UNIVERSITÉ DE BOURGOGNE

Masters IN COMPUTER VISION AND ROBOTICS

Computer Vision toolbox

User manual

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1. Objective

This MATLAB project is aimed at making a graphical user interface that allows its user to implement most of the computer vision tasks without typing hectic code in MATLAB.

2. Interface

The figure given below is the final layout of the GUI

GUI

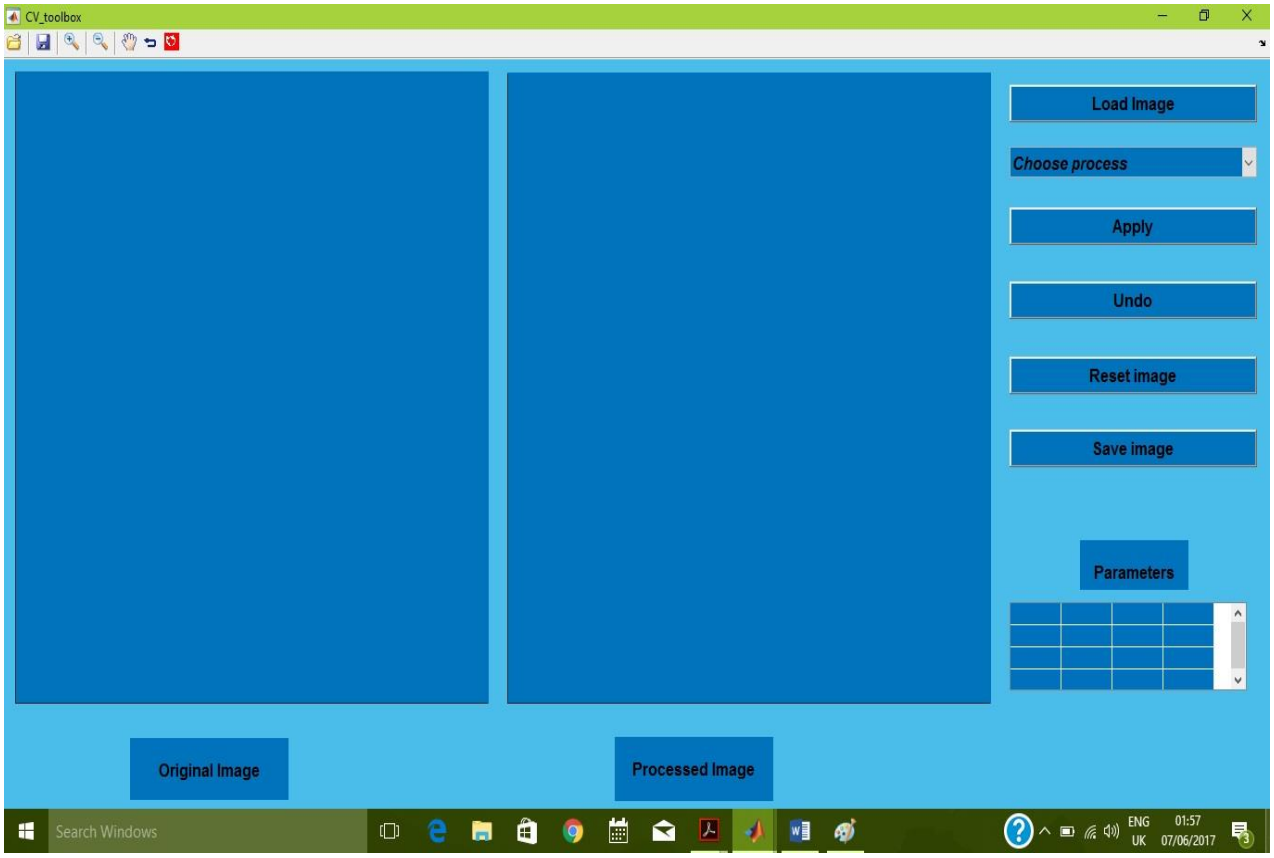


Figure 1: Final Layout of GUI

The layout has been kept as simple and user friendly as possible and allows to user to achieve most of the tasks with a few buttons.

3. Functionalities

This section will explain each functionality given in the GUI.

3.1. Open/Load image buttons

These buttons as shown in the figure below allow the user to load an image to be processed.

