. It opens a file selection dialog for the user.

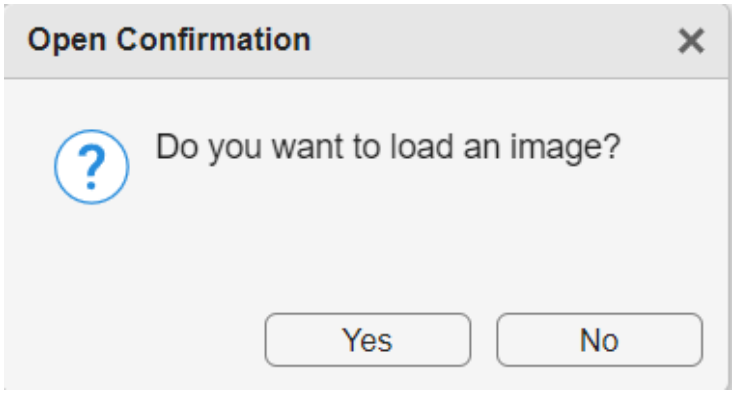


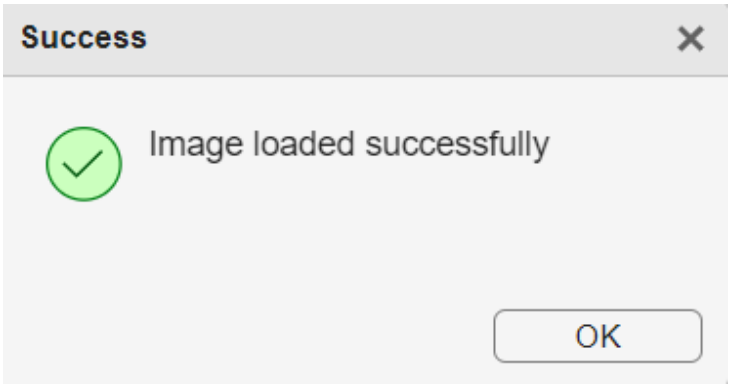
Save: Used to save the processed image to the computer. It opens a save dialog for the user and allows the selection of file format.

