CSE 6367 Assignment #3

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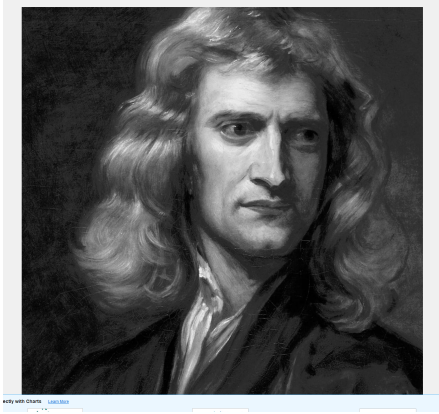
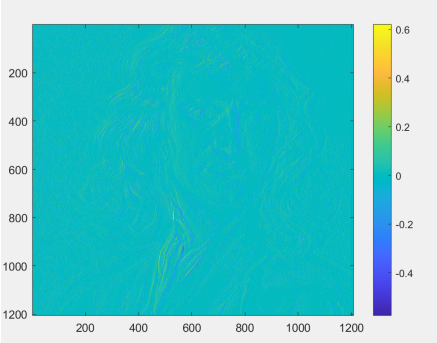
Problem 1

In this problem we need to write a MATLAB function that implements Histogram of Oriented Gradients. For HOG transform we need to implement algorithm 1. I have implemented it for the given image 'einstein.jpg' and for two custom images, 'newton.jpg' and 'galileo.jpg'.

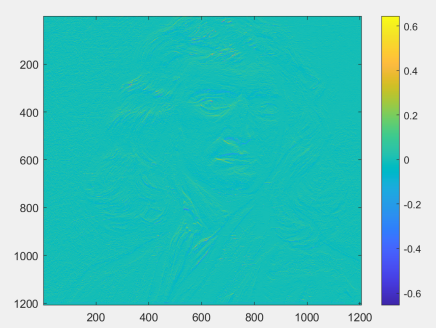
Since the result for implementing hog in 'einstein.jpg' will be discussed later on the report here, I am reporting the result of implementing HOG for my custom figure