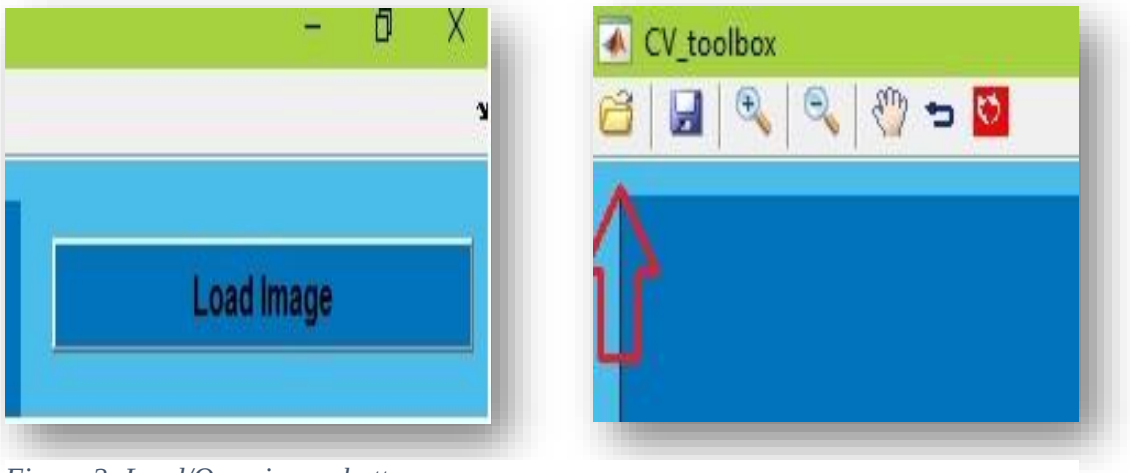


Figure 2: Load/Open image buttons

The user, on clicking either of these buttons can browse through any of the directories on his hard disk and load an image in the image display panel.

3.2. Save image buttons

The save buttons allow a user to save the processed images on anywhere on his hard disk. Once a user presses either of the buttons shown in the figure below, the user is prompted to selected a directory where he wants to save the image.

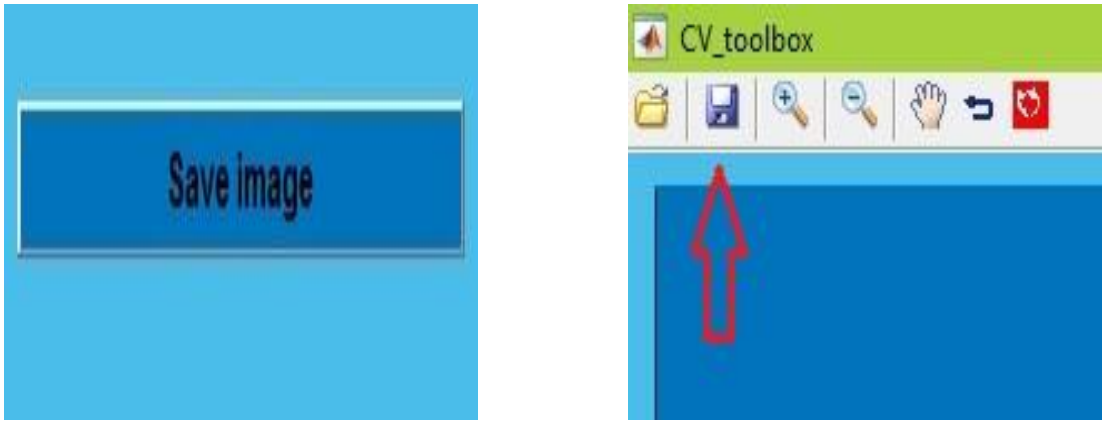


Figure 3:Save image buttons

3.3. Zoom in/out

The zoom in and zoom out options allow the user to zoom in and view the image or zoom out the image.

Figure 4: Zoom in/out

3.4. Pan

Pan allows the user to move the image while it is zoomed

Figure 5: Pan

3.5. Undo buttons

The undo buttons allow the user to undo any processes he applied to the image. The user has the ability to make as many undoes as he wants till he gets back his original image.