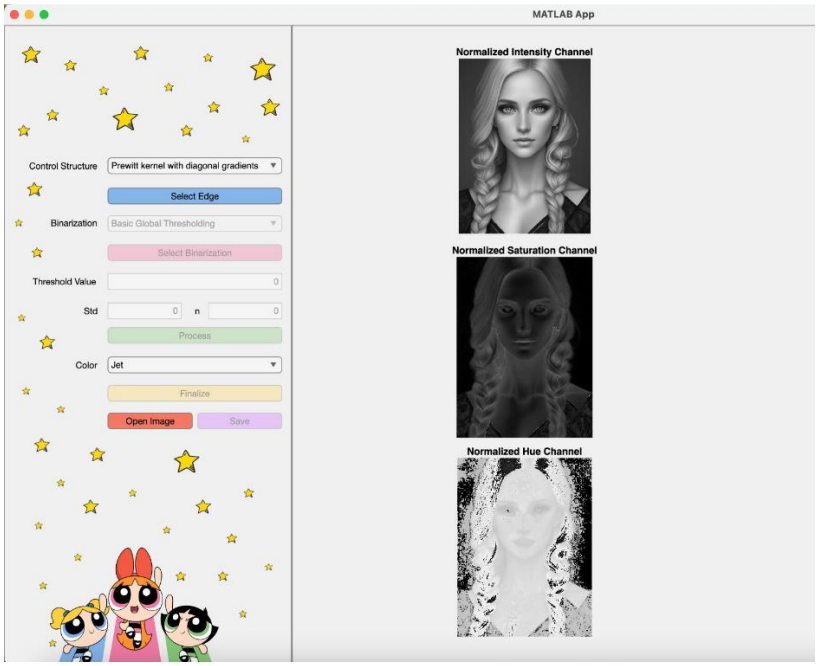


6. Usage Steps

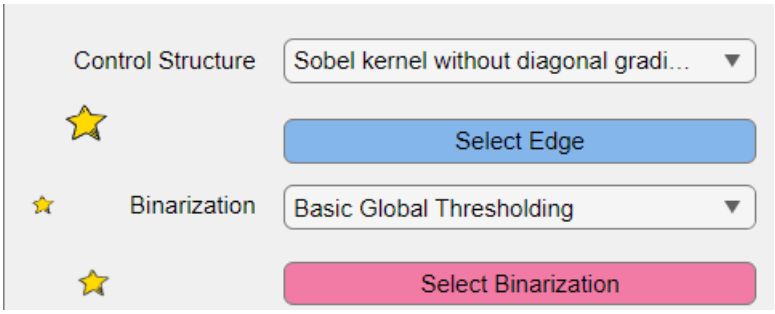
Open Image: Begin by loading the image you wish to process using the 'Open Image' button. A message asking whether you want to upload the photo or not, and after uploading it, a notification that it has been uploaded successfully appears on the screen.



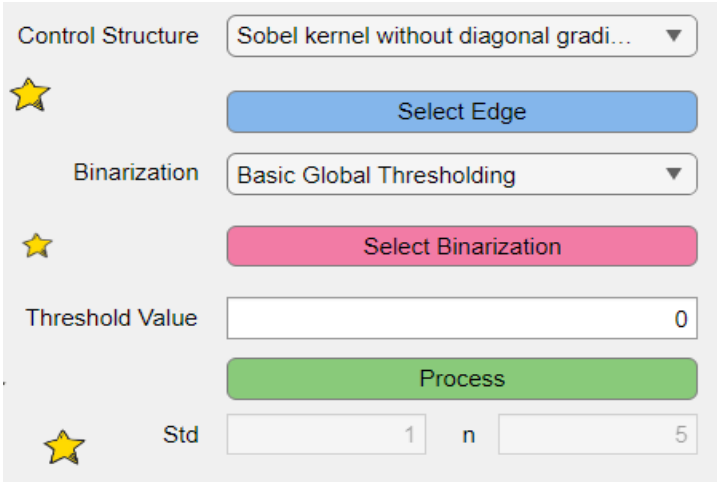




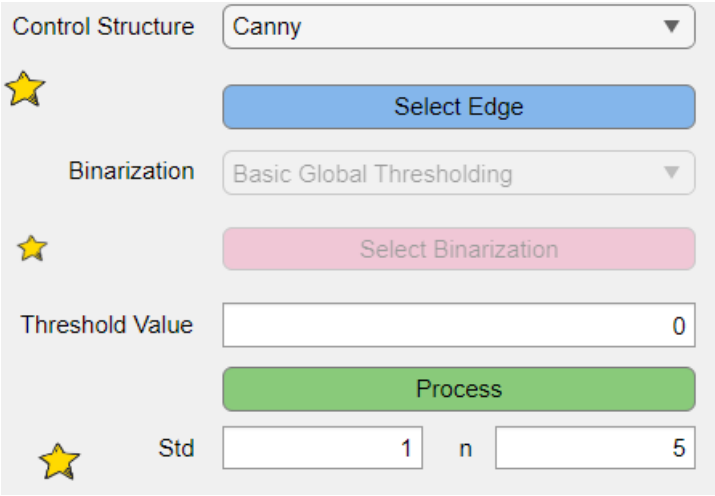
Select Edge Detection Method: Choose an edge detection method from the 'Control Structure' dropdown that suits your analysis needs. After selecting this button the next button becomes visible.



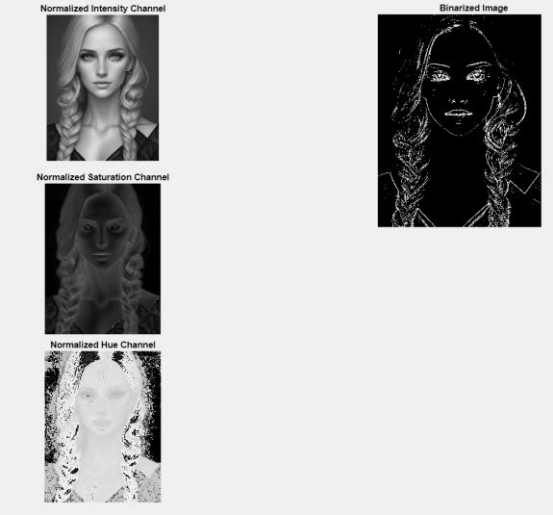
Select Binarization Method: Pick a binarization technique from the 'Binarization' dropdown if you need to convert yoğur image to binary form. After selecting this button the next button becomes visible.



