Bauhaus-Universität Weimar

Image Analysis and Object Recognition

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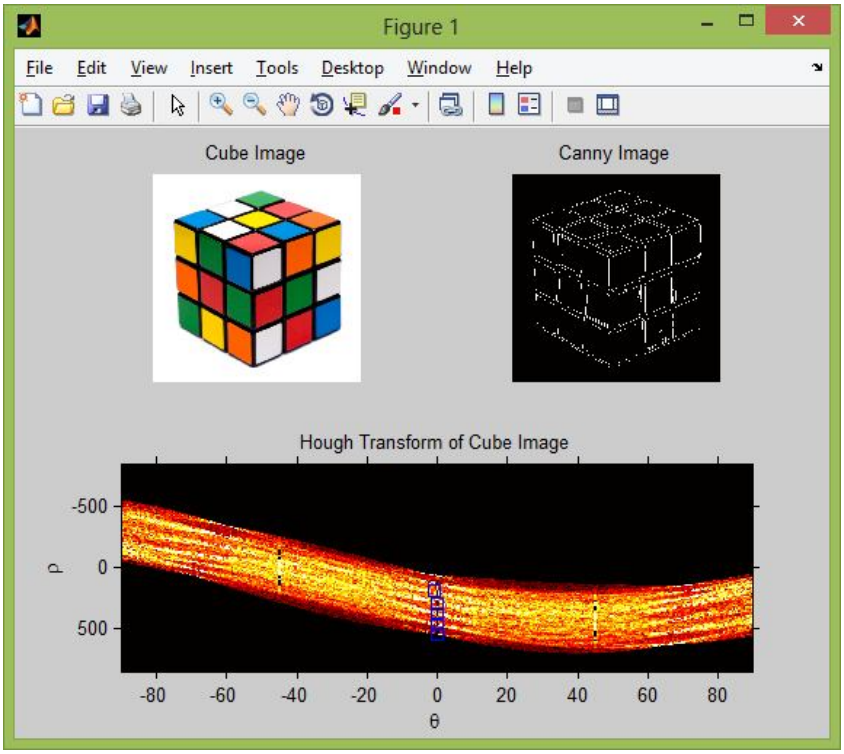
A. Use the given picture cube.jpg and perform a Hough transformation! Visualize the parameter space, show its peaks and describe what that means. Additionally, detect lines inside the given image and visualize them.

Hough transformation uses a voting system to detect a line of interest. After getting the co-ordinates by performing an edge detecting operation, it uses the following equation with co-ordinates (x, y) to find out the distance (ρ) from the origin to the line passes through that point.

$$\rho = x\,cos\theta + y\,sin\theta \quad (\theta\,, discrete\ values)$$

Then, it votes for each ρ and θ values in an array with two axis represented by θ and ρ. The array also known as accumulator where votes for each point get accumulated and ρ turns into a sinusoidal curve based on the variance of θ for a single point. So, there will be a place corresponding to lines where votes will get accumulated and there we get the maxima point (also known as peak) through which maximum number of lines passed through. Using the point containing highest value we can detect the most prominent straight line and there might be other maxima points for other lines. In Figure-1 the blue rectangles are representing the peaks in the parameter space image. And, these peaks are correspondent to the lines detected on the cube image.



