



UNIVERSITY OF BOURGOGNE

MSCV

OpenCV Tool Box

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1 Introduction

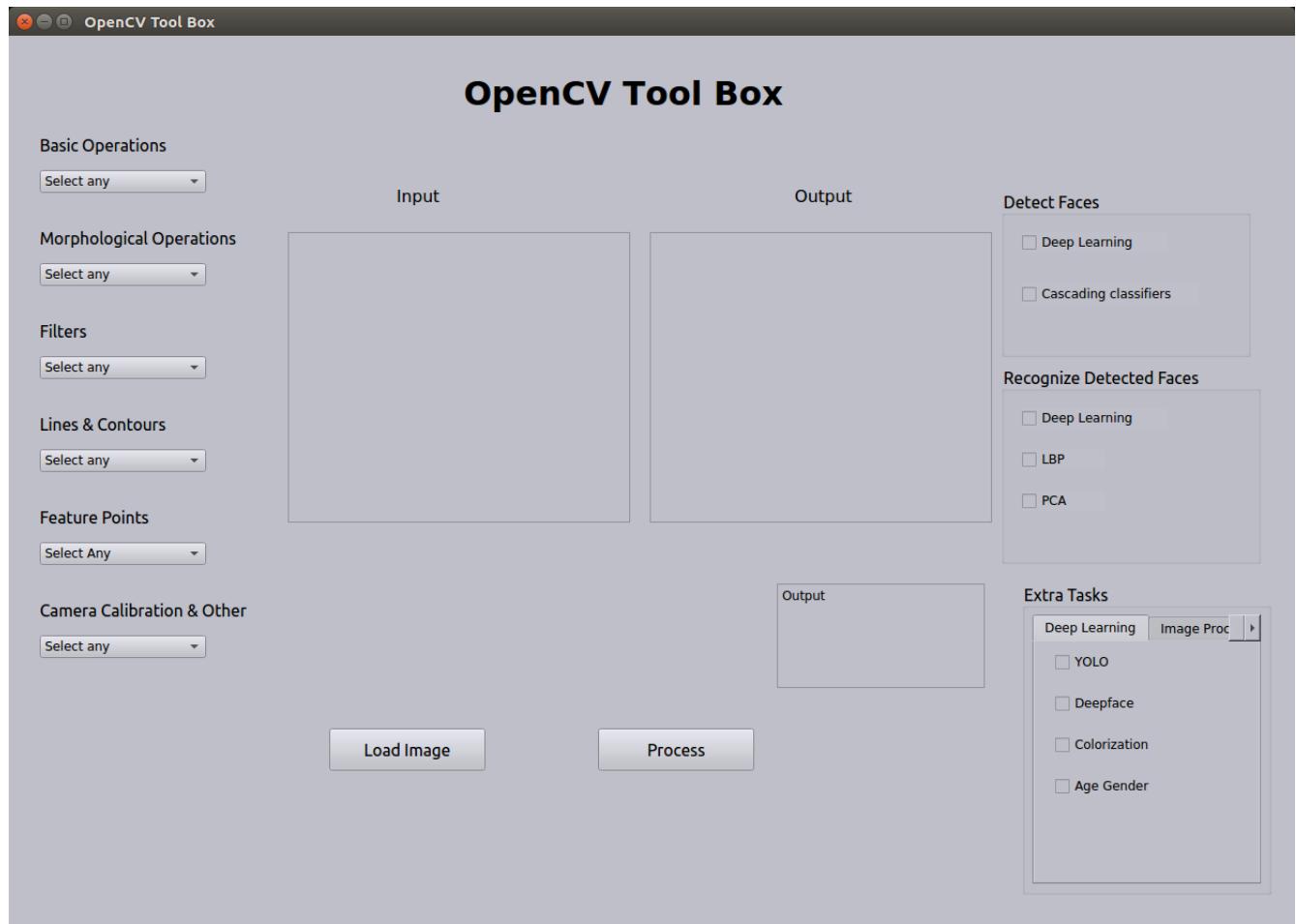
OpenCV (Open Source Computer Vision Library) is an open-source library that includes several hundreds of computer vision algorithms. OpenCV supports a wide variety of programming languages such as C++, Python, Java, etc., and is available on different platforms including Windows, Linux, OS X, Android, and iOS. Interfaces for high-speed GPU operations based on CUDA and OpenCL are also under active development. OpenCV-Python is the Python API for OpenCV, combining the best qualities of the OpenCV C++ API and the Python language.

1.1 Objective

The objective of this project is to make a computer vision toolbox using OpenCV library which performs given tasks. Graphical User Interface namely PyQt5 is used in this project for user friendly experience.

OpenCV Tool Box

The outlook of GUI is as follows



2 Tasks

I subdivided the given task according to the each category

1. Basic Operations
2. Morphological Operations
3. Filters
4. Lines and Contours
5. Feature Points

6. Camera Calibration and Other

Detect Face:

1. Face detection using deep learning
2. Face detection using Cascade

Recognize face

1. Face Recognition using deep learning
2. Face Recognition using LBP
3. Face Recognition using PCA

Extra Tasks

As I was interested to do few more extra tasks I included that too in the project under Extra Tasks group. Extra tasks is divided in two groups namely Deep learning and image processing.

Deep learning

1. YOLO using webcam
2. Face detection using webcam
3. Colorization using deep learning
4. Age and gender prediction using webcam

Image Processing

1. Red eye remover
2. Head Pose
3. Eigen Faces
4. Pencil sketch

3 HOW TO RUN

Before running the code make sure to install all the dependencies given in requirements.txt file are installed using following command.

```
pip install -r requirements.txt
```

TO RUN COLORIZATION IN EXTRA TASKS

In order to run Extra task's Colorization go to Extra tasks directory open colorization and run following command,make sure you in colorization directory

```
bash getModels.sh
```

It will download the pretrained models under the model folder.

TO RUN YOLO IN EXTRA TASKS

In order to run the yolo you will need few files you can download those files by opening Extra tasks and later open yolo folder you will find a python file namely **get-weights.py** run the file by following command

```
python get-weights.py
```

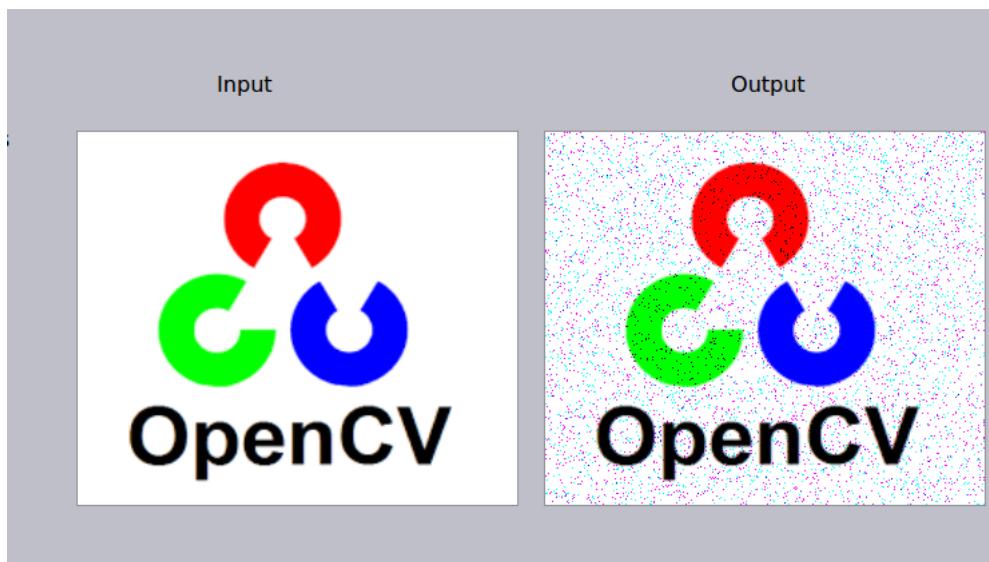
Thats it, we are now good to go to run our Project.

4 Results

4.1 Basic Operations

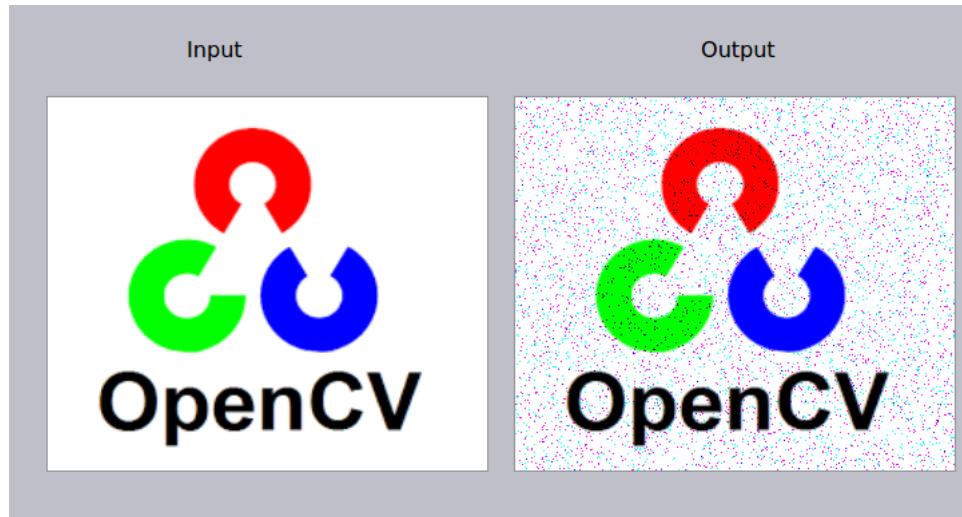
4.1.1 Add Salt Noise

In order to perform this task press **Load Image** button and select the require image and then select **Add Salt** from combobox below Basic and later on press **Process** button to see the results.