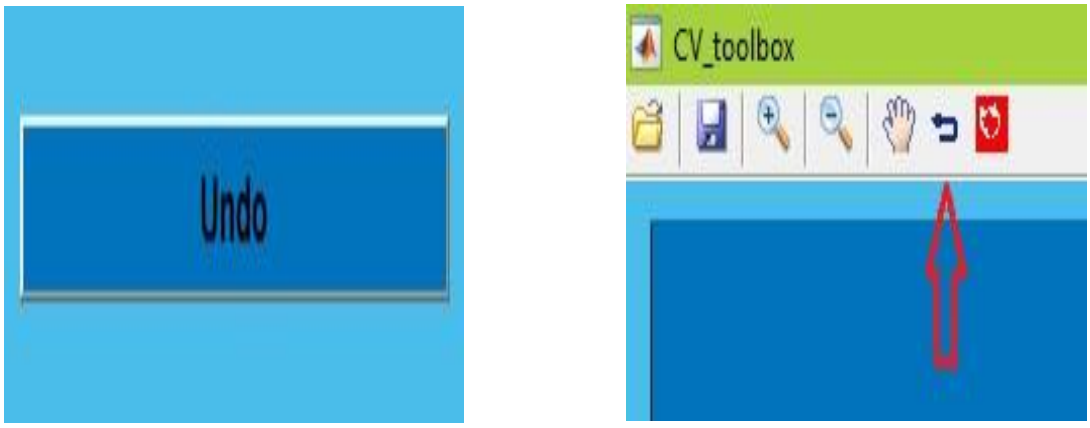


Figure 6: Undo buttons

3.6. Reset buttons

The reset buttons allow user to reset all the processes applied and get back to the original image he loaded.

Figure 7: Reset buttons

3.7. Choose Process drop down menu

This menu allows the user to apply one of the 24 computer vision tasks on selected images. The user first needs to load an image, choose the required process and press apply button.

Figure 8: Choose process drop down menu

3.8. Parameters table

This table displays values of matrices the user calculates such as the fundamental matrix or camera matrix.

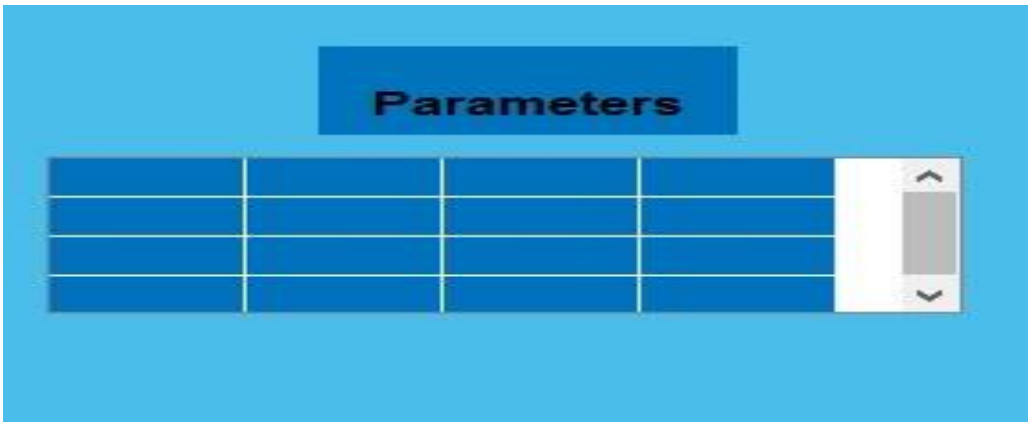


Figure 9: Parameters table

4. Computer vision processes

This section briefly describes each of the computer vision processes that the user can apply on his selected image using this GUI.

4.1. Salt and pepper noise

The interface prompts the user to enter a noise value between 0-1 to add noise to the image. Below is an example of noise of value 0.5 of lena image.

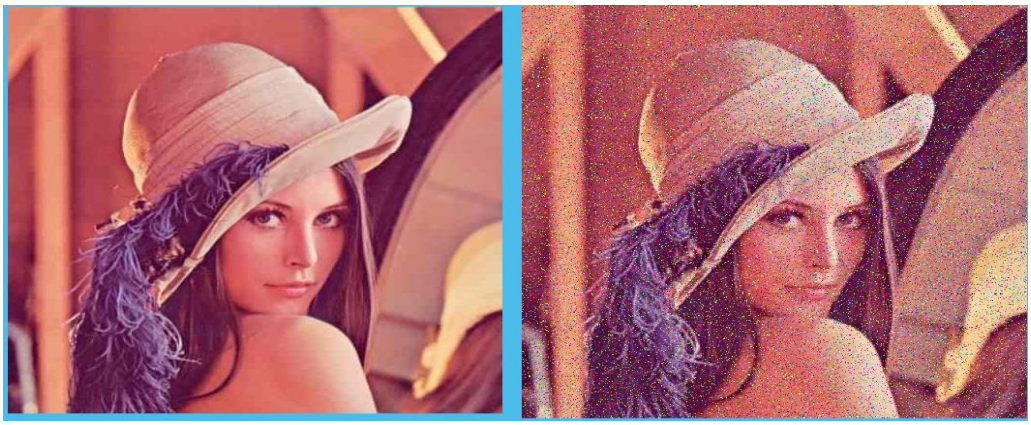


Figure 10: Salt and pepper noise

4.2. Add logo

The user can add a logo of his own choice. He is prompted to select an image from his hard disk to add as logo to the original image. Below is an example of logo of Pakistan flag being added to lena image.

