Visual Perception

OpenCV User Guide

Master in Computer Vision

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Introduction:

Developing Computer Vision applications are difficult. One should consider the capabilities of the framework, on the other hand how this framework will react and perform on given test data. In other case, one may want to see only effect of the consecutive image processing functions on test data. In both and many cases, small toolboxes of the frameworks help people to see results easily, fast and enable them to fast prototyping. Hence this toolbox is created for Computer Vision application developers and enthusiast who want to see image processing functions on their images with very basic knowledge. It's developed with minimal design, which makes it easy to use. However it is also powerful toolbox due to its support of parameters.

About The GUI:

1. Image Toolbox: Basics

This application is embedding functions of OpenCV (tested on 3.2) for users. This application consist of one GUI for displaying input and output images by QT. It accepts one image at a time and storing it as original image. Each modification is applied on output image consecutively. By default, all operations are disabled until you select an image.

2. User Interface

User interface consist of 16 buttons on a single view which embeds all image processing functions.

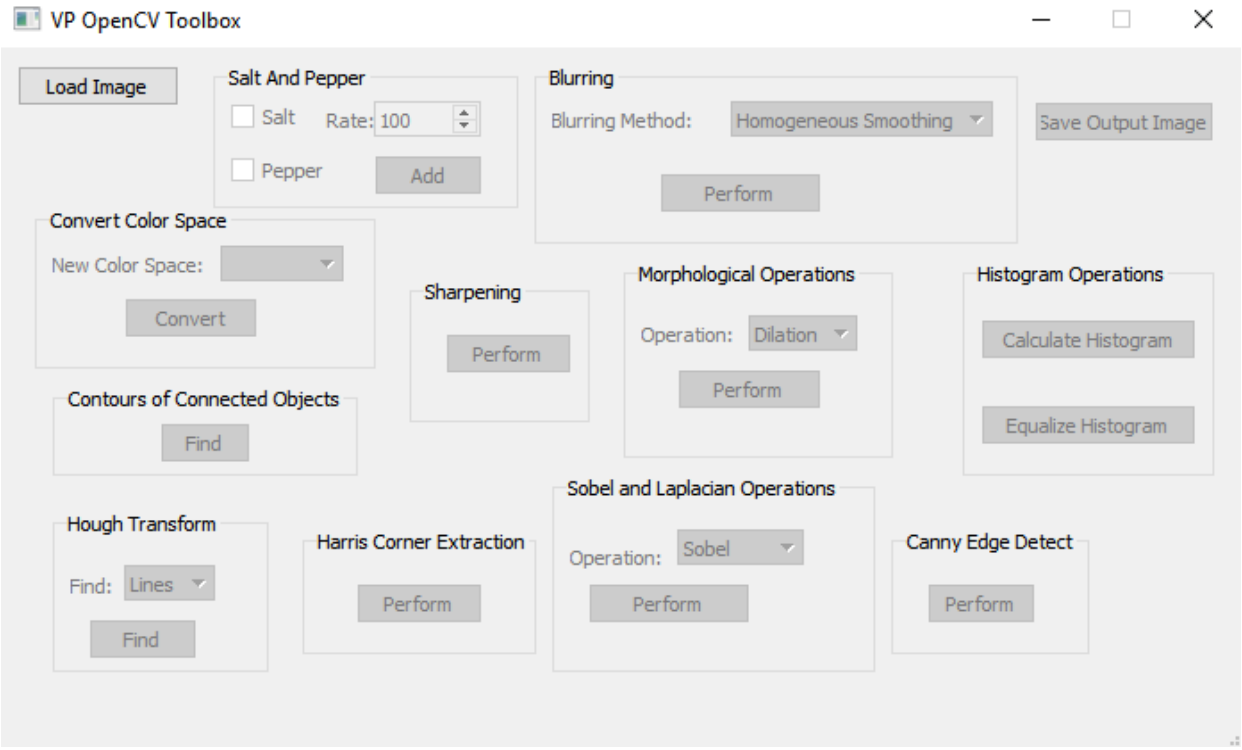

Figure 1: OpenCV Toolbox

Main buttons:

- Load Image: Loads image.
- Save Image: Save processed image.