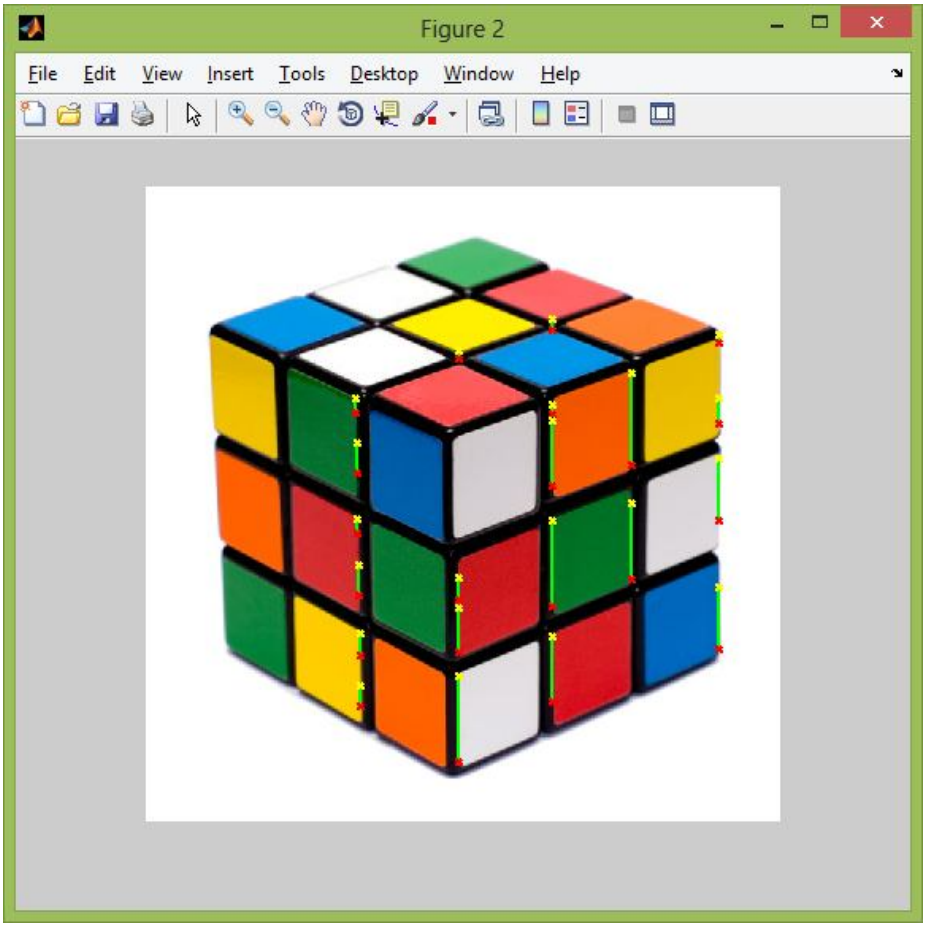
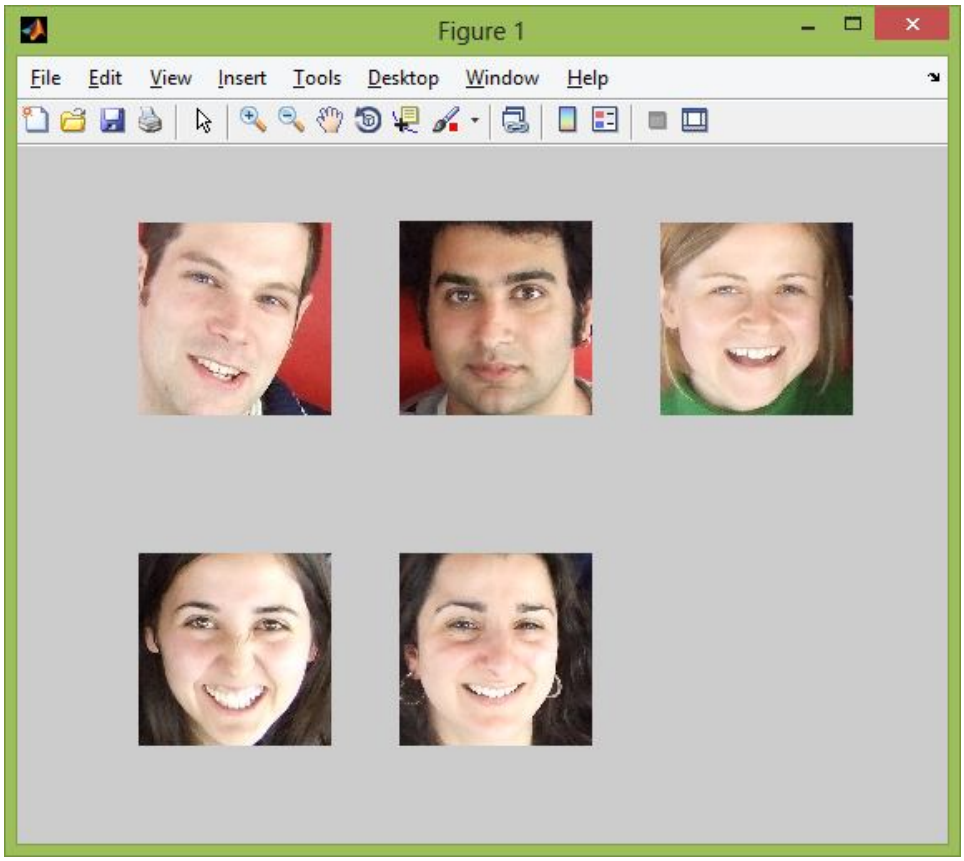