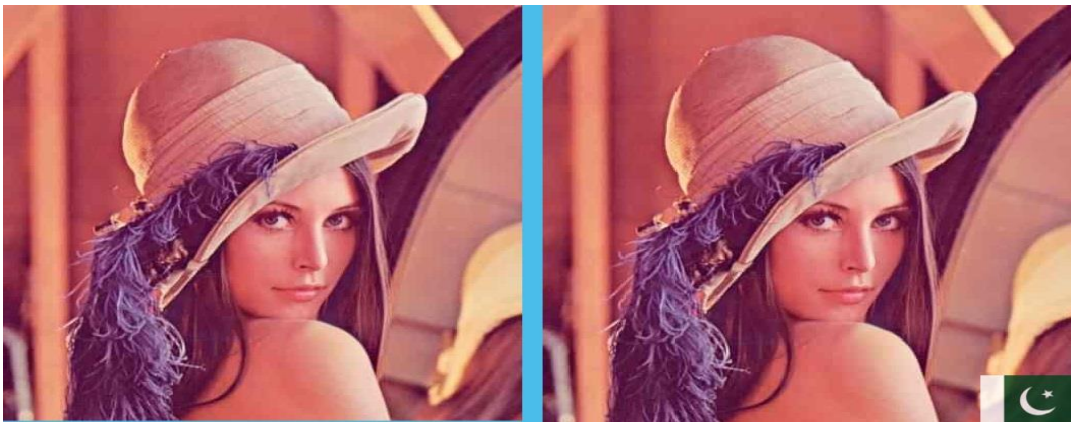


Figure 11: Add logo

4.3. Convert color space

The user can change the color space of his image from RGB to gray, ycbcr, ntsc and hsv.

Figure 12: Change color space

4.4. Compute histogram

Using this command the user can compute and display the histogram of the gray scale version of his input image.

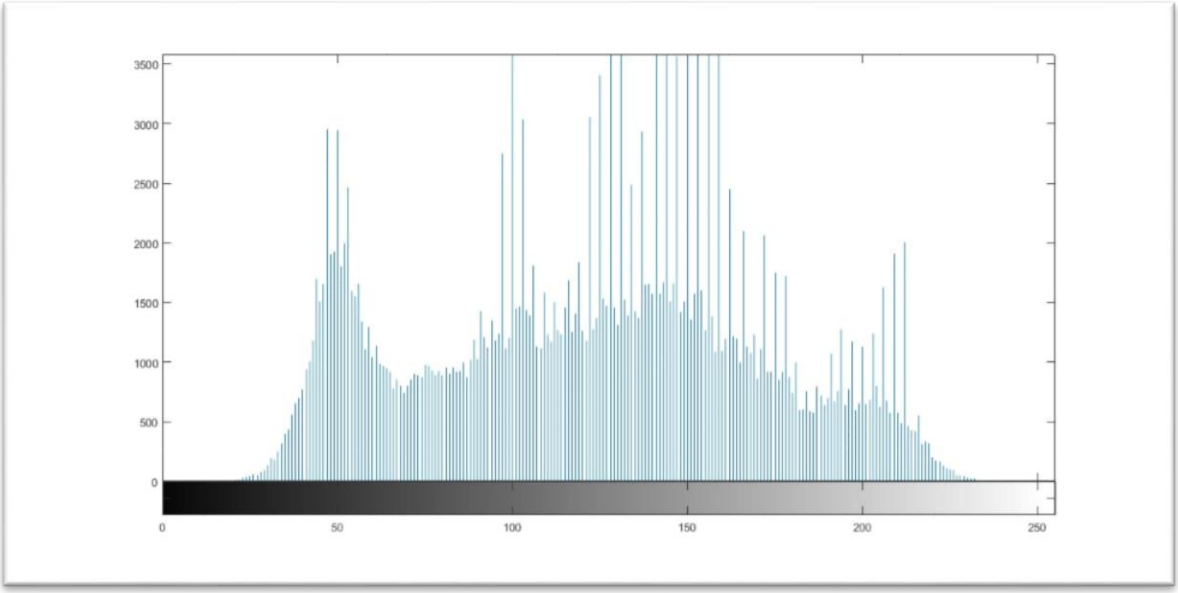


Figure 13: Histogram

4.5. Equalize histogram

The user can equalize the histogram of the grayscale version of his original image. The figure below displays the equalized histogram of the lena image. You can compare it with the histogram in figure 13.

