

Homework-5 Solutions

Question 1

You are given a picture with 5 point at the following (x, y) coordinates:

$(1,3), (2,1), (2,5), (3,3), (3,5)$

Apply the Hough Transform algorithm to search for circles in the parametric representation

$$(x - x_0)^2 + (y - y_0)^2 = r^2.$$

Quantize r^2 into three values: 2, 3, 4.

Quantize x_0 into four values: $-1, 1, 3, 5$.

Quantize y_0 into four values: $-1, 1, 3, 5$.

Follow these steps:

Initialization: Prepare and initialize to 0 the three dimensional accumulator space. You can visualize it (and write it in your notebook) as 3 two dimensional arrays. The first for $r^2 = 2$, the second for $r^2 = 3$, and the third for $r^2 = 4$.

Voting:

- for each point (x, y) of the five picture points
- for each possible value of x_0
- for each possible value of y_0
- {
 - compute r^2 from the equation $r^2 = (x - x_0)^2 + (y - y_0)^2$
 - If r^2 is in the range 2-4 vote by incrementing the corresponding cell
- }

(Notice that this requires calculating r^2 80 times.)

Choose a winner determine the cell with max number of votes.

a. What are the values of the accumulator space after the voting phase?

		$x_0 = -1$	$x_0 = 1$	$x_0 = 3$	$x_0 = 5$
$r^2 = 4 :$	$y_0 = -1$	0	0	0	0
	$y_0 = 1$	0	1	1	0
	$y_0 = 3$	1	1	2	1
	$y_0 = 5$	0	2	1	1

b. What is the most likely circle?

Two solutions:

$$(x - 3)^2 + (y - 3)^2 = 4, \quad (x - 1)^2 + (y - 5)^2 = 4,$$