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Computer Vision, Spring 2021

Professor Nayar

Homework 3, Computer Vision

Written assignment

Problem 1: Show that if you use the line equation $xsin(\theta) - ycos(\theta) + \rho = 0$, each point in the (x, y)-image space results in a sinusoid in the (ρ, θ)-Hough space. Describe the amplitude and phase of the sinusoid in terms of (x, y). Does the period (or frequency) of the sinusoid vary with the image point (x, y)? Why or why not? (4 points)

If we're using the line equation $xsin(\theta) - ycos(\theta) + \rho = 0$ and change some (x, y) coordinates into the equation, for example (1, 1) we will have $sin(\theta) - cos(\theta) + \rho = 0$. Now to get the value of ρ for some value of θ we would get it using the following equation: $\rho = cos(\theta) - sin(\theta)$, which is clearly a sum of sinusoids. $\rho(\theta)$ will for every pair of x and y be a sinusoid function. In fact we can write it in the form A*cos(θ-D), where A is the amplitude defined by x and y: $A = \sqrt{x^2 + y^2}$ and D is the phase defined by x and y through: $D = atan(-\frac{x}{y})$. Period and the frequency don't vary with the image point because it is defined solely by the change of θ.