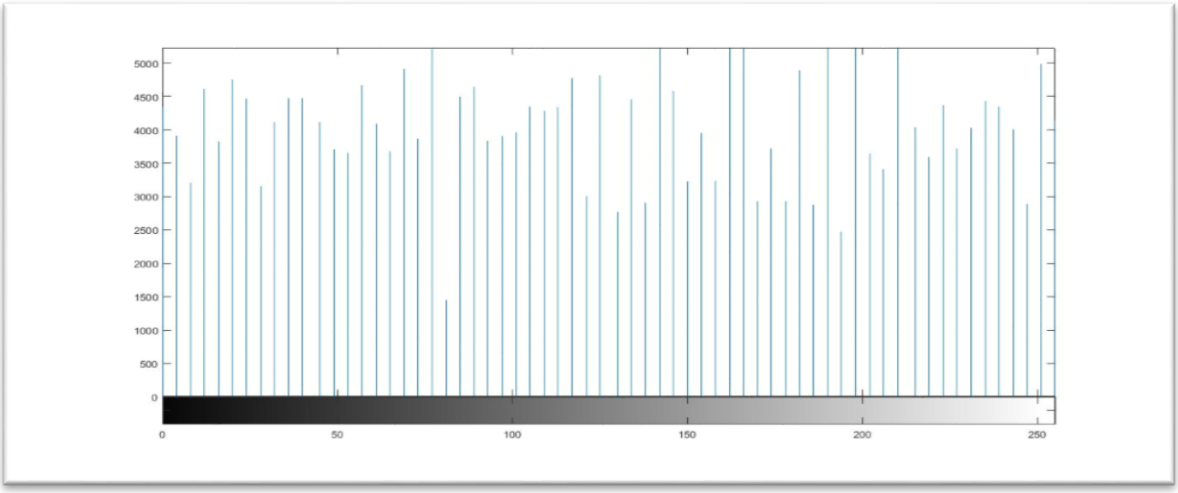


Figure 14: Equalized Histogram

4.6. Morphological operations

The user can choose between the 4 primary morphological operations; dilation erosion, opening and closing. Since these operations are performed on binary images, the resulting image is also binary. Following is a figure of erosion followed by dilation using a square structuring element of size 4.

Figure 15: Morphological operations

4.7. Image Blurring

The user can blur his image and can also specify the sigma value and the filter size for blurring. The following is an example of lena image blurred with a sigma value of 5 and filter size 5.

Figure 16: Image blurring

4.8. Apply sobel

Sobel can be applied to detect edges in the images,

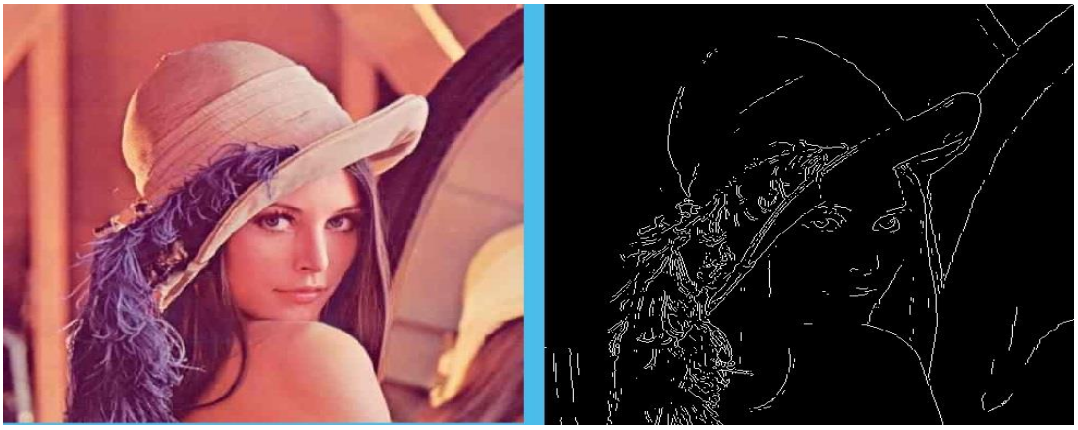


Figure 17:Sobel

4.9. Laplacian

The following is the result of applying Laplacian operator to the lena image.