Panels:

- Noise: Adding salt and pepper noise.
- Color: Changing color space.
- Blur: Blurring operations.
- Histogram: Calculating and Equalizing Histogram.
- Morph: Morphological Operations.
- Hough: Hough Transform finding lines and circles.
- Sobel: Sobel and Laplacian derivative operators.
- Edge: Canny Edge Detect.
- Contour: Detects contours.
- Sharpen: Sharpening images.
- Harris: Edge Detection using Harris edge detection method.

3. Image Input and Output

Image input and output is very easy in this toolbox. "Load Image" button in top left opens file under the Input section in axes and enable to select any image in your computer. Supported formats are *.png, *.jpg, *.jpeg, and *.bmp; by default, OpenCV loads images in BGR color space. As soon as you select and load image, image is opened in windows titled "Input", which you can see there is already toolboxes on it which enable you to zoom in/out, showing pixel values and even saving.

Even Qt built OpenCV windows has saving option, there is also saving current image option on left top of application. It opens save dialog and let you save your image any place you want.

4. Noise

In "Noise" Panel, there is Salt and Pepper noise options. Salt and pepper noise is adding white and black pixels to your image with given amount as "Rate" parameter by default set to 100. Salt and Pepper options are with check-boxes, you have option to add them separately.

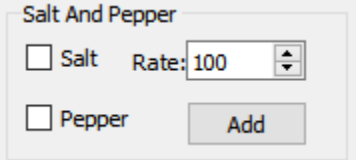

Figure 2: Noise Panel

Figure 3: Noise applied to image

5. Color space

In "ColorSpace" panel, you can color space of your current image. Supported color spaces are: BGR, RGB, GRAY, HSV, HLS. Current color space combo-box is disabled by default that showing current color space of the image. Each time you change the color space both 'Current Color Space' and 'New Color Space' combo-boxes are updated accordingly.

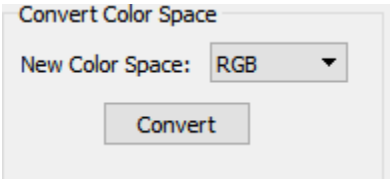

Figure 4: ColorSpace Panel

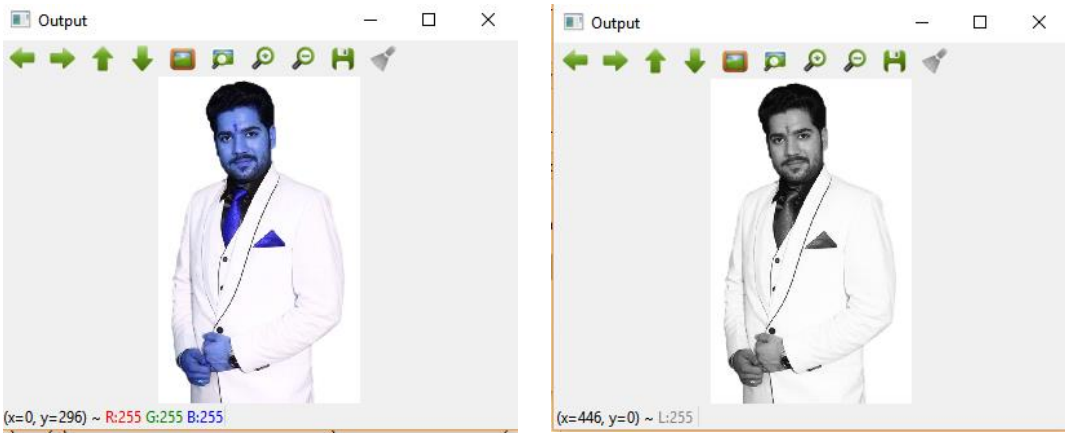

Figure 5: ColorSpace Panel changing ColorSpace of image

6. Histogram

In "Histogram" panel, you can calculate histogram of the image or equalize histogram of the current image. There is also option to choose channel for viewing histograms for multi-channel images.

