RBE549 - Homework 4

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Due date: September 29, 2022

Problem 0

Problem 1

Problem 2

In this problem, we are looking at a Hough Transform problem where x, y, b, c, m, and n may be positive or negative real numbers. 2 points in (x, y) space are given by $P_1 = (2, 4)$ and $P_2 = (4, 3)$.

A

First, we are tasked with finding L_1 and L_2, the lines assoicated in (m, b) space corresponding to P_1 and P_2.

For this we must first solve for m and b to form lines for (m, b) space. Given that $y = mx + b$, we have:

$$L_1 : 4 = 2m + b \tag{1}$$

$$L_1 : b = -2m + 4 \tag{2}$$

$$L_2 : 3 = 4m + b \tag{3}$$

$$L_2 : b = -4m + 3 \tag{4}$$

We can thus plot the lines in (m, b) space from P_1 and P_2 as such:
TODO: PLOT

B

Next we are tasked with finding the intersection of these lines. Thus we can set $L_1 = L_2$ and find:

$$-2m + 4 = -4m + 3 \tag{5}$$

$$1 = -2m \tag{6}$$

$$m = -\frac{1}{2} \tag{7}$$

...and then solve for b using our discovered m:

$$b = -2(-\frac{1}{2}) + 4 = 5 \tag{8}$$

Thus we find a point in (m, b) space such that $L_1 = L_2$ at $(-\frac{1}{2}, 5)$.

C

In this section, we are then asked what line connects both P_1 and P_2. This line is what we discovered in part B, wherein we found the the intersection of L_1 and L_2: $y = -\frac{1}{2}x + 5$.

D

We are tasked on finding where L_3, which passes through (m, b) space of $(0, 0)$ and find the coresponding P_3 with it. For this we solve the intersection along the b axis. Since $b = -mx + y$, we get $0 = -0x + y$ and thus $y = 0$.

Now that we know $y = 0$, we can solve for x:

$$0 = -\frac{1}{2}x + 5 \tag{9}$$

$$x = 10 \tag{10}$$

Now that we have the point $P_3 = (10, 0)$ we can translate this back to (m, b) space:

$$b = -mx + y \tag{11}$$

$$b = -10m + 0 \tag{12}$$

...which is our resulting L_3.