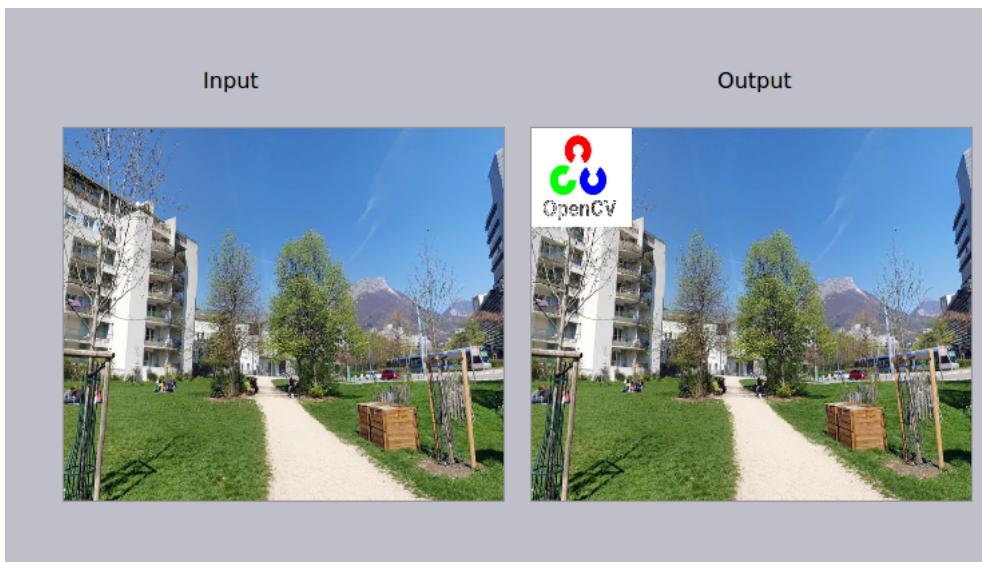
4.1.2 Add Pepper Noise

In order to perform this task press **Load Image** button and select the require image and then select **Add Pepper Noise** from combobox below Basic label and later on press **Process** button to see the results.



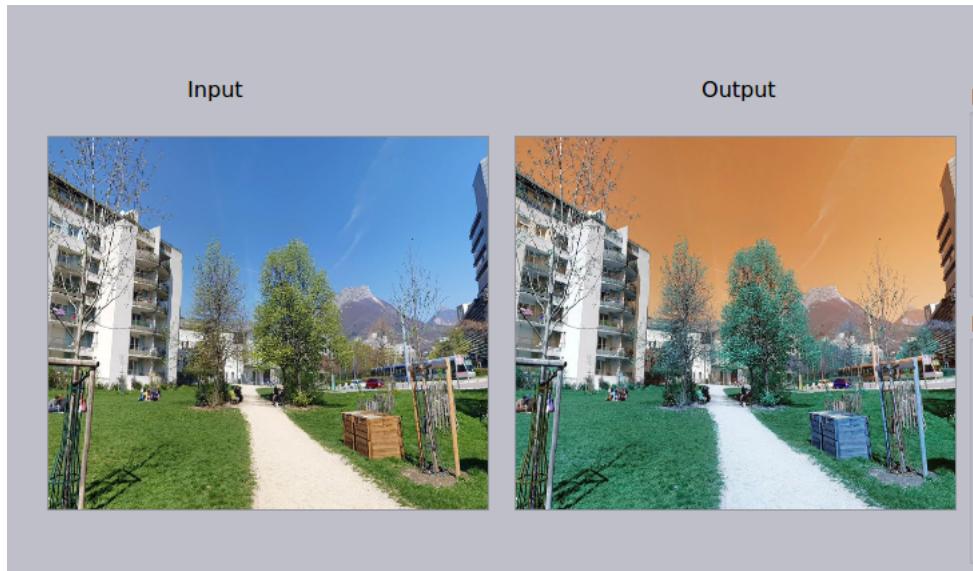
4.1.3 Add Logo

In order to perform this task press **Load Image** button and select the require image and then select **Add Logo** from combobox below Basic and later on press **Process** button you will be asked to give one more image which will be your logo after you give the second image you wiil see the results.



4.1.4 BGR2RGB

In order to perform this task press **Load Image** button and select the require image and then select **BGR2RGB** from combobox below Basic and later on press **Process** button to see the results.



4.1.5 BGR2YCrCb

In order to perform this task press **Load Image** button and select the require image and then select **BGR2YCrCb** from combobox below Basic and later on press **Process** button to see the results.



4.1.6 BGR2Lab

In order to perform this task press **Load Image** button and select the require image and then select **BGR2Lab** from combobox below Basic and later on press **Process** button to see the results.



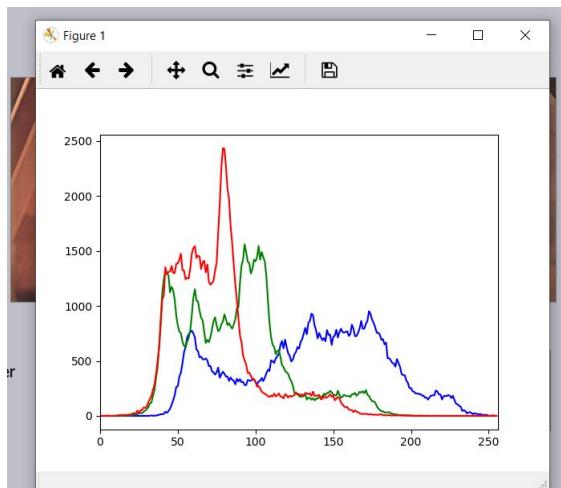
4.1.7 BGR2HSV

In order to perform this task press **Load Image** button and select the require image and then select **BGR2hsv** from combobox below Basic and later on press **Process** button to see the results.



4.1.8 Compute Histogram

In order to perform this task press **Load Image** button and select the require image and then select **Compute Histogram** from combobox below Basic and later on press **Process** button to see the results.



4.1.9 Histogram Equalization

In order to perform this task press **Load Image** button and select the require image and then select **Histogram Equalization** from combobox below Basic and

later on press **Process** button to see the results.



4.2 Morphological Operations

4.2.1 Dilate

In order to perform this task press **Load Image** button and select the require image and then select **Dilate** from combobox below Morphological Operations and later on press **Process** button to see the results.



4.2.2 Erode

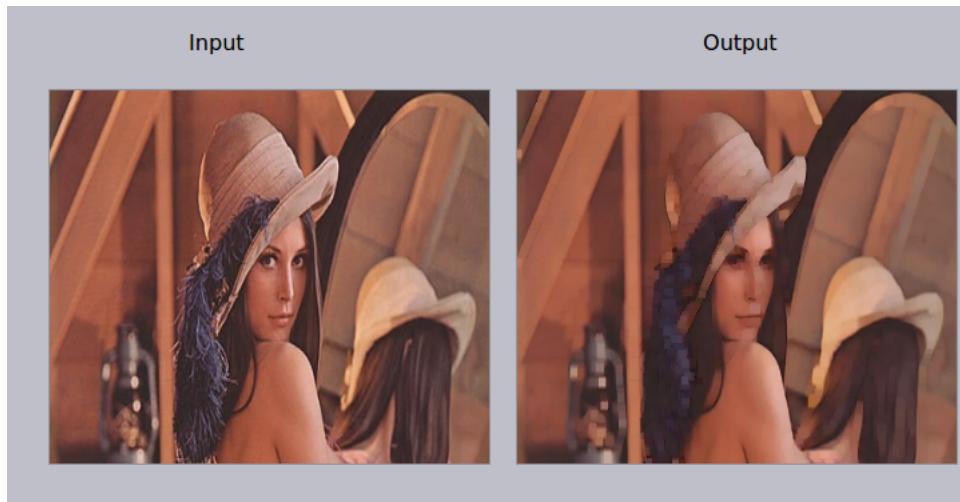
In order to perform this task press **Load Image** button and select the require image and then select **Erode** from combobox below Morphological Operations and

later on press **Process** button to see the results.



4.2.3 Open

In order to perform this task press **Load Image** button and select the require image and then select **Open** from combobox below Morphological Operations and later on press **Process** button to see the results.



4.2.4 Close

In order to perform this task press **Load Image** button and select the require image and then select **Close** from combobox below Morphological Operations and later on press **Process** button to see the results.



4.3 Filters

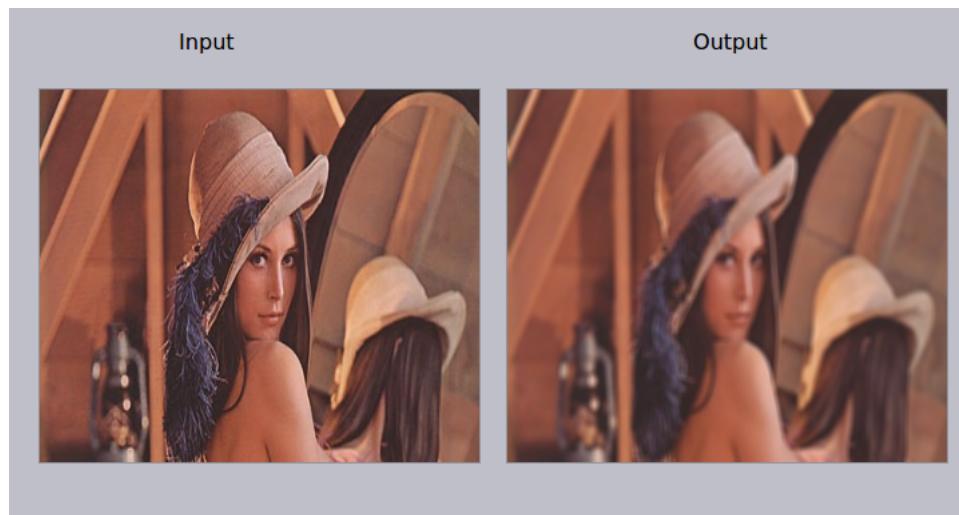
4.3.1 Median Blur

In order to perform this task press **Load Image** button and select the require image and then select **Median Blur** from combobox below Filters and later on press **Process** button to see the results.



4.3.2 Average Blur

In order to perform this task press **Load Image** button and select the require image and then select **Average Blur** from combobox below Filters and later on press **Process** button to see the results.



4.3.3 Gaussian Blur

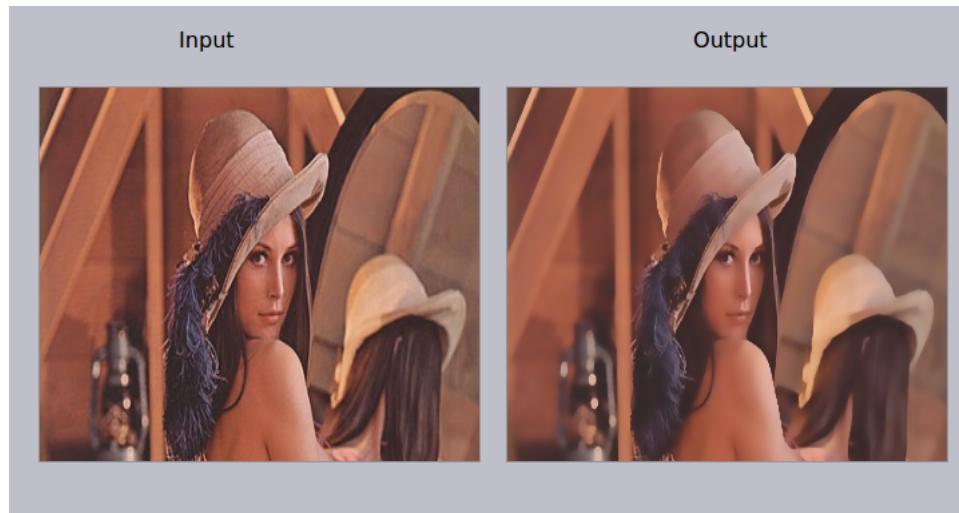
In order to perform this task press **Load Image** button and select the require image and then select **Gaussian Blur** from combobox below Filters and later on

press **Process** button to see the results.