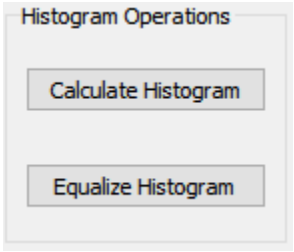

Figure 6: Histogram Panel

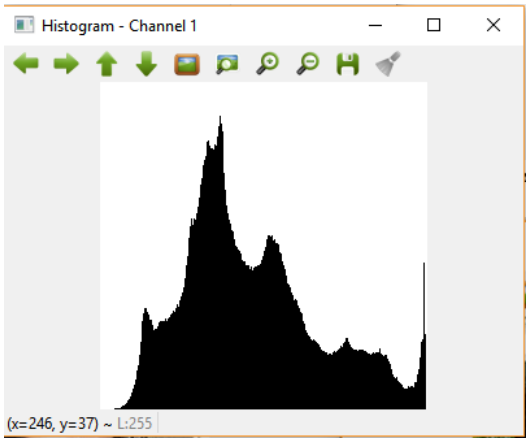

Figure 7: Computing Histogram of image

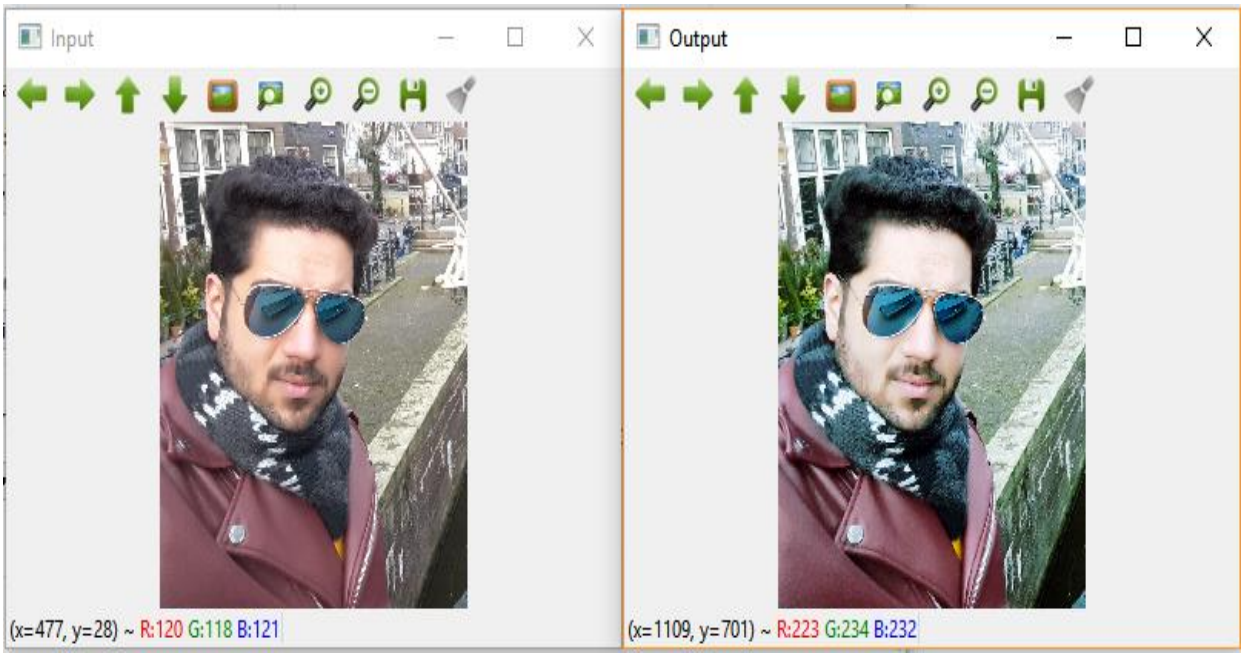

Figure 8: Equalizing Histogram of image

7. Morphological Operations

In "Morph" panel, you can perform morphological operations to your current image. Available operations are; Dilation, Erosion, Opening, Closing.