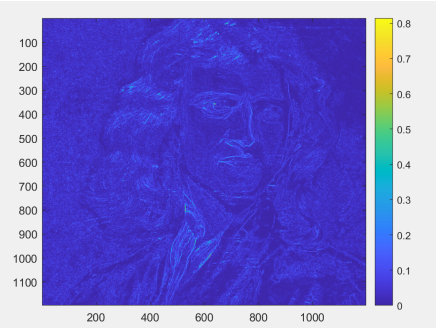
(a) Input Image



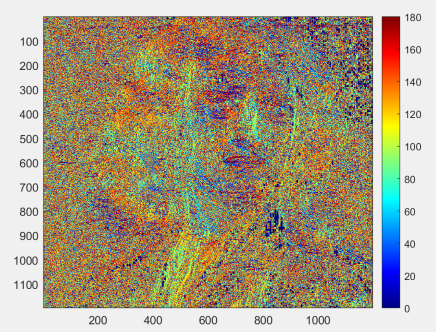
(b) Gradient in X direction



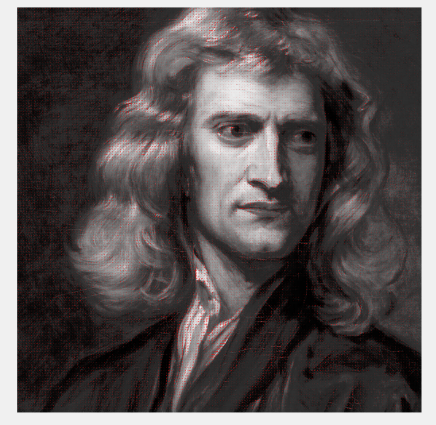
(c) Gradient in Y direction



(d) Gradient Magnitude

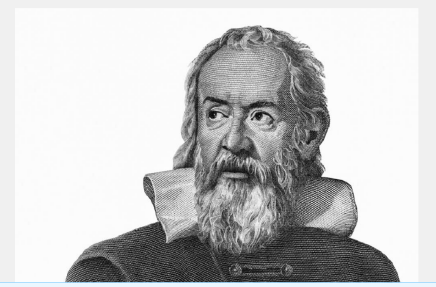


(e) Gradient Direction

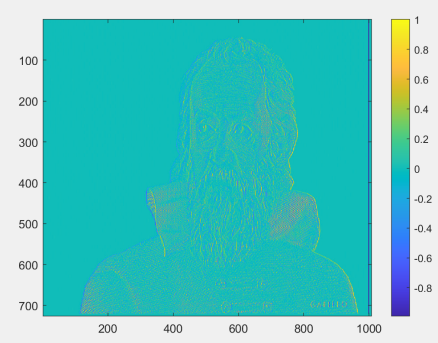


(f) HOG Features in image

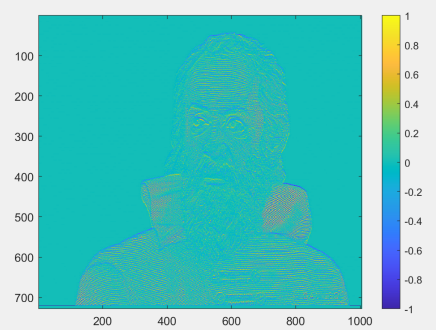
Figure 1: Implementing hog to custom 'newton.jpg' image