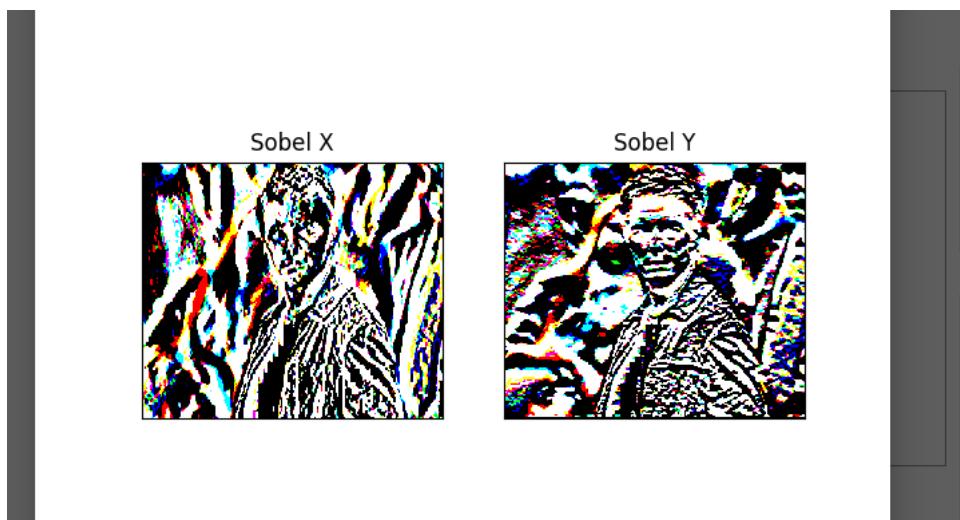
4.3.4 Bilateral Blur

In order to perform this task press **Load Image** button and select the require image and then select **Bilateral Blur** from combobox below Filters and later on press **Process** button to see the results.



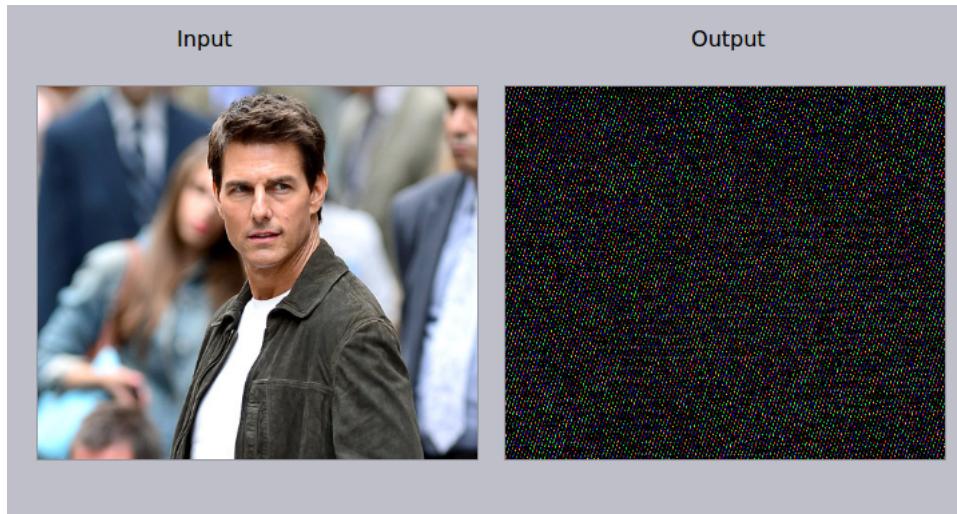
4.3.5 Sobel Operator

In order to perform this task press **Load Image** button and select the require image and then select **Sobel Operator** from combobox below Filters and later on press **Process** button to see the results.



4.3.6 Laplace Operator

In order to perform this task press **Load Image** button and select the require image and then select **Laplace Operator** from combobox below Filters and later on press **Process** button to see the results.



4.3.7 Canny Edge

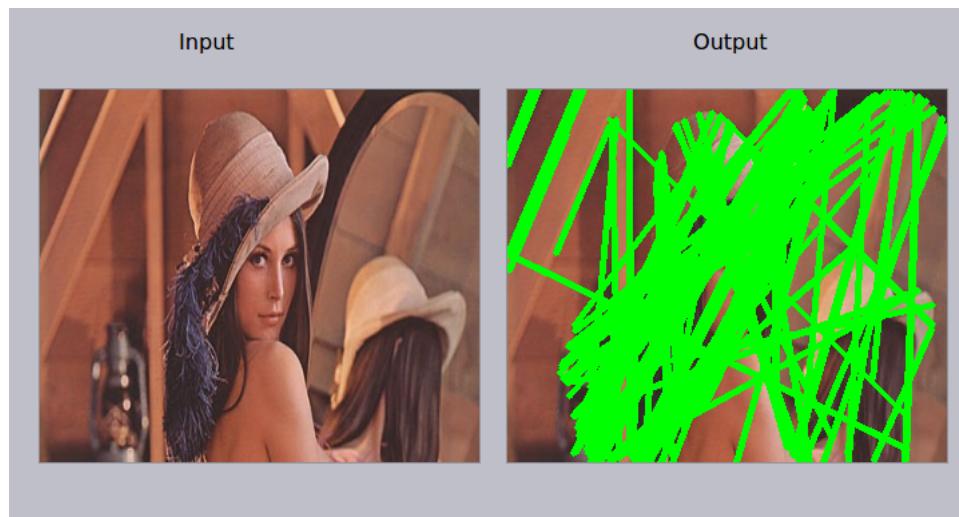
In order to perform this task press **Load Image** button and select the require image and then select **Canny Edge** from combobox below Filters and later on press **Process** button to see the results.



4.4 Lines and Contours

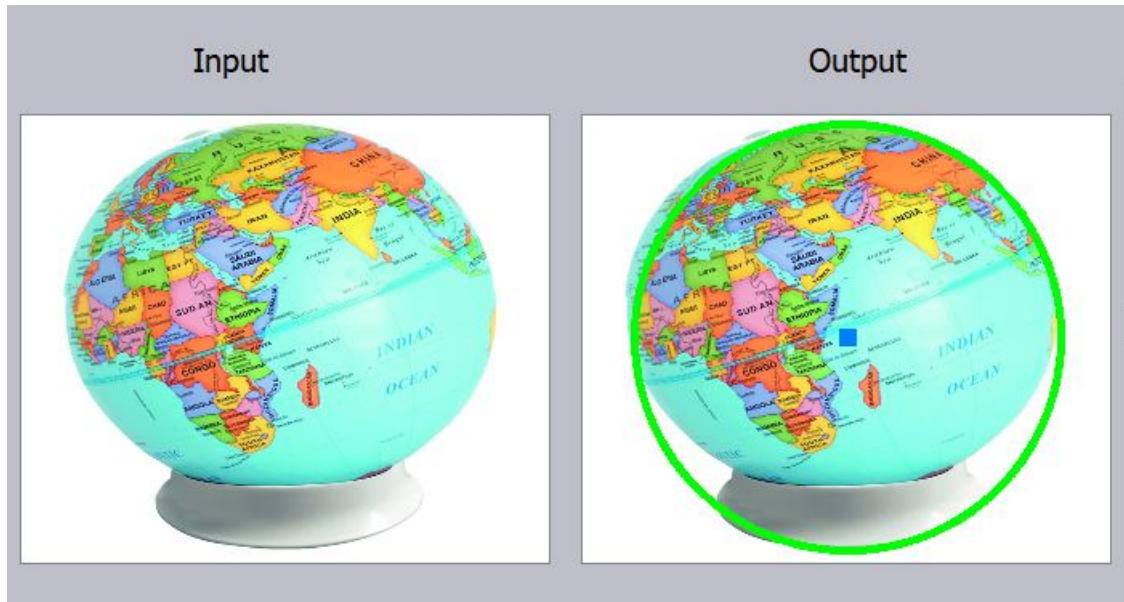
4.4.1 Extract Lines

In order to perform this task press **Load Image** button and select the require image and then select **Extract Lines** from combobox below Lines and Contours and later on press **Process** button to see the results.



4.4.2 Extract Circles

In order to perform this task press **Load Image** button and select the require image and then select **Extract Circles** from combobox below Lines and Contours and later on press **Process** button to see the results.



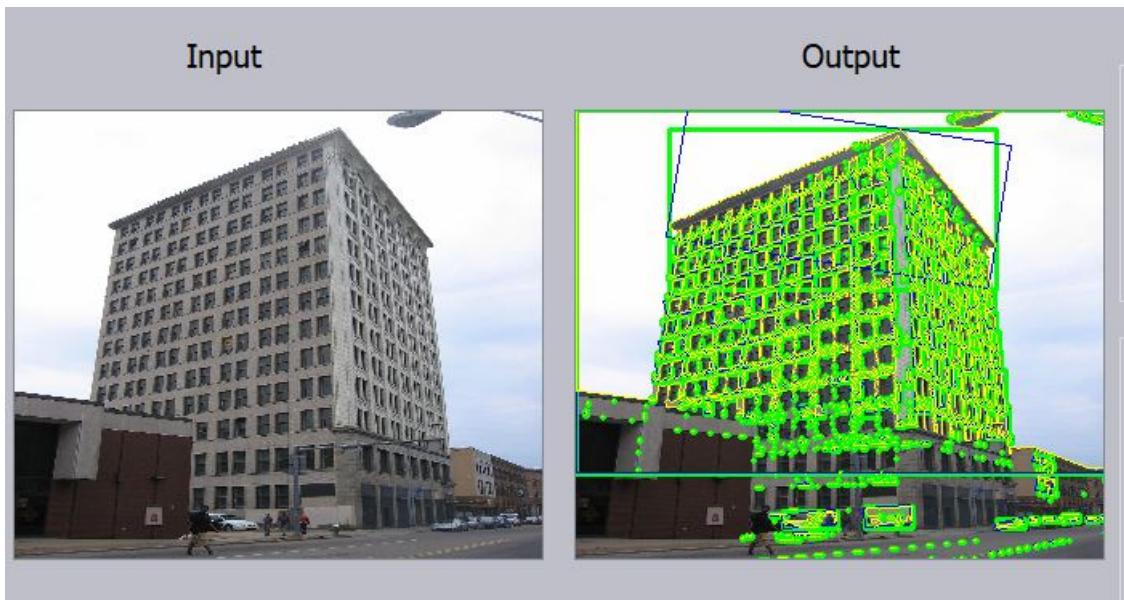
4.4.3 Contours

In order to perform this task press **Load Image** button and select the require image and then select **Conturs** from combobox below Lines and Contours and later on press **Process** button to see the results.