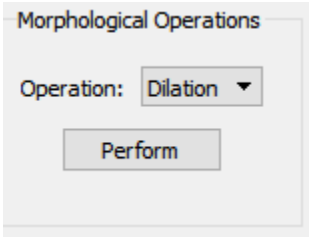

Figure 9: Morphological Panel

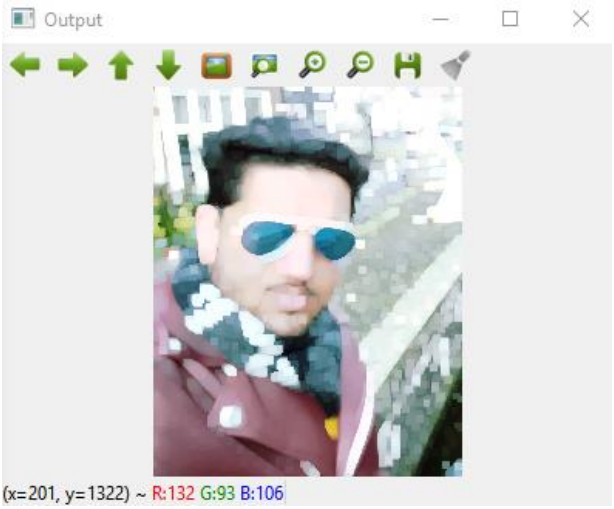

Figure 10: Dilation of image

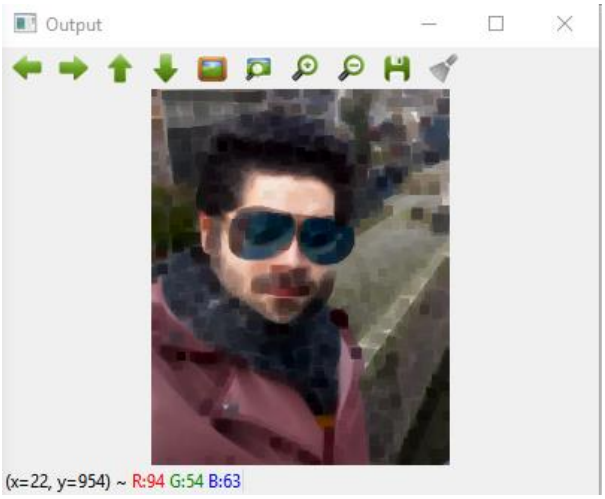

Figure 11: Eroding the image

8. Blur

In "Blur" panel, you can perform blurring your image with Homogeneous, Gaussian, Median or bilateral smoothing. The first filter performs the homogeneous smoothing, second as Gaussian, third as median and last filter used bilateral smoothing.

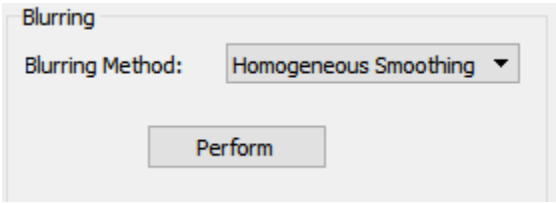

Figure 12: Blurring Panel

Figure 13: Blurring operation on image

9. Sobel And Laplacian

In "Sobel and Laplacian" panel, you can use Sobel and Laplacian operators. There are two buttons in the panel, pressing Sobel, The Sobel operation will be performed and by pressing the Laplacian, Laplacian operation will be performed. The output of both operations can be clearly seen in the output plane.

