Untitled

April 27, 2020

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In [1]: import numpy as np
        import cv2
        import matplotlib.pyplot as plt
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In [ ]:
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In [2]: shapes = cv2.imread('hough.jpg')
        #cv2.imshow('Original Image', shapes)
        #cv2.waitKey(0)
        #cv2.destroyAllWindows()
        shapes_grayscale = cv2.cvtColor(shapes, cv2.COLOR_RGB2GRAY)
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In [ ]:
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In [3]: cv2.imshow('grayscale Image',shapes_grayscale )
        #cv2.waitKey(0)
        #cv2.destroyAllWindows()
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In [ ]:
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In [4]: shapes_blurred = cv2.GaussianBlur(shapes_grayscale, (5, 5), 1.5)
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In [ ]:
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In [5]: canny_edges = cv2.Canny(shapes_blurred, 100, 200)
        cv2.imshow('Canny Edges', canny_edges)
        cv2.waitKey(0)
        cv2.destroyAllWindows()
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In [ ]:
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In [6]: def hough_lines_acc(img, rho_resolution=1, theta_resolution=1):
            height, width = img.shape # we need heigth and width to calculate the diag
            img_diagonal = np.ceil(np.sqrt(height**2 + width**2)) # a**2 + b**2 = c**2
            rhos = np.arange(-img_diagonal, img_diagonal + 1, rho_resolution)
            thetas = np.deg2rad(np.arange(-90, 90, theta_resolution))

            # create the empty Hough Accumulator with dimensions equal to the size of
            # rhos and thetas
            H = np.zeros((len(rhos), len(thetas)), dtype=np.uint64)
            y_idxs, x_idxs = np.nonzero(img) # find all edge (nonzero) pixel indexes

            for i in range(len(x_idxs)): # cycle through edge points
                x = x_idxs[i]
                y = y_idxs[i]

                for j in range(len(thetas)): # cycle through thetas and calc rho
                    rho = int((x * np.cos(thetas[j]) +
                               y * np.sin(thetas[j])) + img_diagonal)
                    H[rho, j] += 1

            return H, rhos, thetas

In [ ]:

In [7]: def hough_simple_peaks(H, num_peaks):
            indices =  np.argpartition(H.flatten(), -2)[-num_peaks:]
            return np.vstack(np.unravel_index(indices, H.shape)).T

In [ ]:

In [8]: def hough_peaks(H, num_peaks, threshold=0, nhood_size=3):

            # loop through number of peaks to identify
            indicies = []
            H1 = np.copy(H)
            for i in range(num_peaks):
                idx = np.argmax(H1) # find argmax in flattened array
                H1_idx = np.unravel_index(idx, H1.shape) # remap to shape of H
                indicies.append(H1_idx)

                # surpess indicies in neighborhood
                idx_y, idx_x = H1_idx # first separate x, y indexes from argmax(H)
                # if idx_x is too close to the edges choose appropriate values
                if (idx_x - (nhood_size/2)) < 0: min_x = 0
                else: min_x = idx_x - (nhood_size/2)
                if ((idx_x + (nhood_size/2) + 1) > H.shape[1]): max_x = H.shape[1]
                else: max_x = idx_x + (nhood_size/2) + 1

                # if idx_y is too close to the edges choose appropriate values
                if (idx_y - (nhood_size/2)) < 0: min_y = 0
                else: min_y = idx_y - (nhood_size/2)
                if ((idx_y + (nhood_size/2) + 1) > H.shape[0]): max_y = H.shape[0]
                else: max_y = idx_y + (nhood_size/2) + 1

                # bound each index by the neighborhood size and set all values to 0
                for x in range(int(min_x),int( max_x)):
                    for y in range(int(min_y), int(max_y)):
                        # remove neighborhoods in H1
                        H1[y, x] = 0

                        # highlight peaks in original H
                        if (x == min_x or x == (max_x - 1)):
                            H[y, x] = 255
                        if (y == min_y or y == (max_y - 1)):
                            H[y, x] = 255

            # return the indicies and the original Hough space with selected points
            return indicies, H
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In [ ]:
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In [9]: def plot_hough_acc(H, plot_title='Hough Accumulator Plot'):

            fig = plt.figure(figsize=(10, 10))
            fig.canvas.set_window_title(plot_title)

            plt.imshow(H, cmap='jet')

            plt.xlabel('Theta Direction'), plt.ylabel('Rho Direction')
            plt.tight_layout()
            plt.show()
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In [ ]:
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In [10]: def hough_lines_draw(img, indicies, rhos, thetas):

             for i in range(len(indicies)):
                 # reverse engineer lines from rhos and thetas
                 rho = rhos[indicies[i][0]]
                 theta = thetas[indicies[i][1]]
                 a = np.cos(theta)
                 b = np.sin(theta)
                 x0 = a*rho
                 y0 = b*rho
                 # these are then scaled so that the lines go off the edges of the image
                 x1 = int(x0 + 1000*(-b))
                 y1 = int(y0 + 1000*(a))
                 x2 = int(x0 - 1000*(-b))
                 y2 = int(y0 - 1000*(a))

                 cv2.line(img, (x1, y1), (x2, y2), (0, 255, 0), 2)
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In [ ]:
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In [11]: H, rhos, thetas = hough_lines_acc(canny_edges)
         indicies, H = hough_peaks(H, 10, nhood_size=11) # find peaks
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plot_hough_acc(H) # plot hough space, brighter spots have higher votes
hough_lines_draw(shapes, indicies, rhos, thetas)

# Show image with manual Hough Transform Lines
cv2.imshow('Major Lines: Manual Hough Transform', shapes)
cv2.waitKey(0)
cv2.destroyAllWindows()
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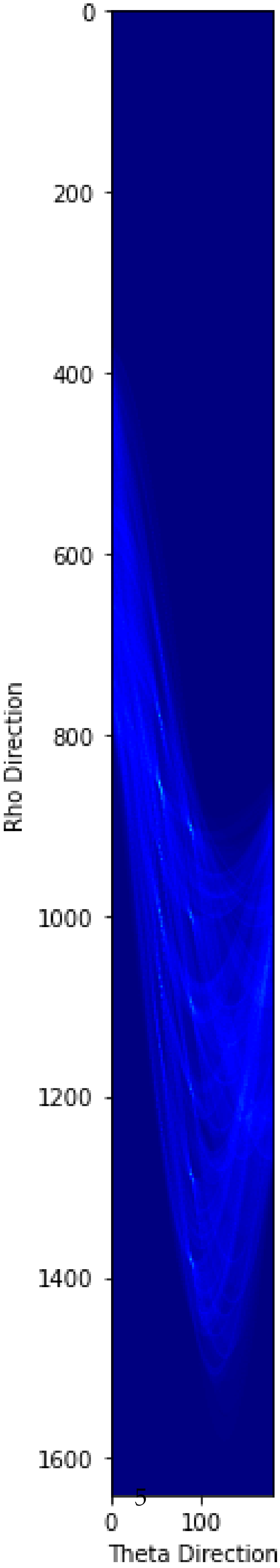
0
200
400
600
800
1000
1200
1400
1600
Rho Direction
0
100
Theta Direction

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In [ ]:
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