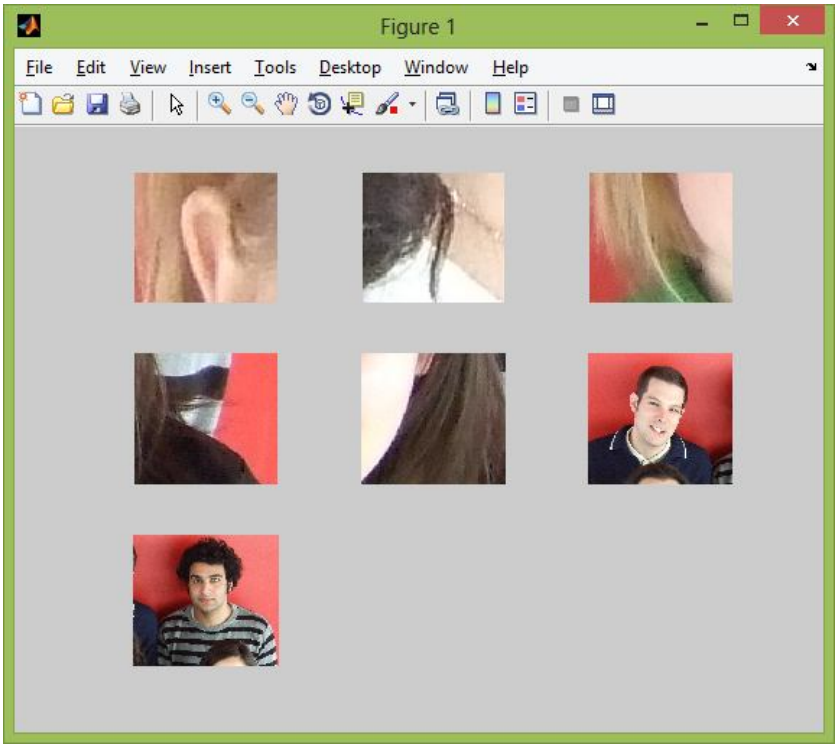
Figure 2
File Edit View Insert Tools Desktop Window Help

B. Take or choose a picture that contains faces. Download Matlab's implementation of the Viola Jones object detection and try to detect the faces with this toolkit. Change the given parameters and discuss what happens. Please don't forget to send your chosen image as well as the image that shows the detected faces!

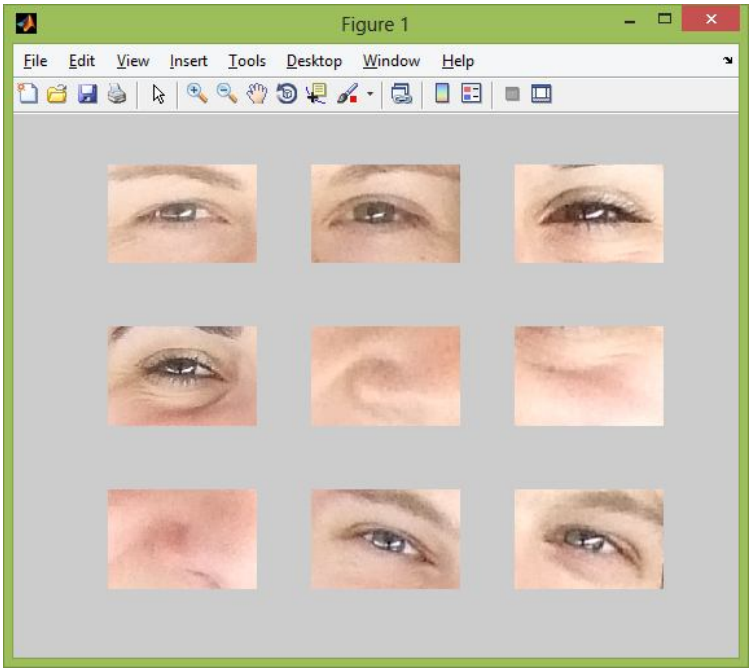
The Viola Jones object detection has been quite successful in detection of faces.