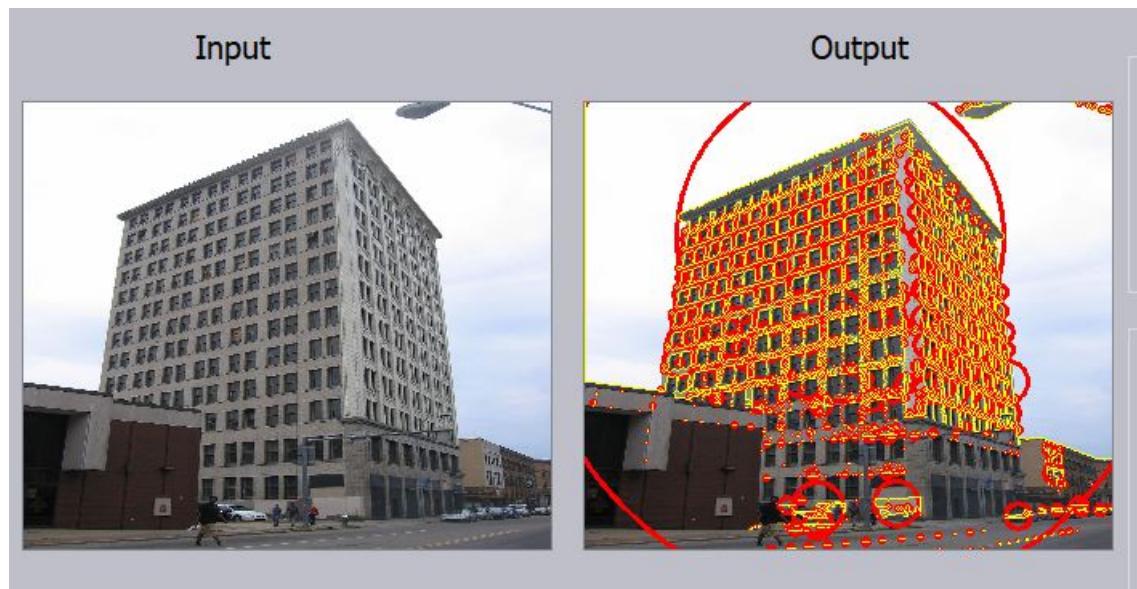
4.4.4 Bounding box

In order to perform this task press **Load Image** button and select the require image and then select **Bounding box** from combobox below Lines and Contours and later on press **Process** button to see the results.



4.4.5 Enclosing Circle

In order to perform this task press **Load Image** button and select the require image and then select **Enclosing Circle** from combobox below Lines and Contours and later on press **Process** button to see the results.



4.5 Feature Points

4.5.1 Harris Corner

In order to perform this task press **Load Image** button and select the require image and then select **Harris Corner** from combobox below Feature Points and later on press **Process** button to see the results.



4.5.2 FAST

In order to perform this task press **Load Image** button and select the require image and then select **FAST** from combobox below Feature Points and later on press **Process** button to see the results.



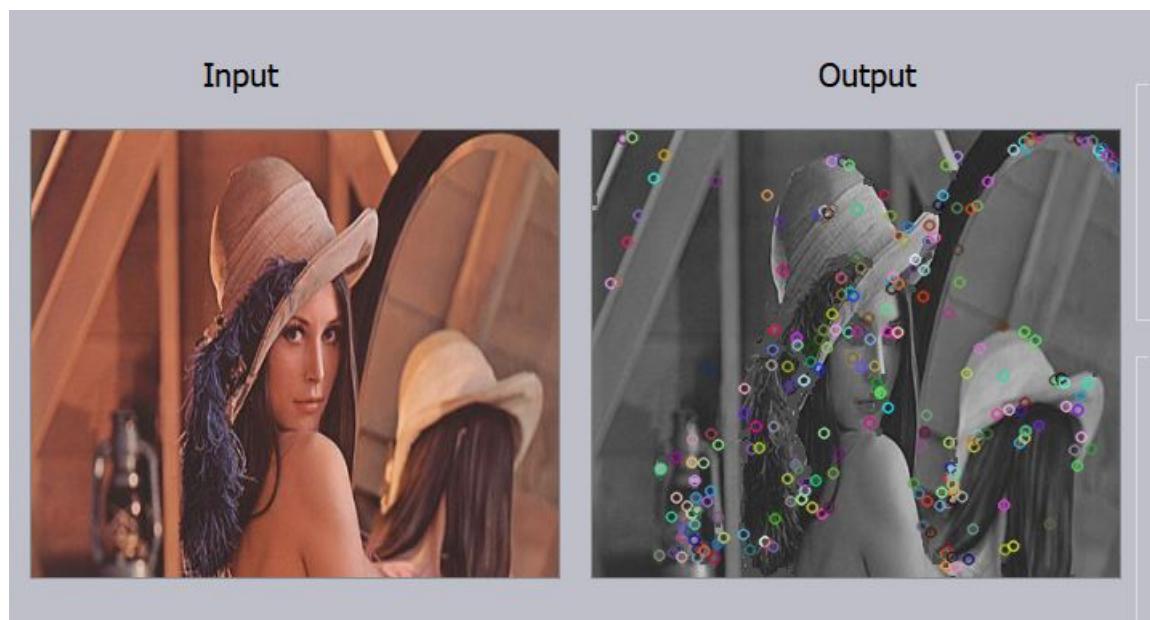
4.5.3 SURF

In order to perform this task press **Load Image** button and select the require image and then select **SURF** from combobox below Feature Points and later on press **Process** button to see the results.



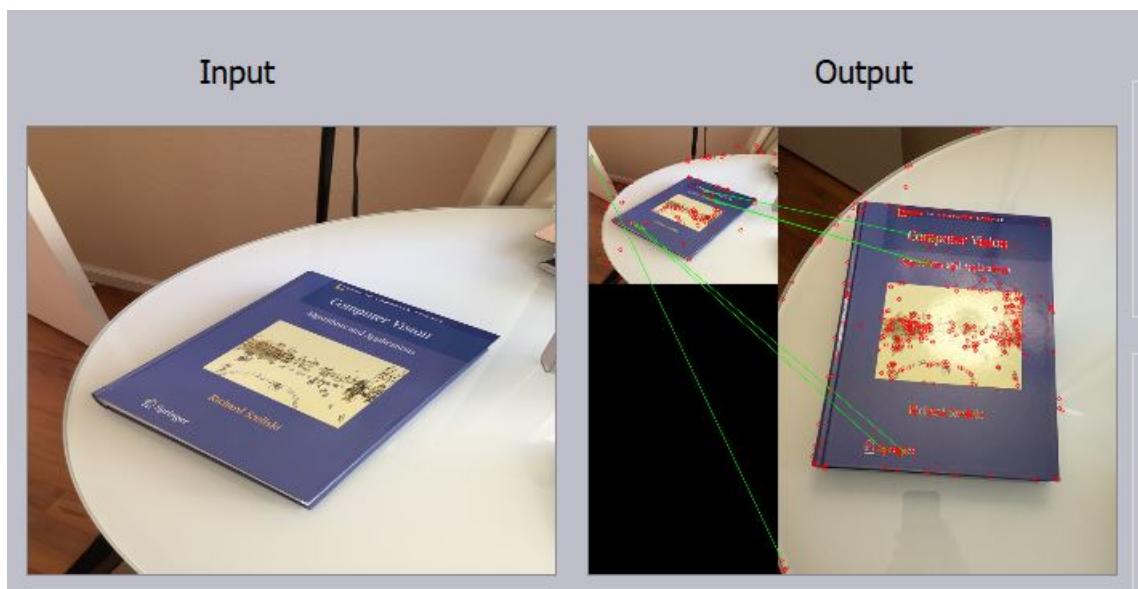
4.5.4 SIFT

In order to perform this task press **Load Image** button and select the require image and then select **SIFT** from combobox below Feature Points and later on press **Process** button to see the results.