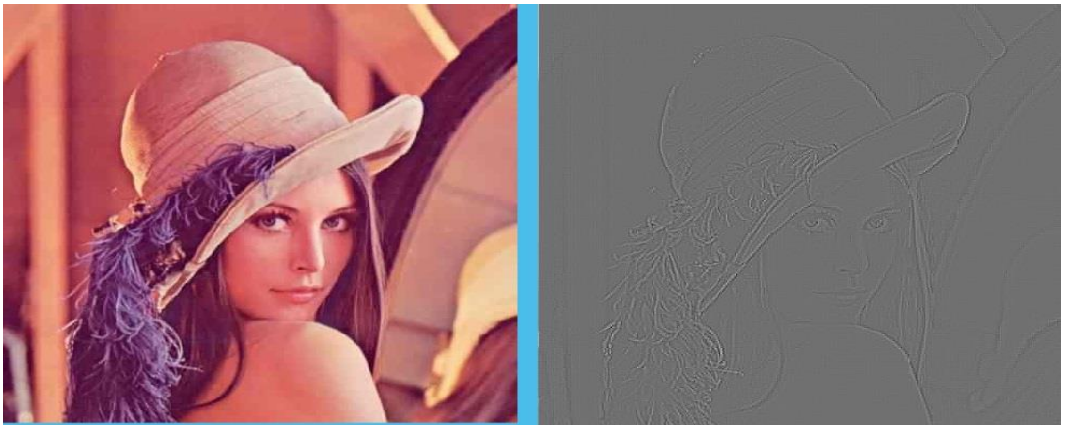


Figure 18: Laplacian

4.10. Canny edge detector

The image edges are detected using the canny edge detector.

Figure 19: Canny edge detector

4.11. Image sharpening.

The user has the ability to apply image sharpening over and over. The following is the result of applying image sharpening on lena image thrice.

Figure 20: Image sharpening

4.12. Hough lines

Application of Hough transform to extract lines in an image and plot them using the parametric equation of line.

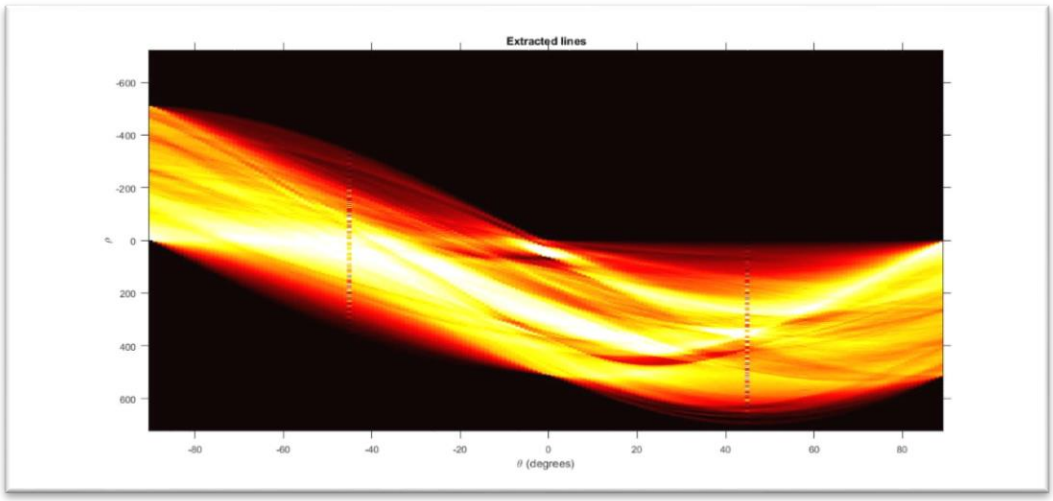


Figure 21: Hough lines

4.13. Extract circles

Application of Hough transform to extract circles in image. Then user can also specify the number of circles he is looking for. If he specifies a number greater than detected, an error message is displayed.

Figure 22: Circle extraction.

4.14. Harris corners

This process allows the user to extract and plot corners using the Harris algorithm. The user also can specify the number of corners he is looking for.

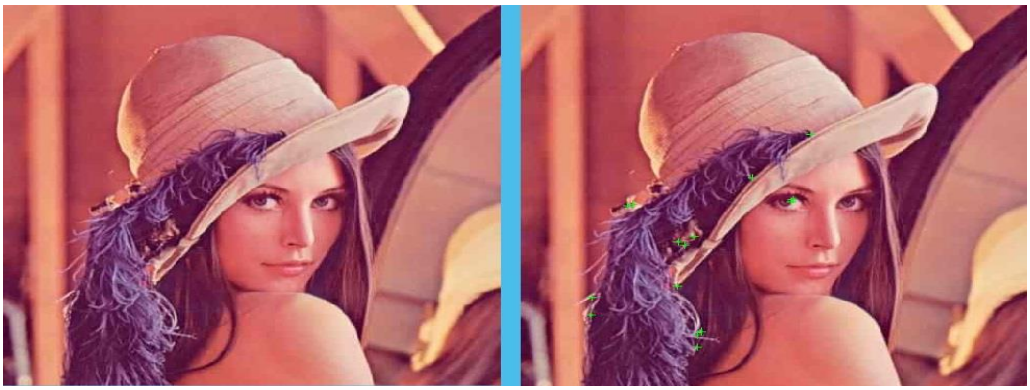


Figure 23: Harris corners

4.15. FAST features.

Allows extraction of features using the FAST algorithm.