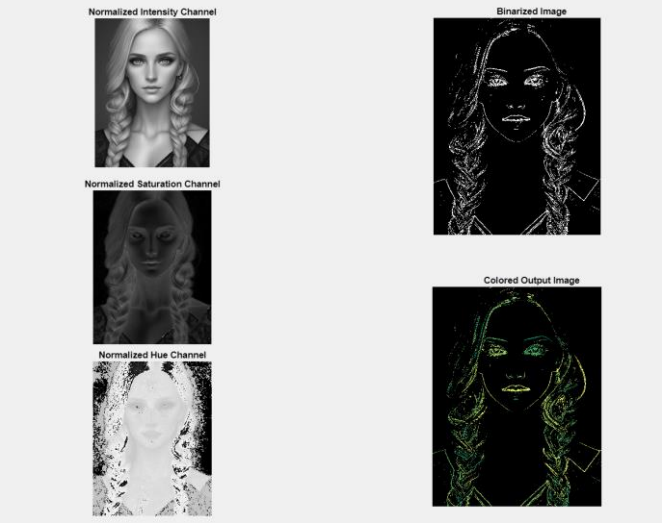
Set Threshold Value: If binarization is required, input a suitable threshold value in the 'Threshold Value' field. Ensure it is within the valid range of 1 to 254.



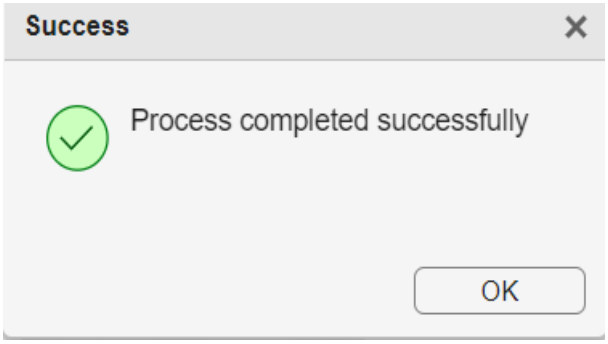
Process Image: Click 'Process' to apply the selected edge detection or binarization to the image.

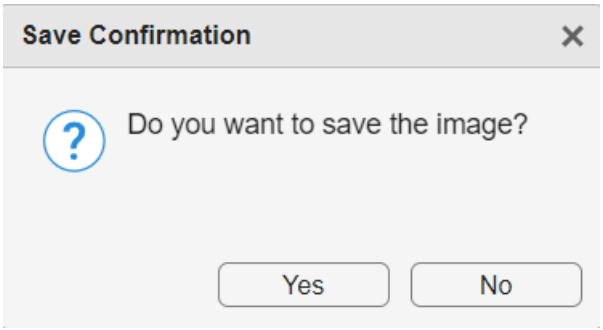


Color Mapping: Choose a color map from the 'Color' dropdown to visualize the processed image data effectively.



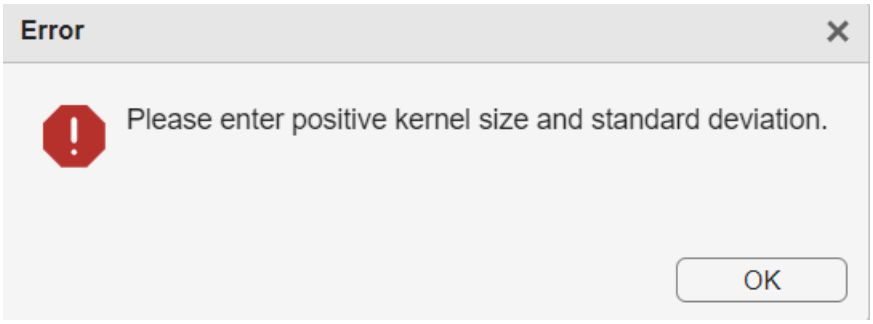
Finalize and Save: Once satisfied with the image, click 'Finalize' to complete processing, A notification appears on the screen stating that the process is completed. and use the 'Save' button to download the image to your computer.