4.5.5 Feature matching

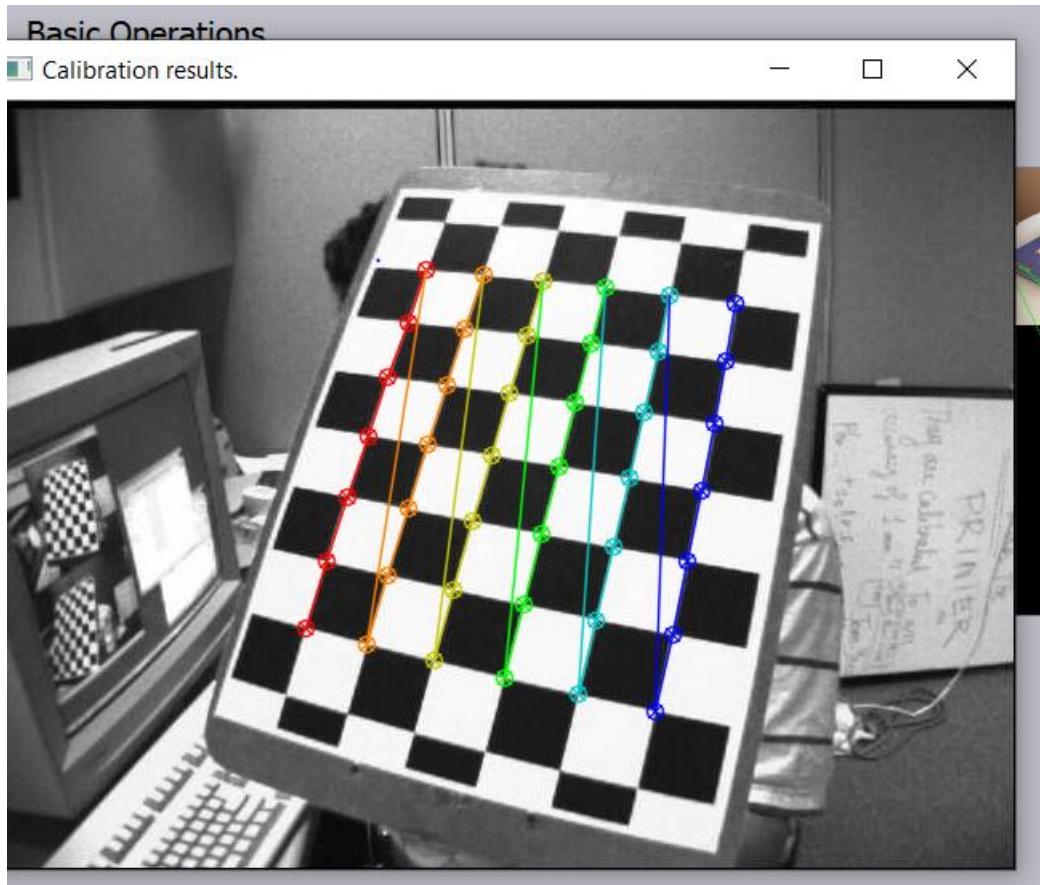
In order to perform this task press **Load Image** button and select the require image and then select **Feature matching** from combobox below Feature Points and later on press **Process** button and then again you should give your second image then you will see the results.



4.6 Camera Calibration and other

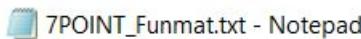
4.6.1 Calibrate

In order to perform this task just select **Calibrate** from combobox below Camera Calibration and other and later on press **Process** button and then you will see the results automatically since in the code I already gave the path of the images which needed to be calibrated.



4.6.2 7POINT

In order to perform this task press **Load Image** button and select the require image and then select **7POINT** from combobox below Camera Calibration and other and later on press **Process** button and then again you should give your second image then you will see the result of fundamental matrix in notepad.



7POINT_Funmat.txt - Notepad

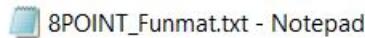
File Edit Format View Help

-6.029009819030761719e-05	-8.201599121093750000e-04	1.545292232096366250e+14
9.040832519531250000e-04	0.0000000000000000e+00	-8.349609375000000000e-02
-1.545292232096366250e+14	7.885742187500000000e-02	1.0000000000000000e+00

The above values are of Fundamental matrix obtained using 7POINT Algorithm

4.6.3 8POINT

In order to perform this task press **Load Image** button and select the require image and then select **8POINT** from combobox below Camera Calibration and other and later on press **Process** button and then again you should give your second image then you will see the result of fundamental matrix in notepad.



8POINT_Funmat.txt - Notepad

File Edit Format View Help

-4.632941065232764156e-06	-7.169396554769983775e-05	1.5563285666313417
6.659186059406176582e-05	1.486309154784955201e-05	-4.56869091824376252
-1.149244989492852545e-02	3.671467200504944378e-02	9.99999999999999899

The above values are of Fundamental matrix obtained using 8POINT Algorithm

4.6.4 RANSAC

In order to perform this task press **Load Image** button and select the require image and then select **RANSAC** from combobox below Camera Calibration and

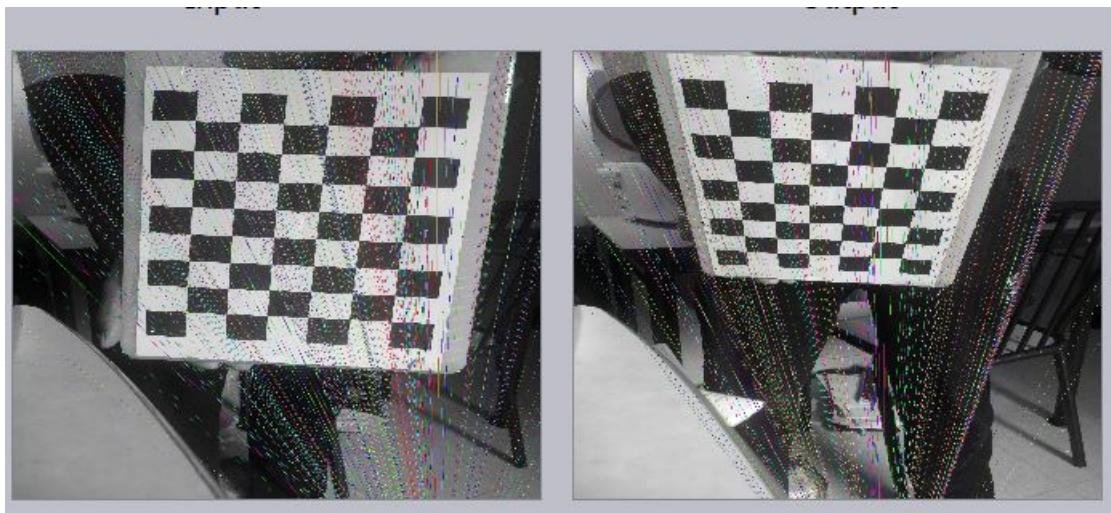
other and later on press **Process** button and then again you should give your second image then you will see the result of fundamental matrix in notepad.

```
RANSAC_Funmat.txt - Notepad
File Edit Format View Help
-4.632941065232764156e-06 -7.169396554769983775e-05 1.556328566631341725e-02
6.659186059406176582e-05 1.486309154784955201e-05 -4.568690918243762528e-02
-1.149244989492852545e-02 3.671467200504944378e-02 9.9999999999999890e-01

The above values are of Fundamental matrix obtained using RANSAC Algorithm
```

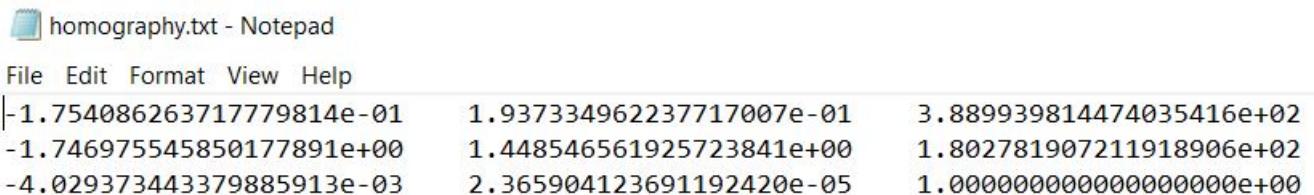
4.6.5 Epipolar Lines

In order to perform this task press **Load Image** button and select the require image and then select **Epipolar Lines** from combobox below Camera Calibration and other and later on press **Process** button and then again you should give your second image then you will see the result.



4.6.6 Compute Homography

In order to perform this task press **Load Image** button and select the require image and then select **Compute Homography** from combobox below Camera Calibration and other and later on press **Process** button and then again you should give your second image then you will see the result of H matrix in notepad.



A screenshot of a Windows Notepad window titled "homography.txt - Notepad". The window shows a table of numerical values representing a homography matrix. The columns are labeled with scientific notation. The first row contains three values: -1.754086263717779814e-01, 1.937334962237717007e-01, and 3.889939814474035416e+02. The second row contains three values: -1.746975545850177891e+00, 1.448546561925723841e+00, and 1.802781907211918906e+02. The third row contains three values: -4.029373443379885913e-03, 2.365904123691192420e-05, and 1.0000000000000000000000e+00.

-1.754086263717779814e-01	1.937334962237717007e-01	3.889939814474035416e+02
-1.746975545850177891e+00	1.448546561925723841e+00	1.802781907211918906e+02
-4.029373443379885913e-03	2.365904123691192420e-05	1.0000000000000000000000e+00

The above values are of Homography

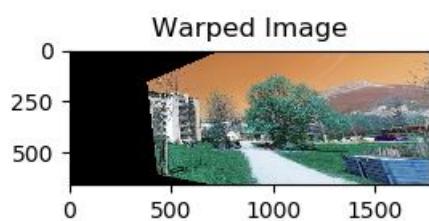
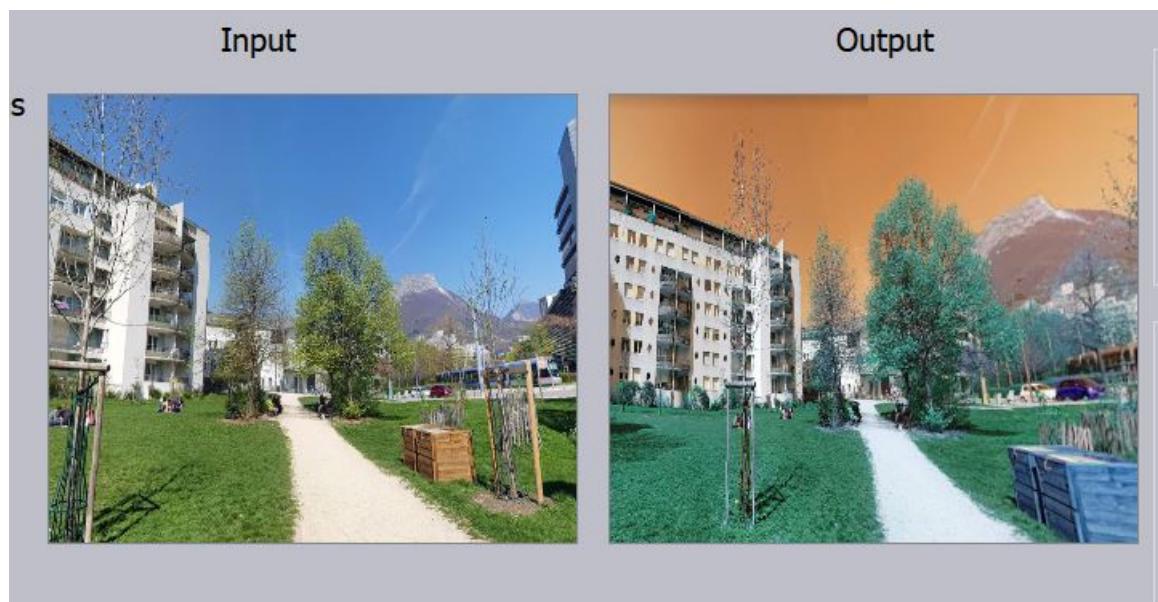
4.6.7 Mosaic

In order to perform this task press **Load Image** button and select the require image and then select **Mosaic** from combobox below Camera Calibration and other and later on press **Process** button and then again you should give your second image then you will see the result.



