

Assignment 1

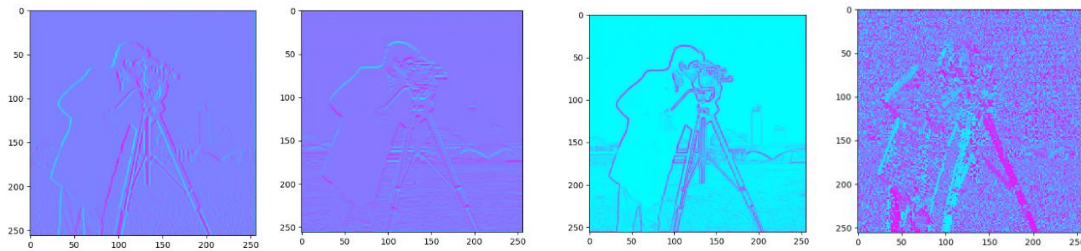
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Histogram of Oriented Gradients.

1.get_differential_filter(): returns Sobel filters along x and y axis, which is calculated from the gaussian filter and difference filter.

2.filter_image(im, filter): Inputs are image and the Sobel filter, and returns its filtered image, which is calculated from the padded image and the Sobel filter

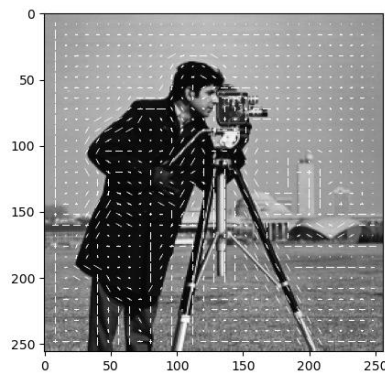
3.get_gradient(im_dx, im_dy): Inputs are the filtered images in x and y directions, and returns the gradient magnitude ($\sqrt{\frac{\partial I}{\partial u} + \frac{\partial I}{\partial v}}$) and angle ($\tan^{-1}(\frac{\partial I}{\partial v} / \frac{\partial I}{\partial u})$) of the filtered image.



Filtered image - x axis Filtered image - y axis Gradient Magnitude Gradient Angle

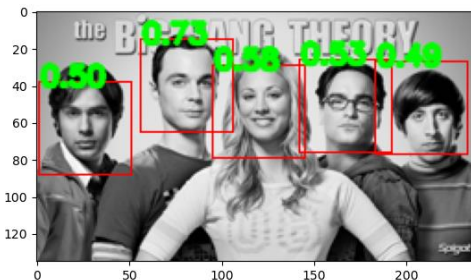
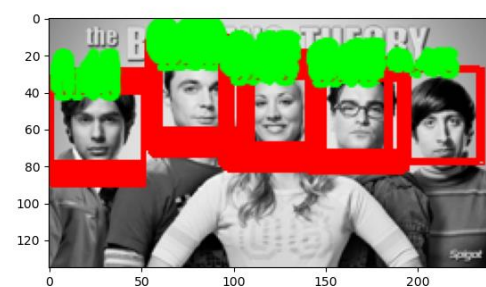
4.build_histogram(grad_mag, grad_angle, cell_size): Inputs are the gradient magnitude and angle of an image, cell_size = 8, and returns the histogram of oriented gradients.

5.get_block_descriptor(ori_histo, block_size): Inputs are the histogram of oriented gradients and block_size = 2, and returns the normalized histogram of oriented gradients.



Face Detection:

face_recognition(l_target, l_template): Inputs are the target image and the template image, and returns the detections of face shown in the target image.



Target image after thresholding on NCC score Result of the face detection(remove duplicate)