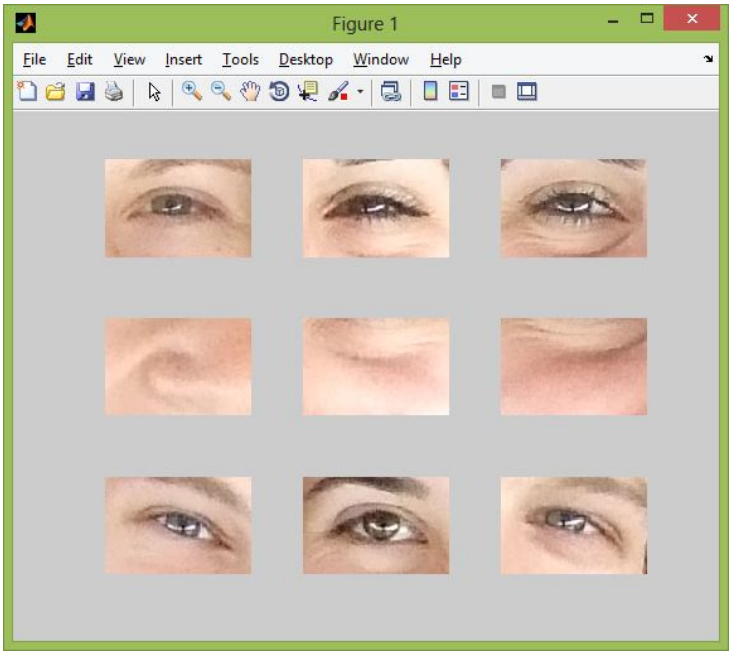
After changing the parameter to detect upper body, it produced the following image. In which it has detected the most visible bodies in the original image. This parameter mainly detects head and shoulder area.



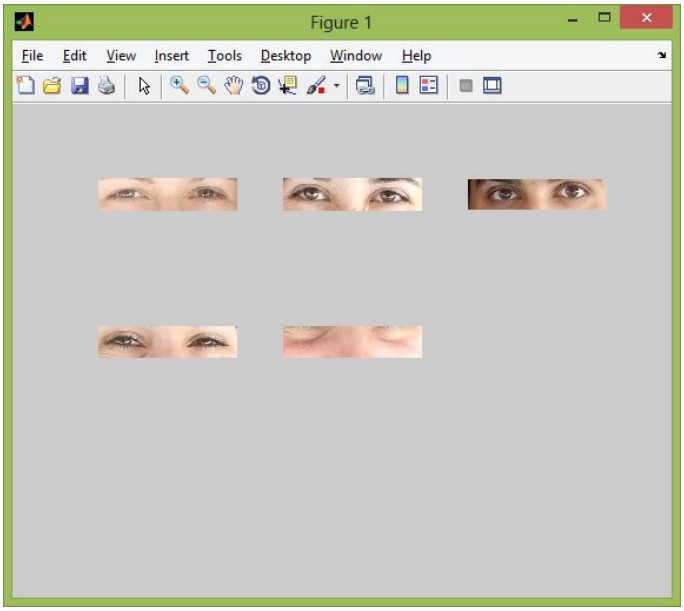
Parameter with “left eye”, it detects some right eyes and noses as well.