4.6.8 Stitch

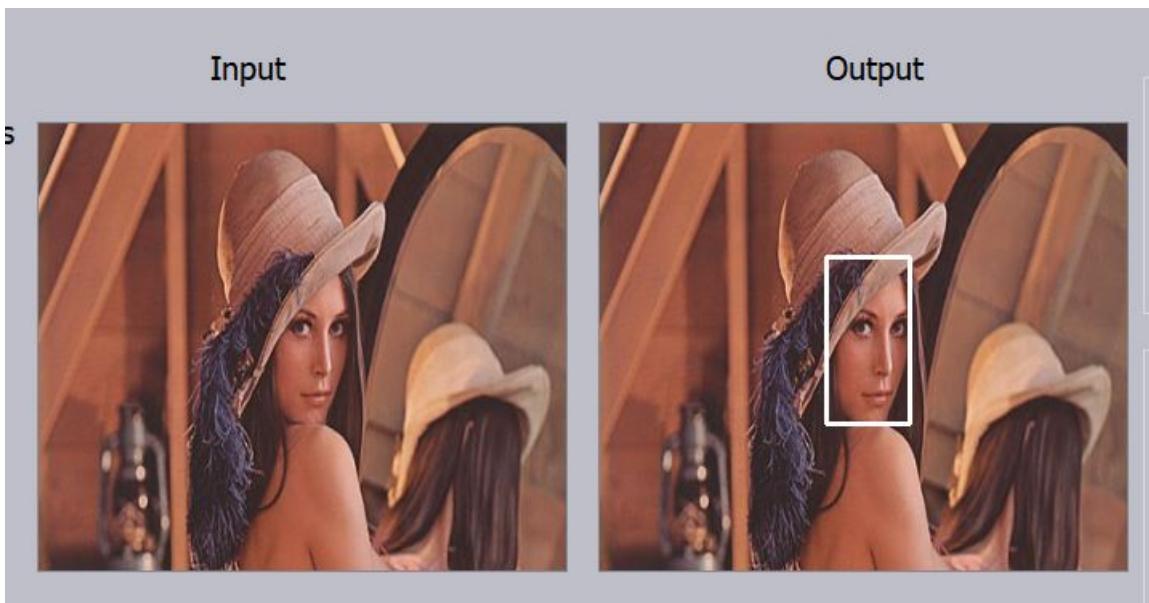
In order to perform this task press **Load Image** button and select the require image and then select **Stich** from combobox below Camera Calibration and other and later on press **Process** button and then again you should give your second image then you will see the result.



4.7 Face Detection

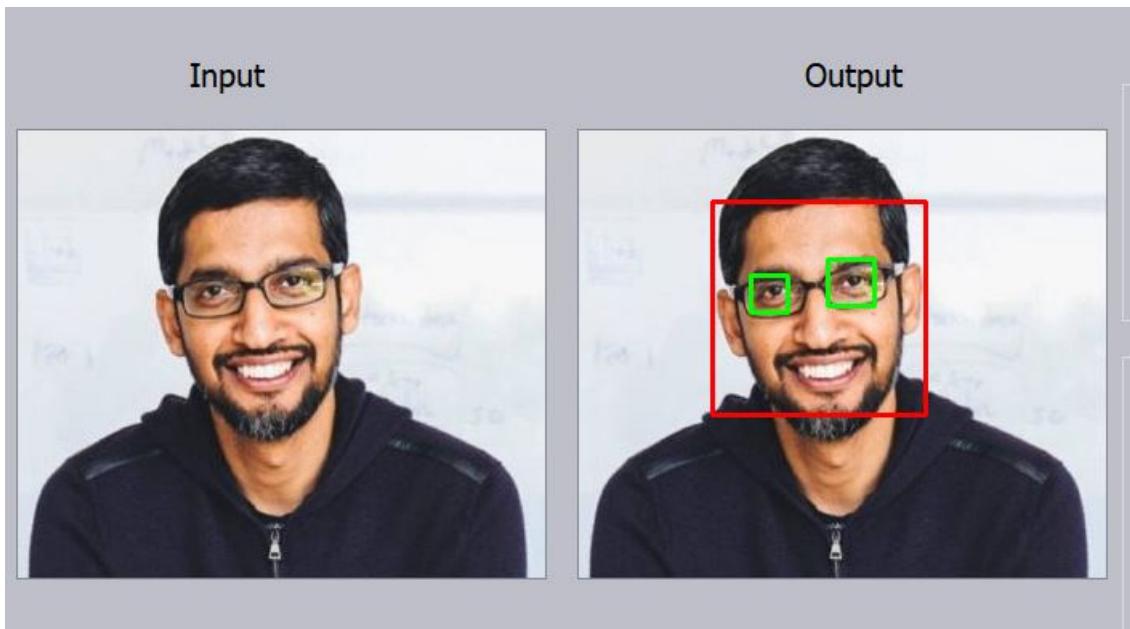
4.7.1 Deep learning

In order to perform this task press **Load Image** button and select the require image and then check **Deep learning** and later on press **Process** button you will see the result in few seconds.



4.7.2 Cascading Classifiers

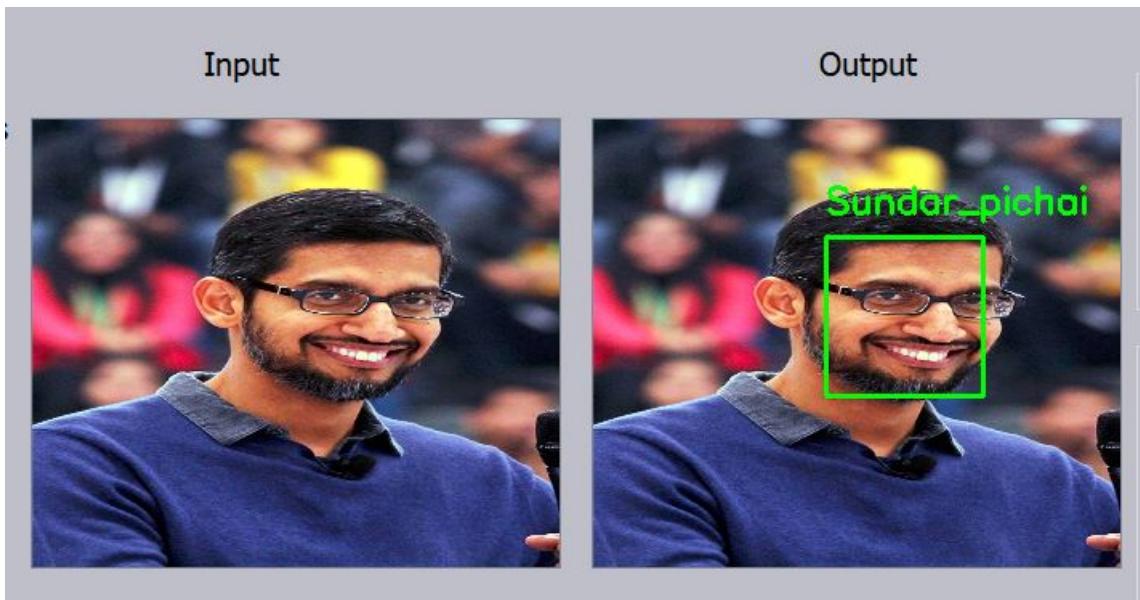
In order to perform this task press **Load Image** button and select the require image and then check **Cascading Classifiers** and later on press **Process** button you will see the result in few seconds.



4.8 Face Recognition

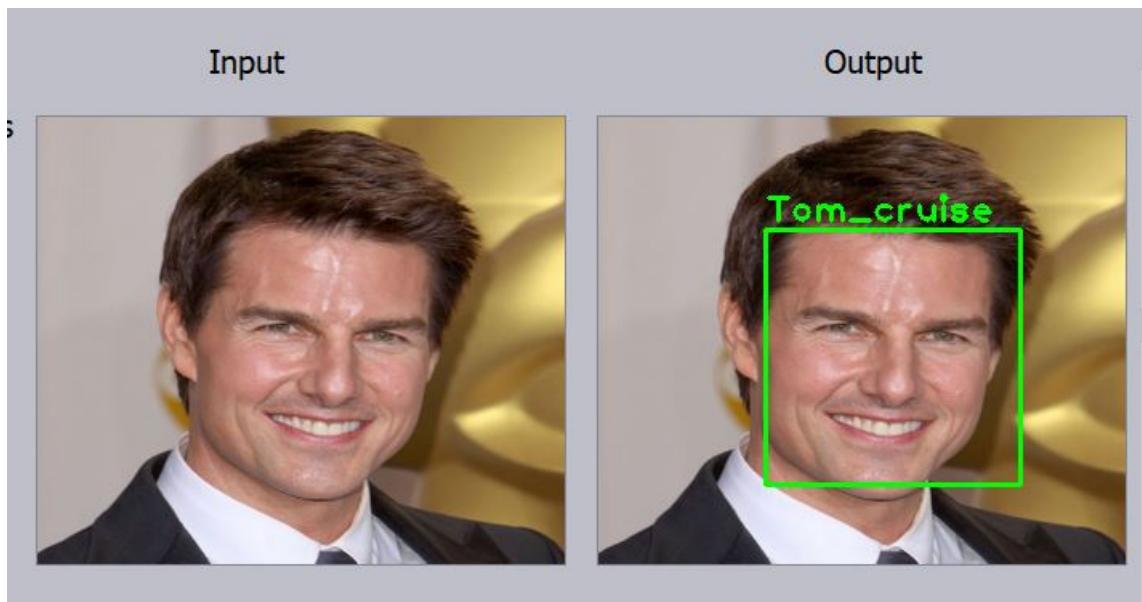
4.8.1 Deep learning

In order to perform this task press **Load Image** button and select the require image only from deeptest namely since we train on some data itself so it works on those category itself, folder and then check **Deep learning** and later on press **Process** button you will see the result in few seconds.