Figure 24: FAST features

4.16. SURF features

Allows extraction of SURF features.

Figure 25: SURF features

4.17. Contours

Allows user to plot contours of connected regions in the image.

Figure 26: Contours

4.18. Bounding box

Draws a rectangle bounding box around connected regions in the binarized version of the image. The user can also specify the threshold for binarization of the number of bounding boxes to draw starting with the biggest.

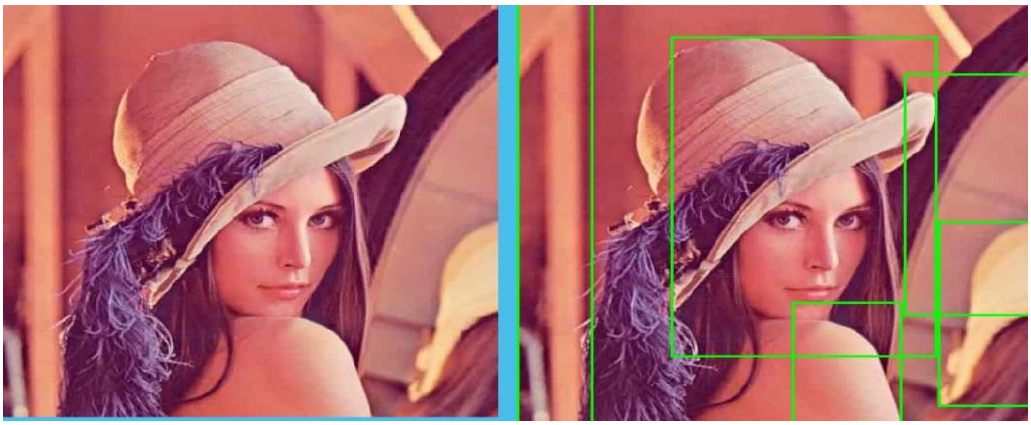


Figure 27: Bounding box

4.19. Enclosing circle

Encloses in a circle, the connected regions in the binarized version of the original image. The user can also specify the number of circles to draw and the binarization threshold.

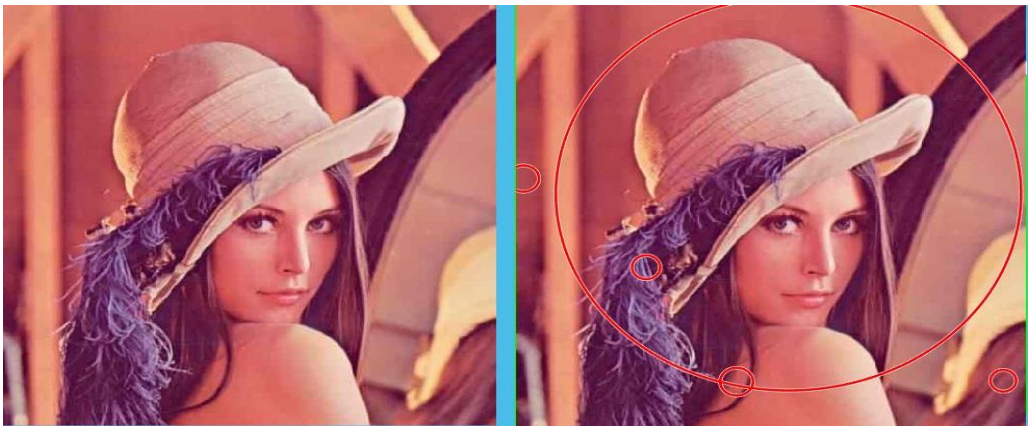


Figure 28: Minimum Enclosing circle

4.20. Feature matching

The user can input two images taken from the same camera with one camera slightly displaced with respect to the other. The corresponding features can be matched.