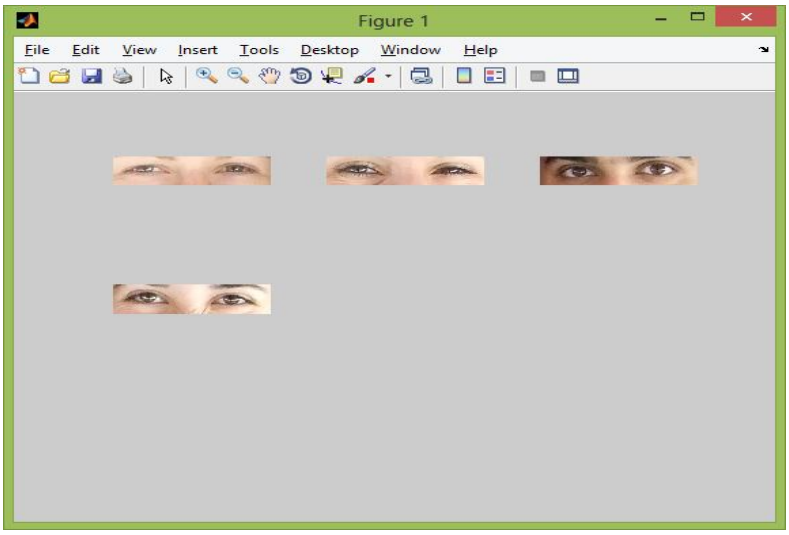
Parameter with “right eye”, it detects some left eyes and areas near eyes as well.



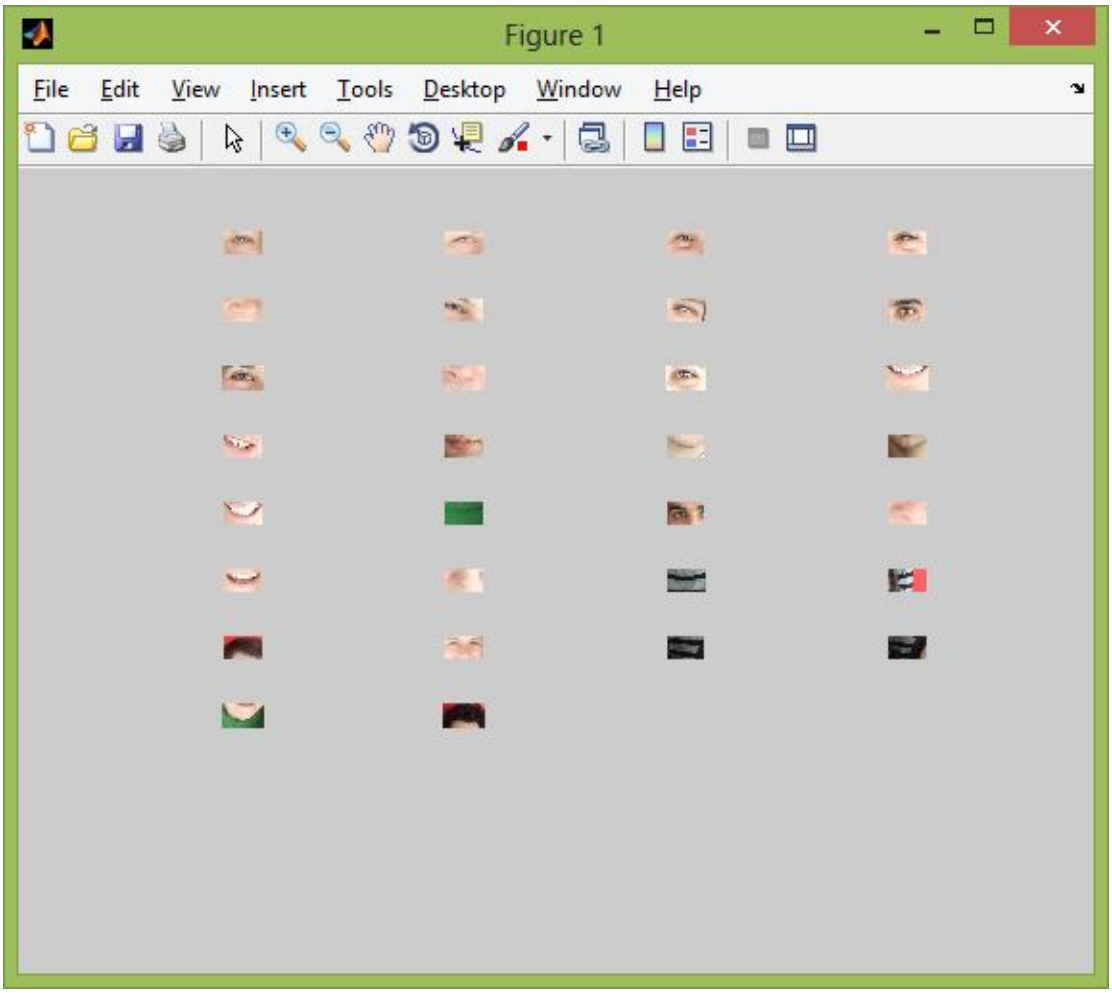
Parameter with “eye pair big”, it detects some four pair of eyes.