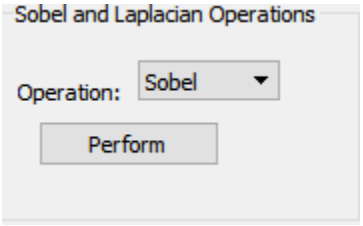

Figure 14: Sobel and Laplacian Panel

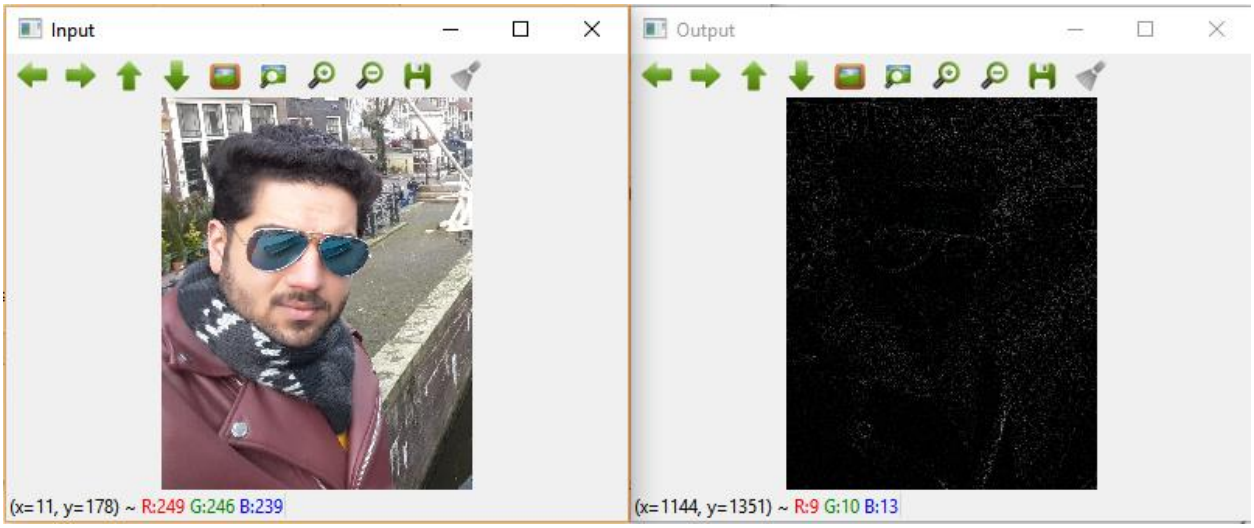

Figure 15: Sobel operation on image

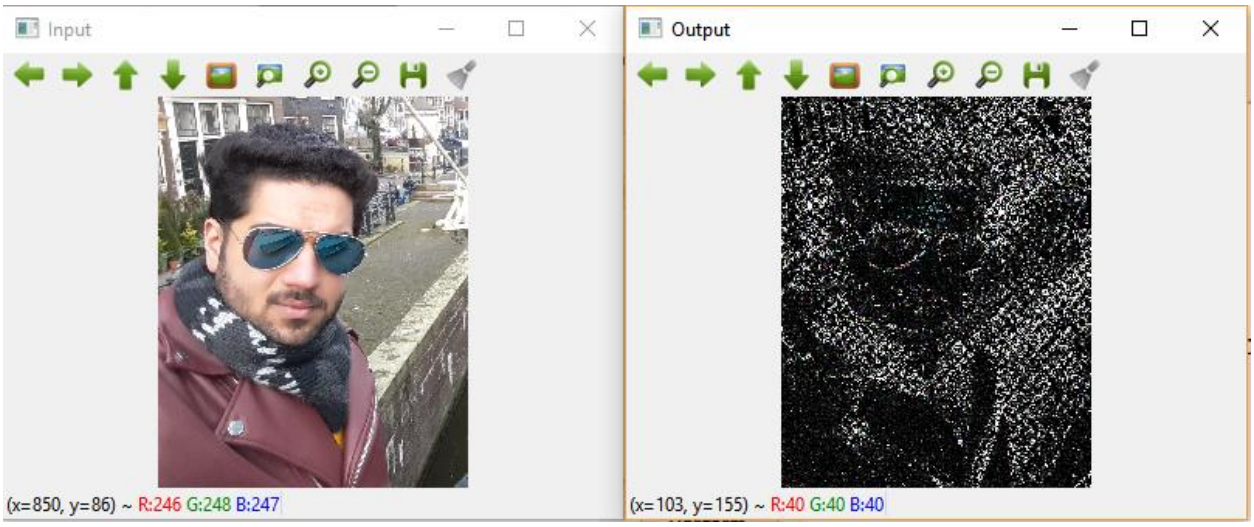

Figure 16: Laplacian operation on image

10. Sharpen

In "Sharpen" panel, you can perform sharpening on images. Behind the code, Gaussian blurred image is weighted with the current image.