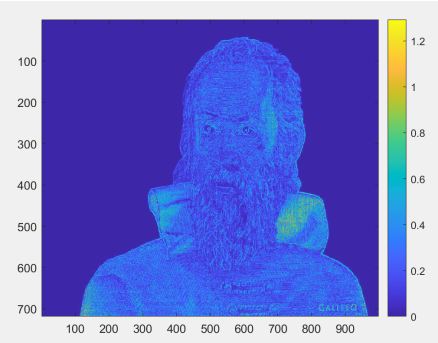
(a) Input Image



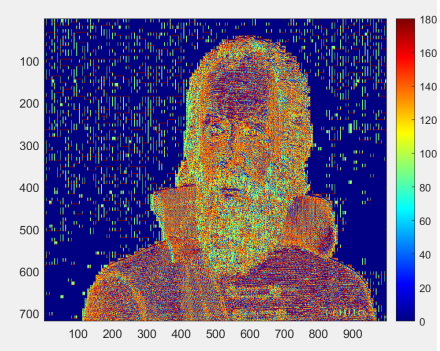
(b) Gradient in X direction



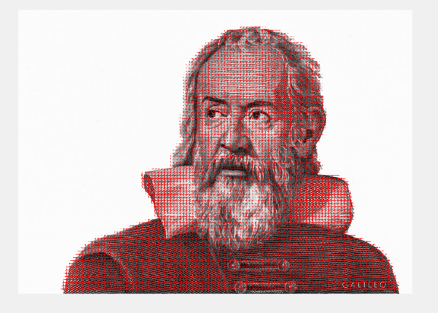
(c) Gradient in Y direction



(d) Gradient Magnitude



(e) Gradient Direction



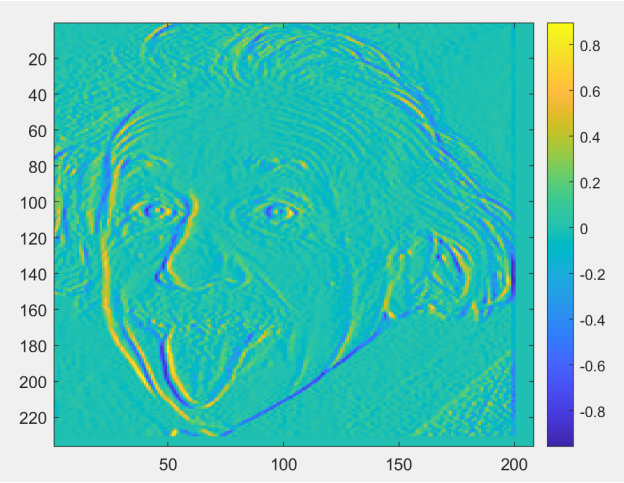
(f) HOG Features in image

Figure 2: Implementing hog to custom 'galileo.jpg' image

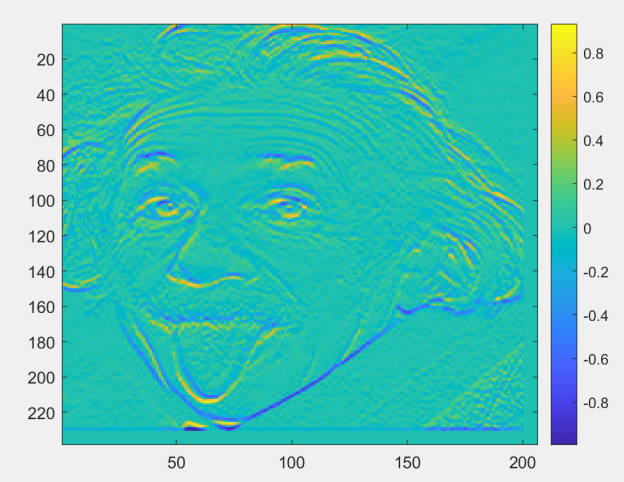
Problem 2

Image Filtering

For this particular problem, we need to compute the gradient of the input image by differentiating the image along the x and y directions. I have written the matlab function "filter image(im)" that does the above mentioned task. The x and y directed gradients are-



(a) Gradient in X direction



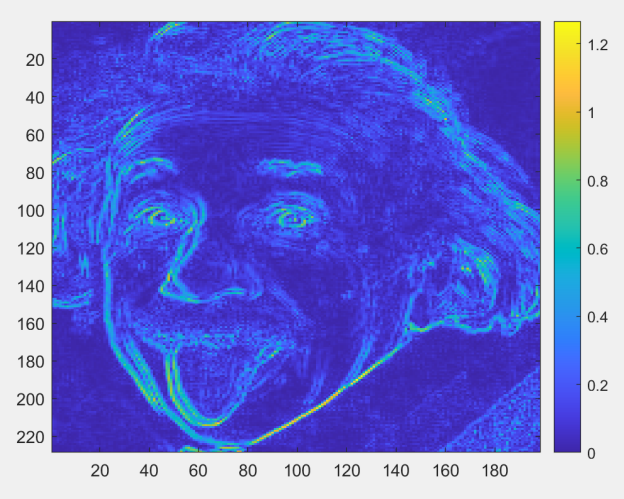
(b) Gradient in Y direction

Figure 3: Get the gradient in X and Y direction

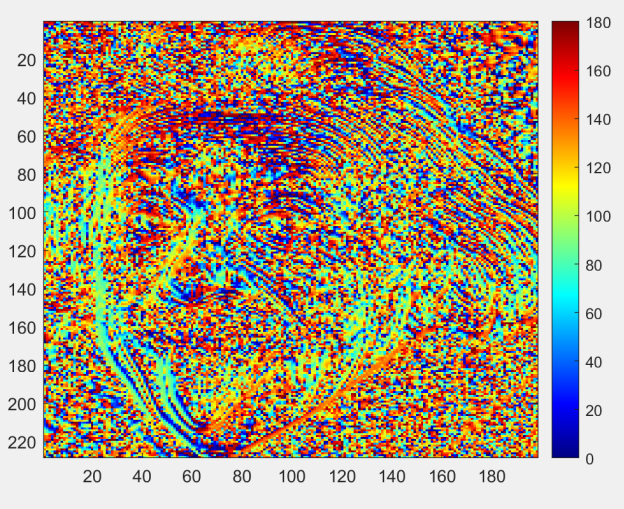
Problem 3

Gradient Computation

For this particular problem, we need to compute the magnitude and angle of the gradient. I have written the matlab function "get gradients(im dx, im dy)" that does the above mentioned task. The magnitude and angle of the gradients are-