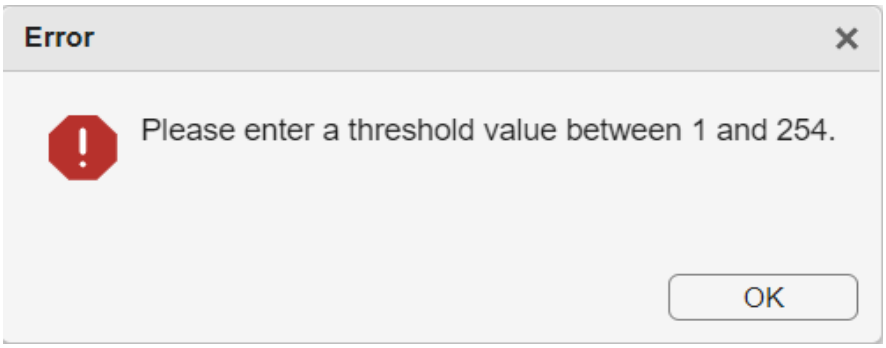


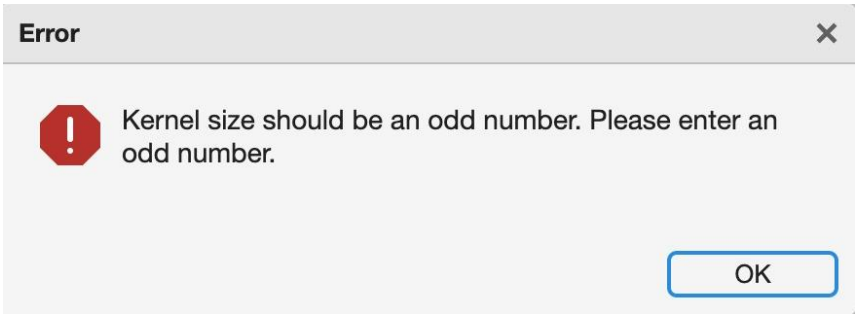


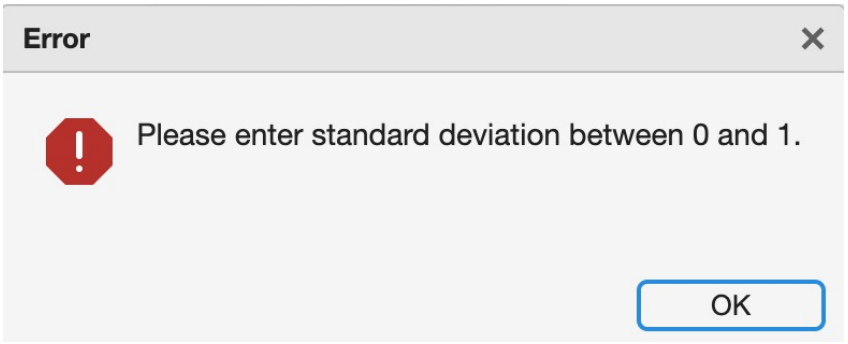
7. Warnings and Error Messages

When the user performs an incorrect operation or enters invalid input, the application displays error messages and warnings. These messages remind the user of the correct value ranges and expected actions.









8. Saving and Exporting Results

8.1 File Formats

- The application supports saving in multiple file formats, catering to various post-processing or presentation requirements.

8.2 Exporting Images

- Processed images can be saved directly from the application, enabling easy integration into reports or presentations.

9. Troubleshooting and Tips

9.1 Common Issues

- Image Load Failure: Ensure the image is in a compatible format like JPEG, PNG, or TIFF.
- Unexpected Processing Results: Adjust the edge detection and thresholding parameters or consult the MATLAB documentation for detailed algorithm information.
- Saving Errors: Verify write permissions in the target directory or try saving in a different format.

9.2 Best Practices

- Pre-Processing: Clean up the image or adjust its contrast before processing for optimal results.

- Parameter Tweaking: Small adjustments to the edge detection and binarization settings can significantly affect the output; iterative tweaking is recommended.
- Post-Processing: Consider further processing in MATLAB or external software for detailed analysis or visual enhancements.

10. Conclusion

This application serves as a powerful tool for image analysis and processing within the MATLAB environment. Its user-friendly interface simplifies complex operations, making it accessible to both novices and experienced users. Follow this guide to unlock the full potential of the application for your image processing tasks in CMPE 490 and beyond.