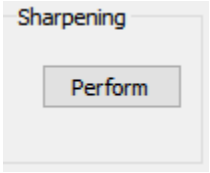

Figure 17: Sharpen Panel

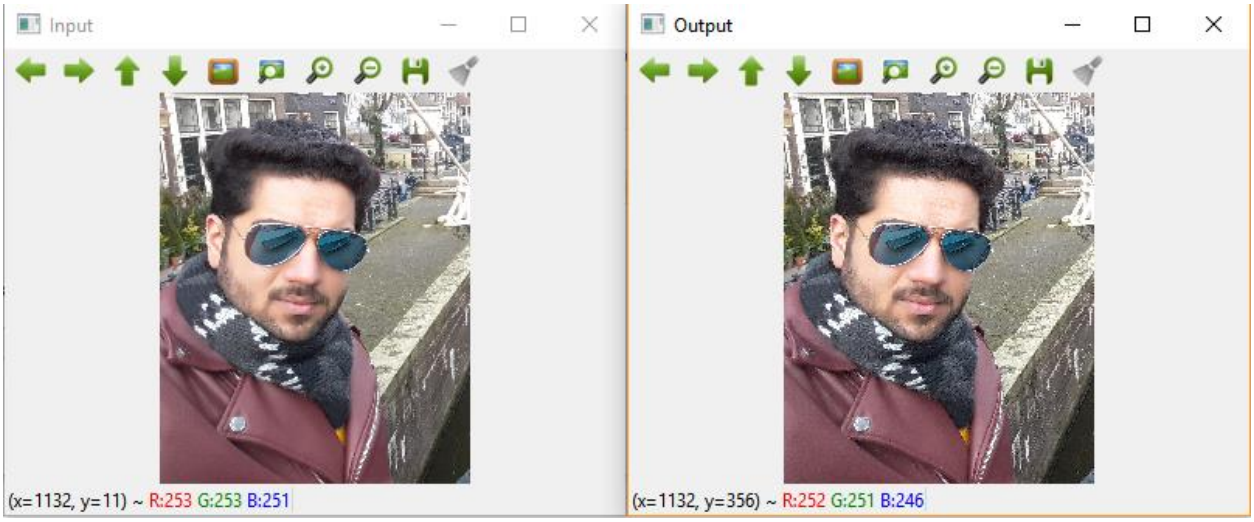

Figure 18: Sharpening operation on image

11. Edge Detection

In "Edge Detection" panel, we are using Canny Edge detector algorithm to find edges in the image. The output after applying the edge detection using canny can be clearly seen in the output panel.

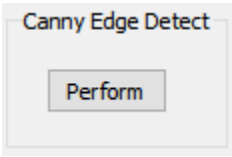

Figure 19: Edge Detection Panel

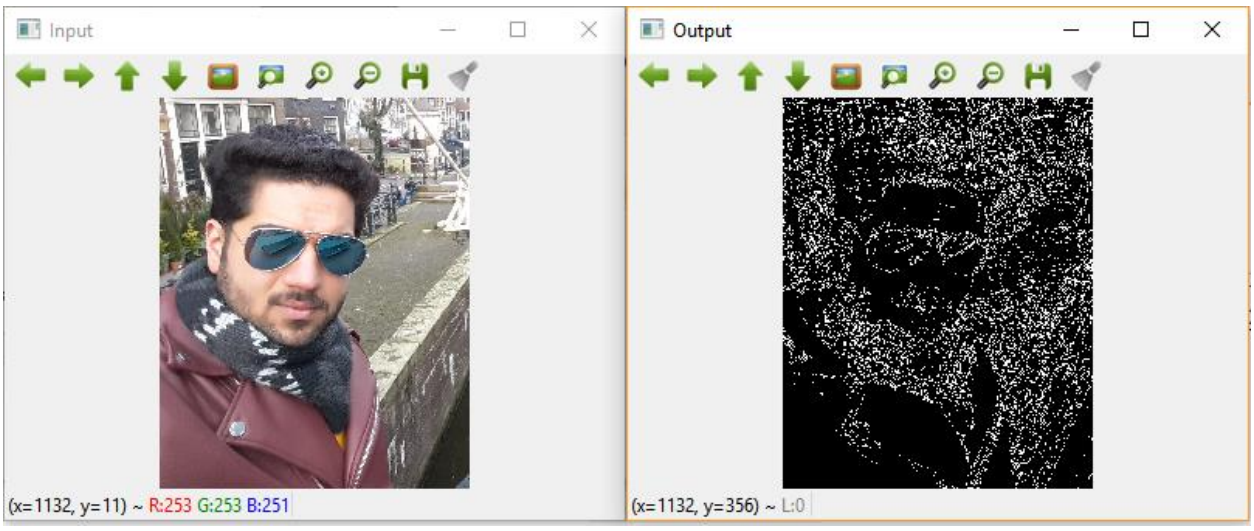

Figure 20: Edge Detection Panel

12. Hough Transform

In "Hough Transform" panel, you can find lines and circles with Hough Transform method. By choosing find method Lines or Circles. The output after applying the Hough Transform method can be clearly seen in the output panel.