(a) Gradient Magnitude



(b) Gradient Direction

Figure 4: Getting the Gradient Magnitude and DIrection

Problem 4

Orientation Binning

For this particular problem, we need to compute the histogram of oriented gradients for each cell. I have written the matlab function "build histogram(grad mag, grad ang, cell size)" that does the above mentioned task. I have used 8×8 as the cell size and there are 6 bins for different angles. I have written another function named, "create_Hog_feature_images" that can plot the Histogram of oriented gradients on the image.

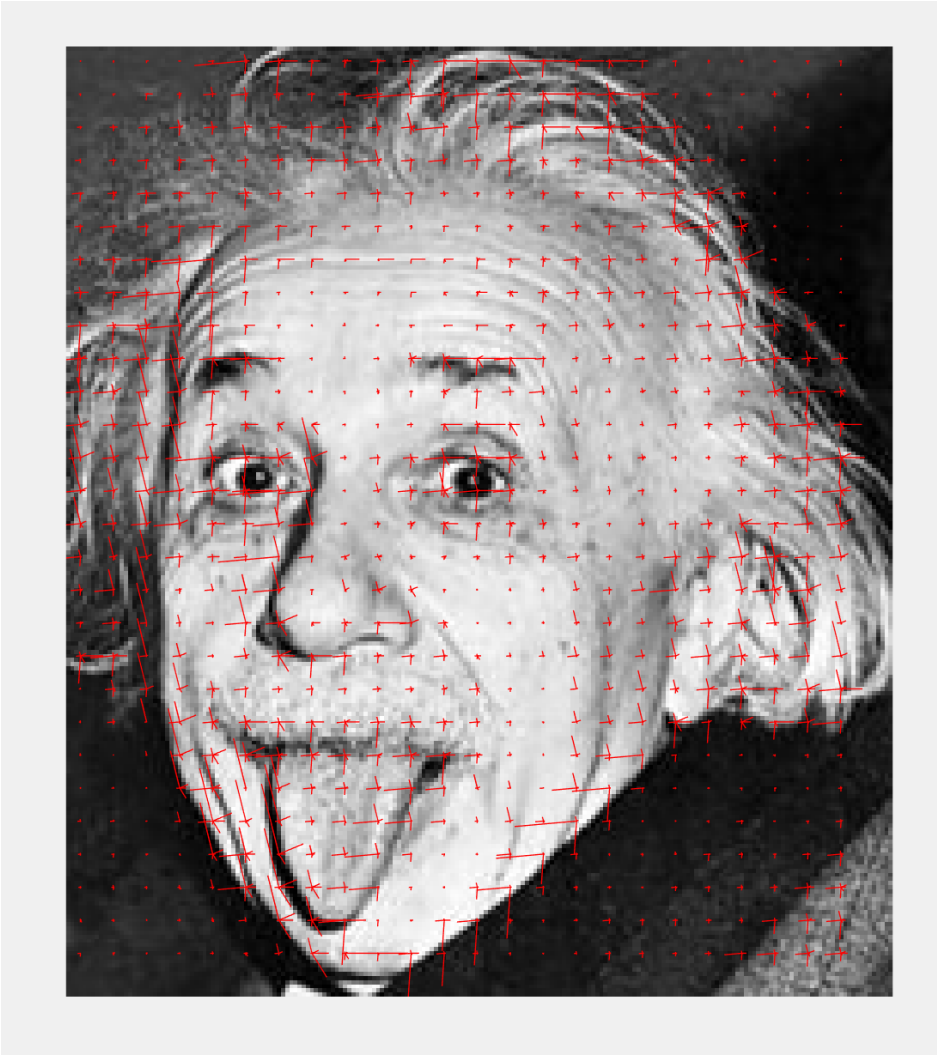


Figure 5: Visualization of Histogram of oriented gradients

Problem 5

Block Normalization

For this particular problem, we need to build the normalized histogram.. I have written the matlab function "get block descriptor(ori histo, block size)" that does the above mentioned task. I have used 2×2 as the block size and therefore we will get 6×2×2 total 24 long vector for each cell. In the figure you can see that I have got the long HOG descriptor for all the cells. I am attaching a fraction part of the long vector.