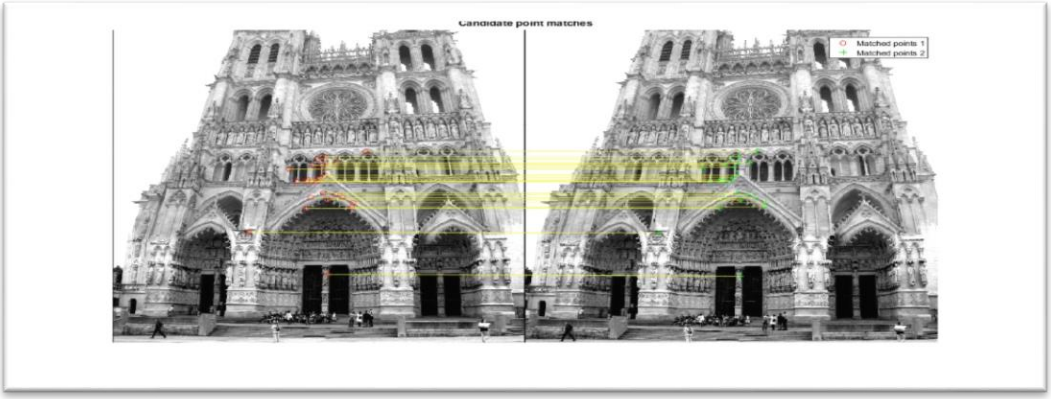


Figure 29: Feature Matching

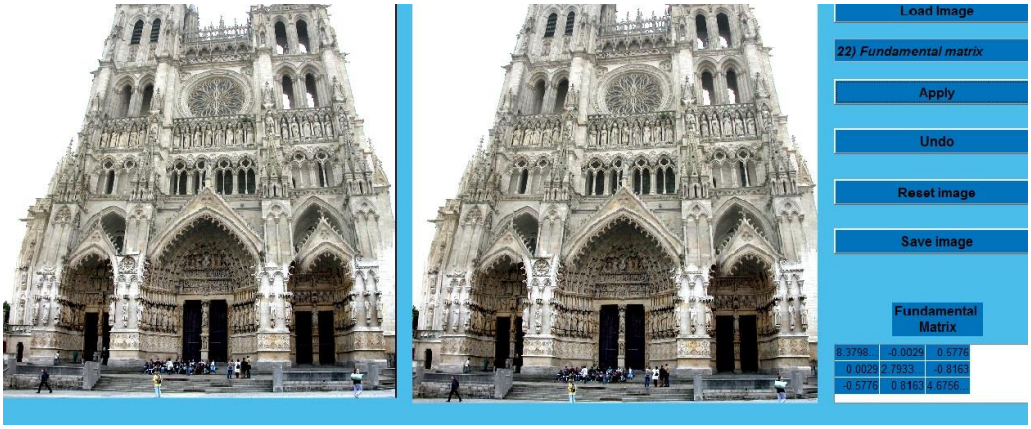
4.21. Camera Calibration

The user has to input a series of calibration pattern images and the interface will calculate the camera intrinsics and display them in the parameter table. It will also plot detected corners on the first image of the image set.

Figure 30: Camera Calibration

4.22. Fundamental Matrix

The fundamental matrix is computed using two images and displayed in the parameters table.



31: Fundamental matrix

4.23. Epipoles and epipolar lines

This function allows the user to compute and plot epipoles and epipolar lines in two images of the same view taken from different camera positions.

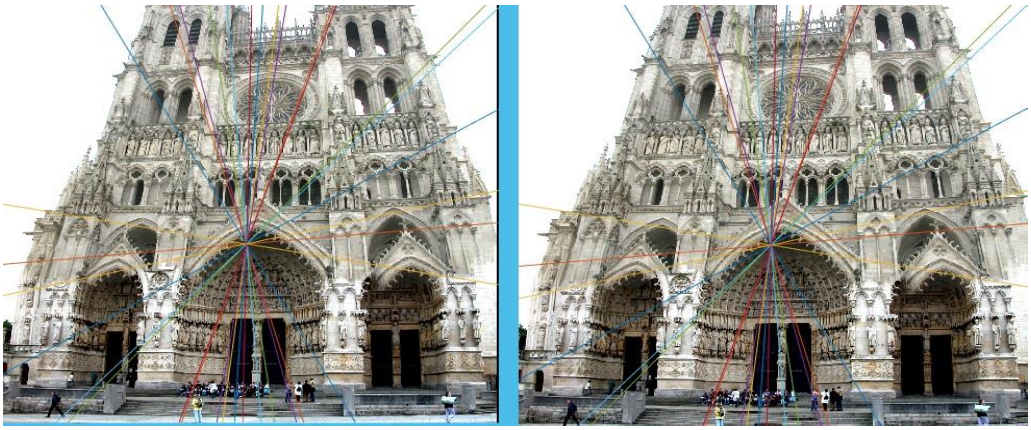


Figure 32: Epipolar lines and Epipoles