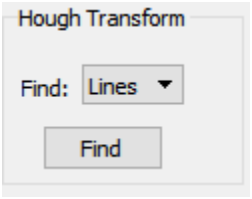

Figure 21: Hough Transform Panel

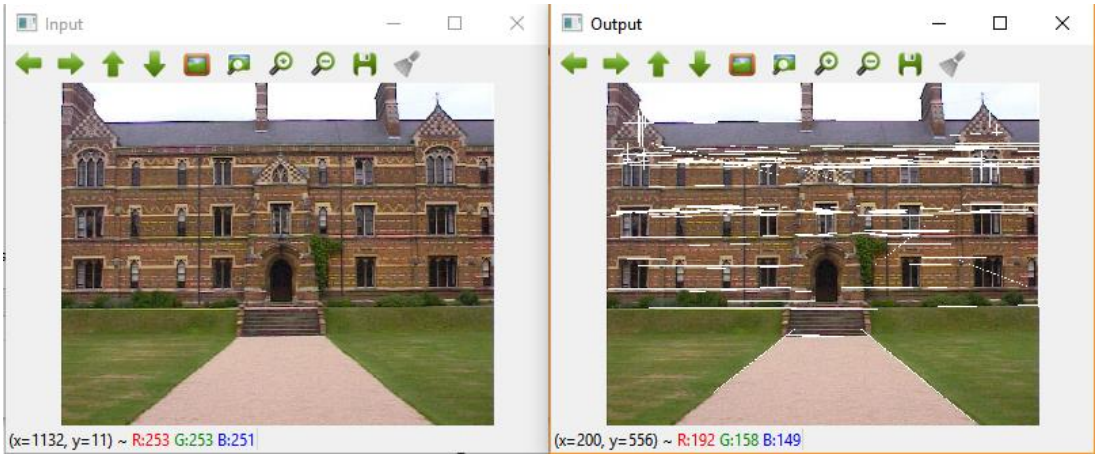

Figure 22: Finding lines in Hough Transform on image

13. Contour

In "Contour" panel, you can find contours of connected object and draw them onto image. There are many parameters available. The output after applying the Contour can be clearly seen in the output panel.

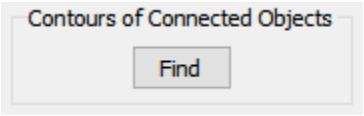

Figure 23: Contour Panel

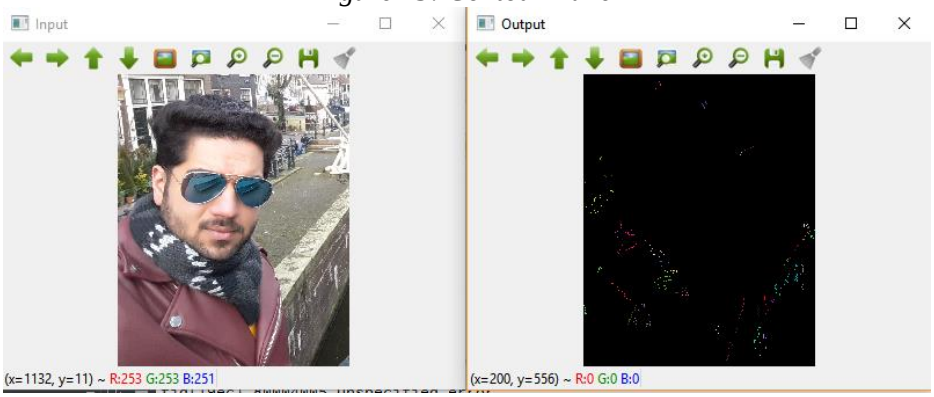

Figure 24: Finding Contour on image

14. Harris Corner Detection

In "Harris corner Detection" panel, you can extract corners with Harris Corner Extraction. The output after applying the Harris corner Detection can be clearly seen in the output panel.

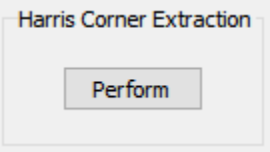

Figure 25: Harris corner Detection Panel

Figure 26: Finding corners using Harris corner Detection in image