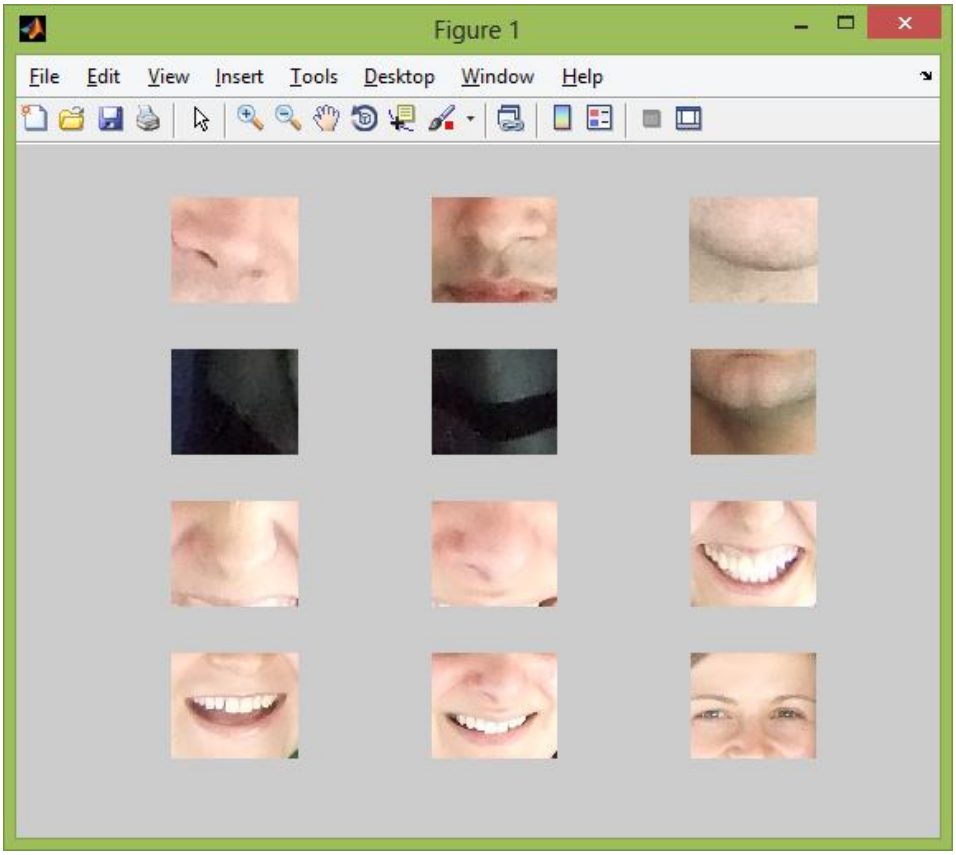
Parameter with “eye pair small”, it detect four pair of eyes which are similar to the eyes from previous image.



Parameter with “mouth”, it detects five mouths which as well as other parts of the face and body.



Parameter with “Nose”, it detects five noses but there is duplication of same noses.



References:

1.Use of the Hough Transformation To Detect Lines and Curves in Pictures

Richard O. Duda and Peter E. Hart Stanford Research Institute, Menlo Park, California

2.Hough transform in Matlab (pdf)

3.http://www.youtube.com/watch?v=hYcugbbf9ug