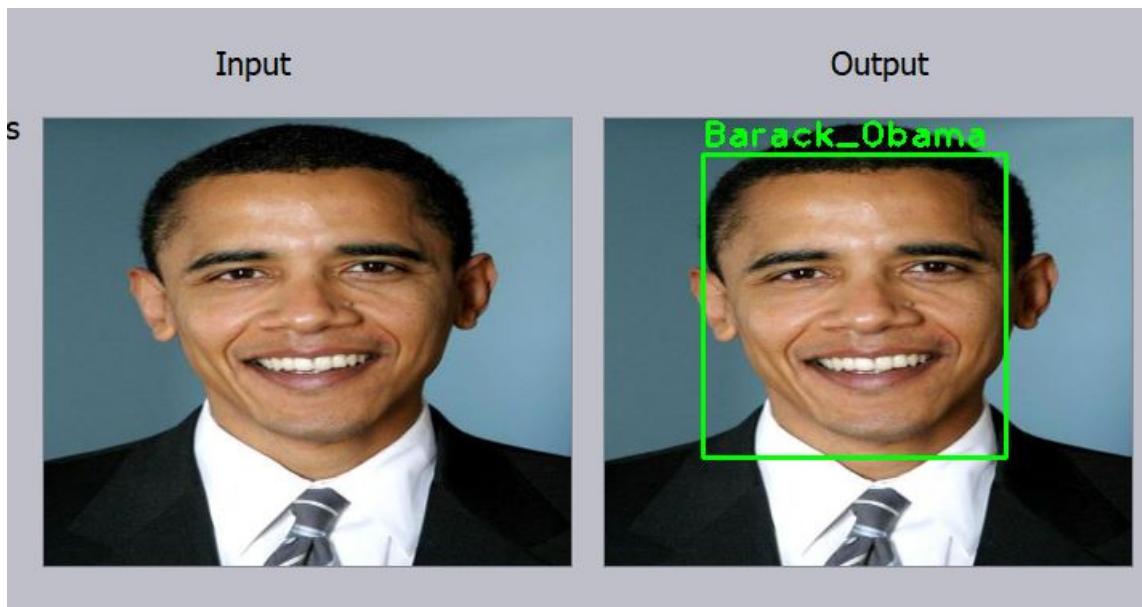
4.8.2 LBP

In order to perform this task press **Load Image** button and select the require image only from deeptest namely since we train on some data itself so it works on those category itself, and then check **LBP** and later on press **Process** button you will see the result in few seconds.



4.8.3 PCA

In order to perform this task press **Load Image** button and select the require image only from deeptest namely since we train on some data itself so it works on those category itself, and then check **PCA** and later on press **Process** button you will see the result in few seconds.



5 Extra Task

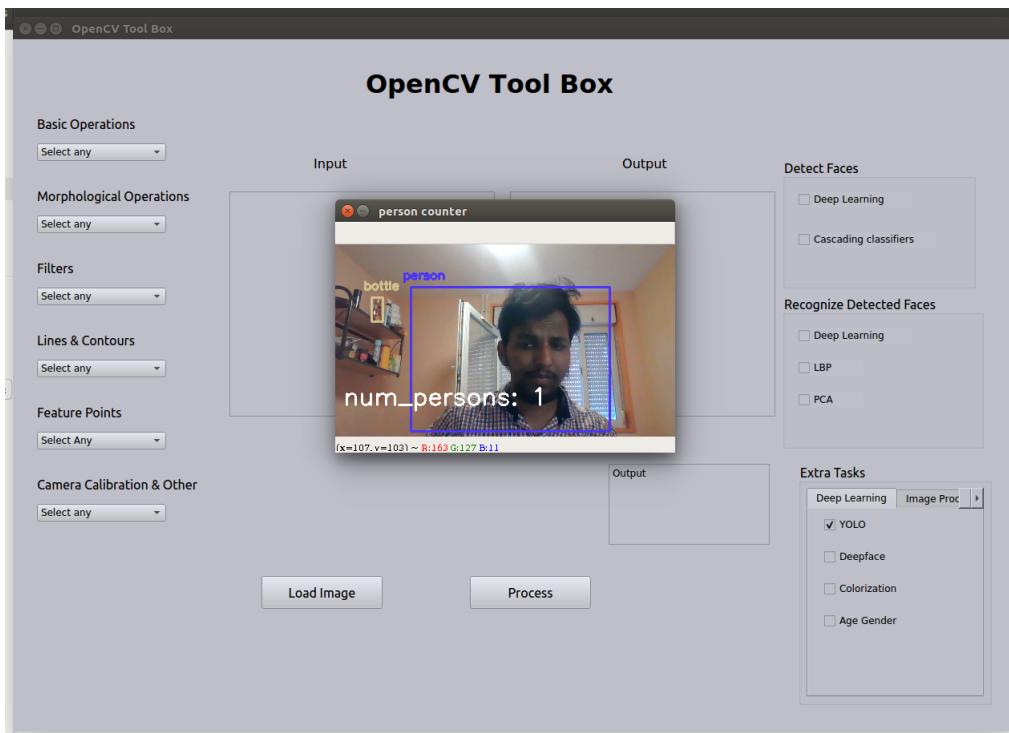
As I was interested to do few more tasks I included these extra tasks in separate Group box namely Extra Tasks which is further divided into two i.e, Deep learning and Image processing

5.1 Deep learning

5.1.1 YOLO

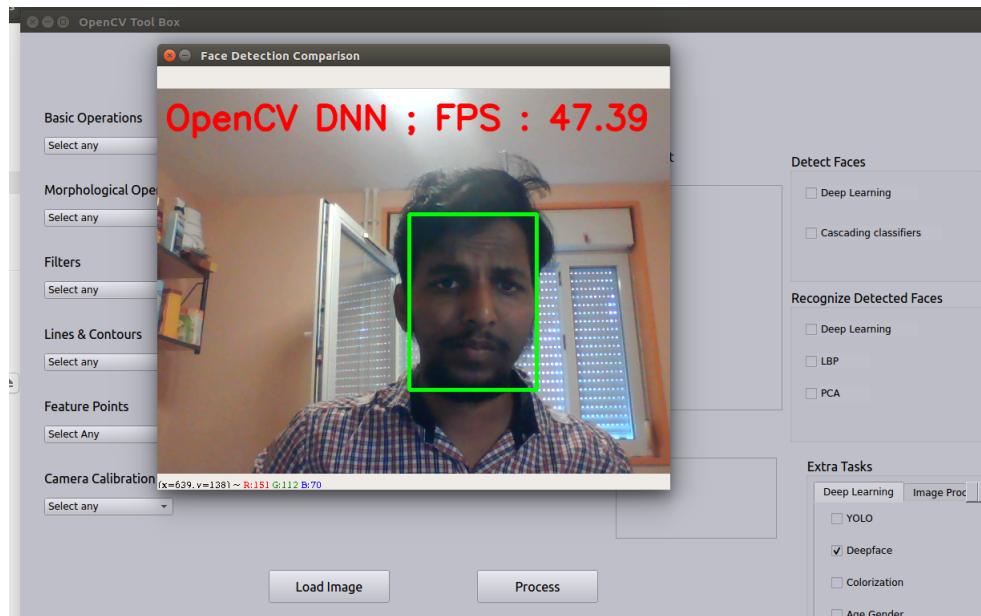
In order to perform this task just check **YOLO** and later on press **Process** button then your webcam gets on and yolo object detection will be performed , press "Q" or Esc button to close.

OpenCV Tool Box



5.1.2 Deepface

In order to perform this task just check **Deepface** and later on press **Process** button then your webcam gets on and Deepface face detection will be performed , press "Q" or Esc button to close.



5.1.3 Colorization

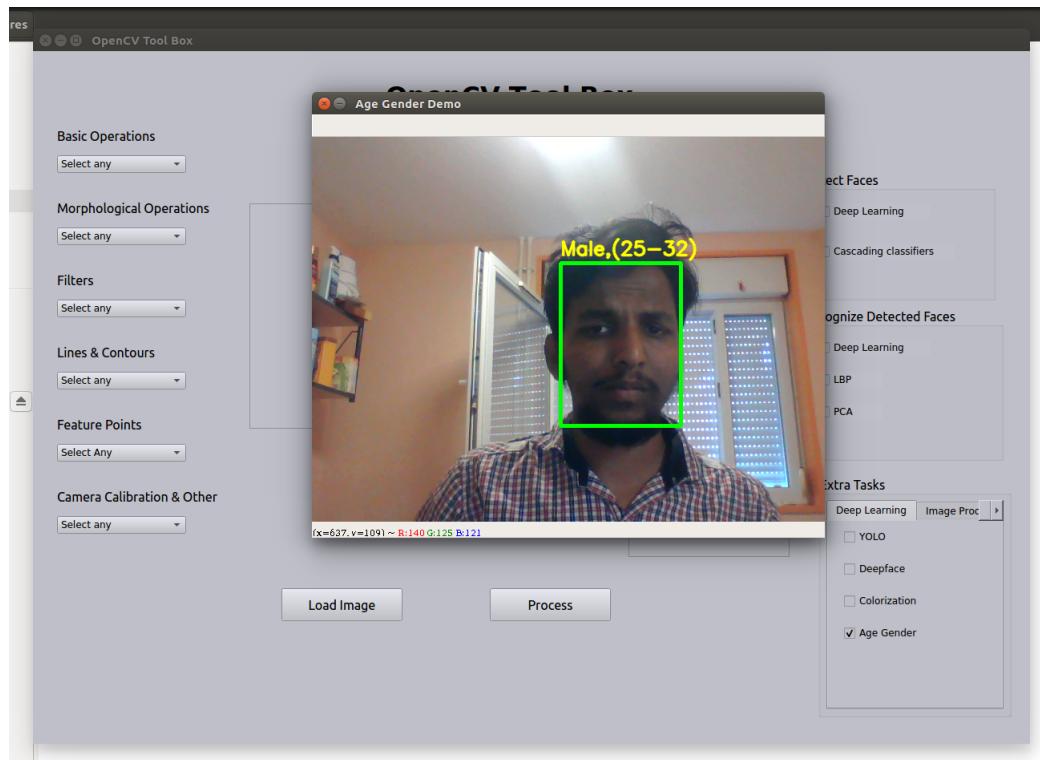
In order to perform this task press **Load Image** button and select the require image and then check **Colorization** and later on press **Process** button you will see the result in few seconds.