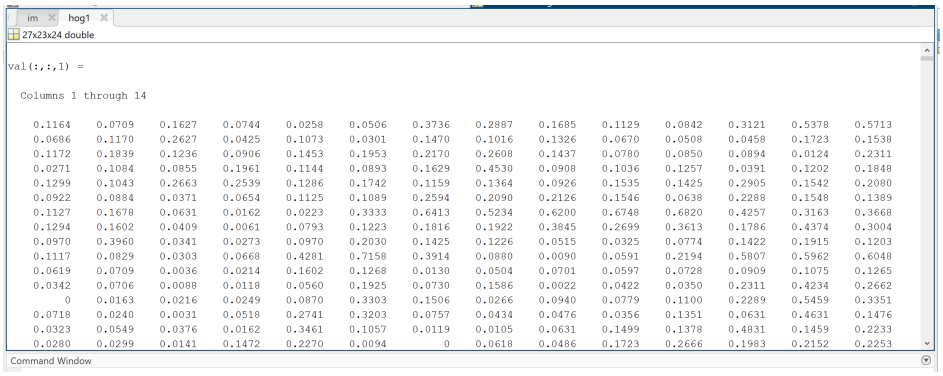
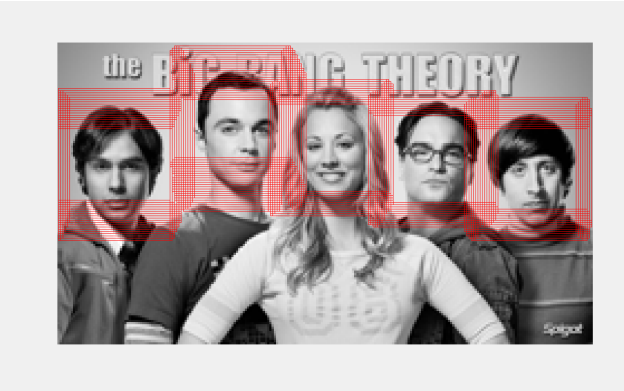


Figure 6: long HOG descriptor for all the cells

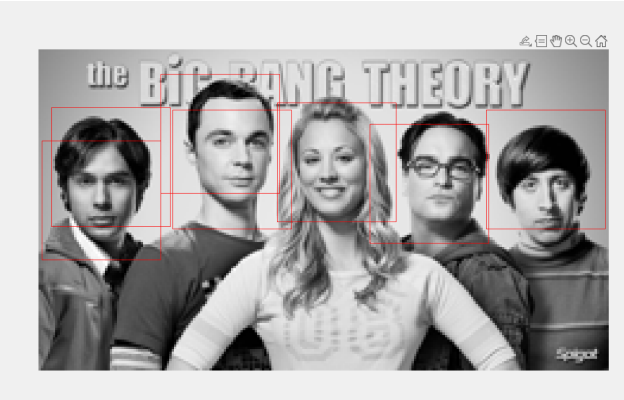
Problem 6

Face Detection

For this particular problem, we need to use a HOG descriptor to perform face detection. I have written the matlab function "face detector(im target, im template)"that does the above mentioned task. I have implemented the face detector with the target image provided and also to a custom image. I have also used non-maximum suppression (e) to get rid of overlapping bounding boxes. the results are attached below-



(a) Face detection using overlapping bounding Boxes



(b) Face detected using correct bounding boxes

Figure 7: HOG descriptor to perform face detection

(a) Face detection using overlapping bounding Boxes

(b) Face detected using correct bounding boxes

Figure 8: HOG descriptor to perform face detection for custom image 'target2.jpg'