OpenCV Tool Box

5.1.4 Age gender

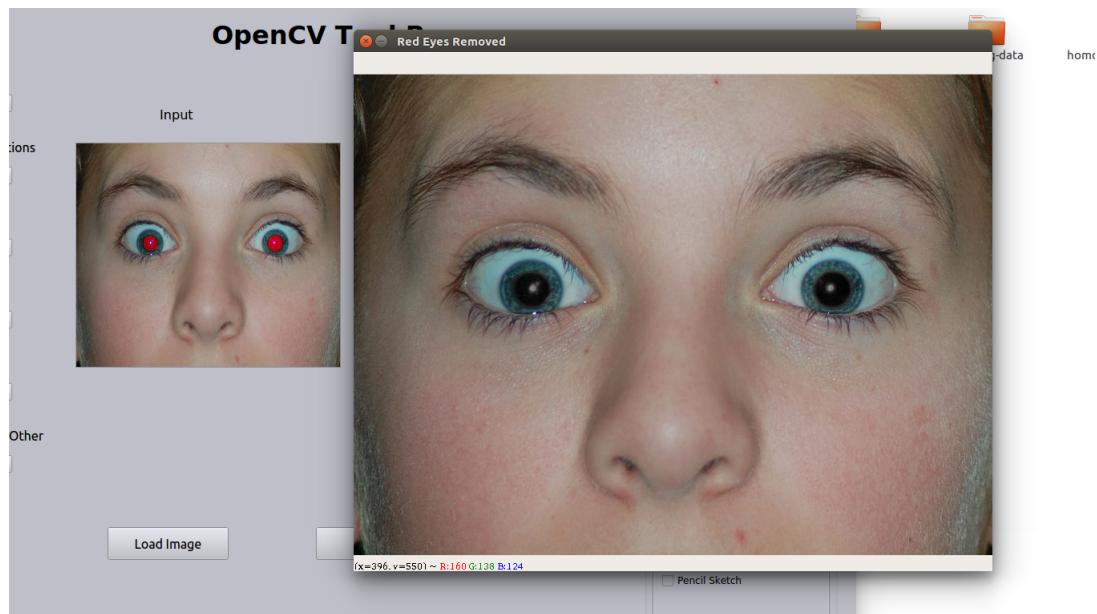
In order to perform this task just check **Age gender** and later on press **Process** button then your webcam gets on and Age and gender detection will be performed , press "Q" or Esc button to close.



5.2 Image Processing

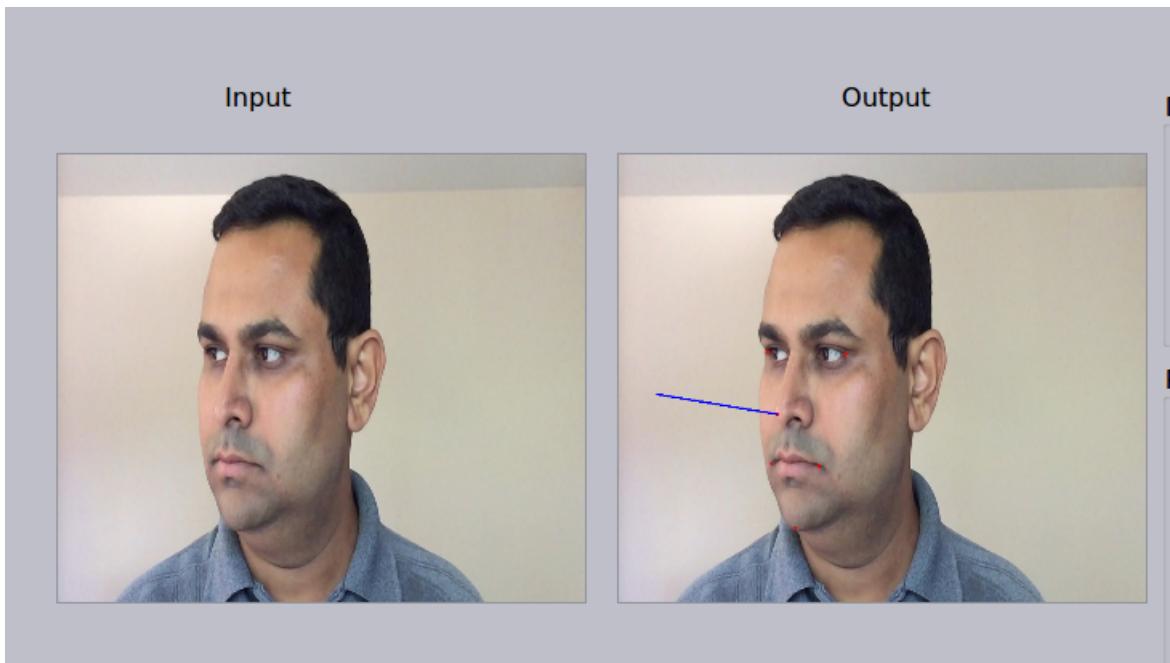
5.2.1 Red Eye Remover

In order to perform this task press **Load Image** button and select the require image and then check **Red Eye Remover** and later on press **Process** button you will see the result in few seconds.



5.2.2 Head Pose

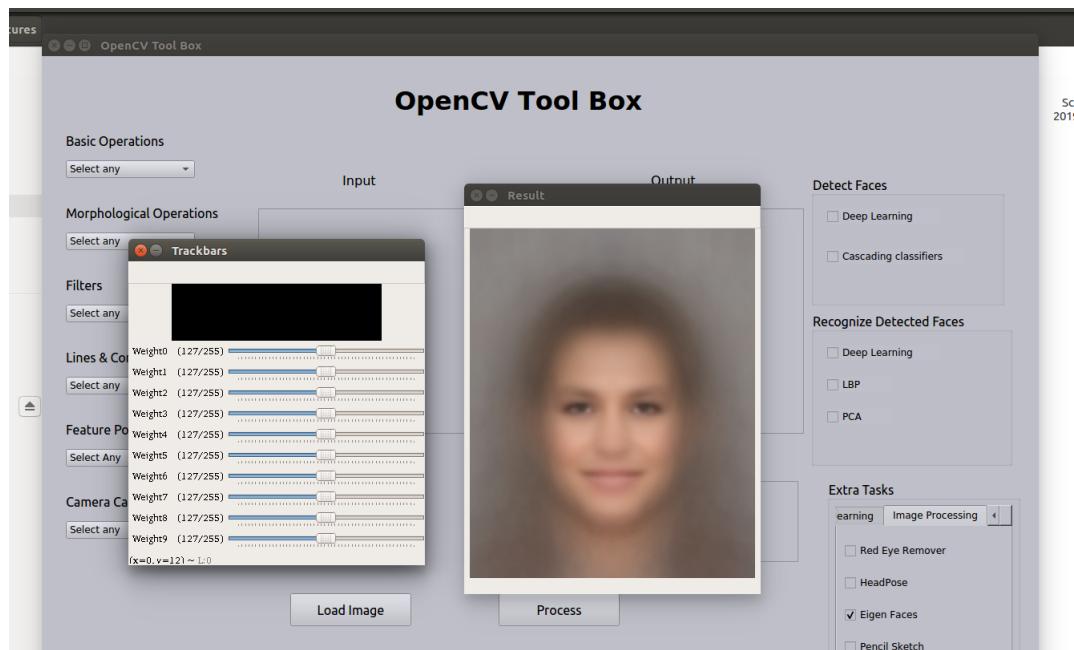
In order to perform this task press **Load Image** button and select the require image and then check **Head Pose** and later on press **Process** button you will see the result in few seconds.



OpenCV Tool Box

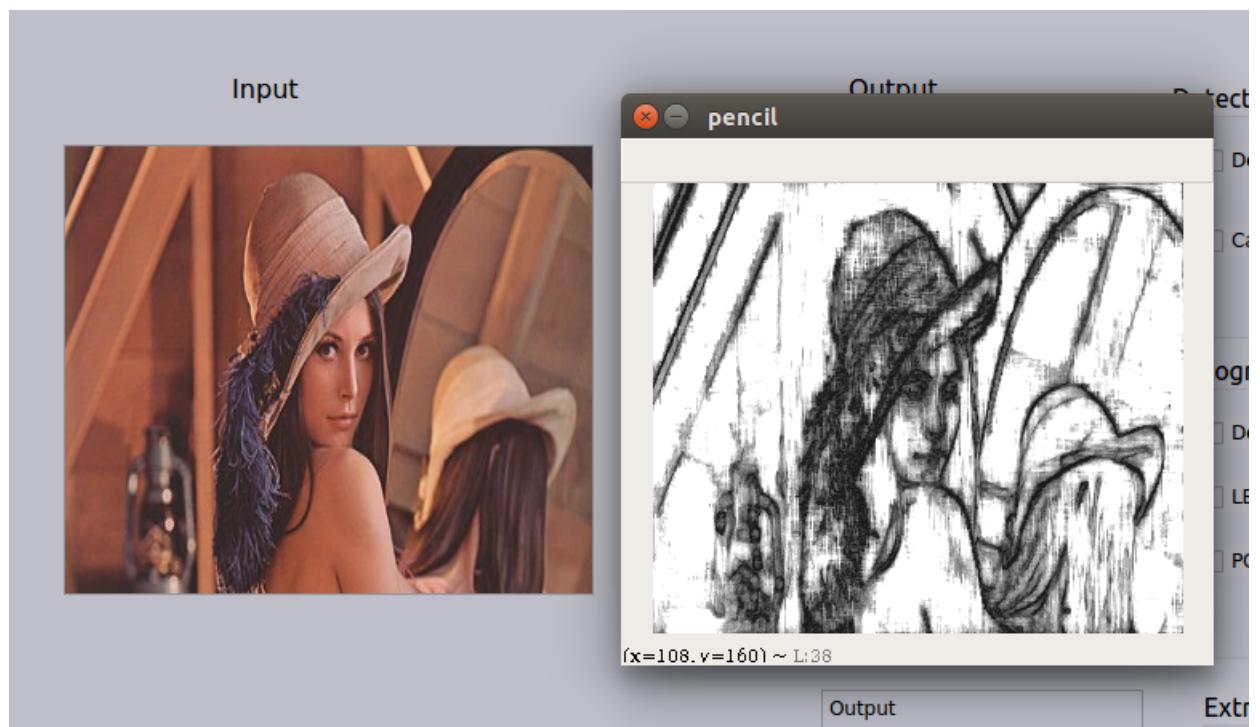
5.2.3 Eigen faces

In order to perform this task check **Eigen faces** and later on press **Process** button you will see the result in few seconds.



5.2.4 Pencil sketch

In order to perform this task press **Load Image** button and select the require image and then check **Pencil sketch** and later on press **Process** button you will see the result in few seconds.



6 Conclusion

I thank Professor Albdel Rehman Shabayek for giving this project, I have learnt alot about OpenCV and PyQt , further I would work to deploy this application in android since PYQT support android.

References

- [1] OpenCV library, learnopencv.com