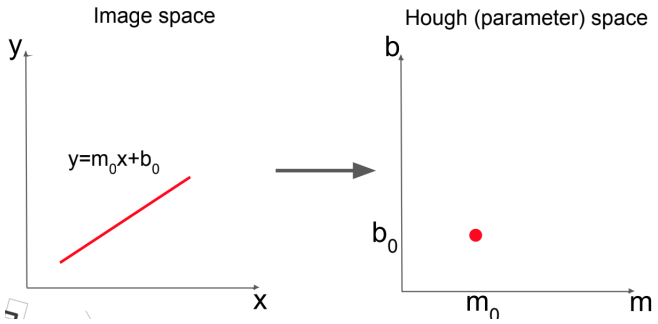
1 Hough space

In short, Hough space is the interpretation of (x, y, ..) coordinates' *a, slope* and *b, intercept*, for $y = ax + b$ linear function, eg:

- point in Cartesian coordinate - line in Hough space
- line in Cartesian coordinate - point in Hough space

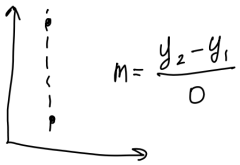


However, in Cartesian coordinate system there is a problem for Hough space:

Проблема с декартовым уравнением линии

$y=m_0x+b_0$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$



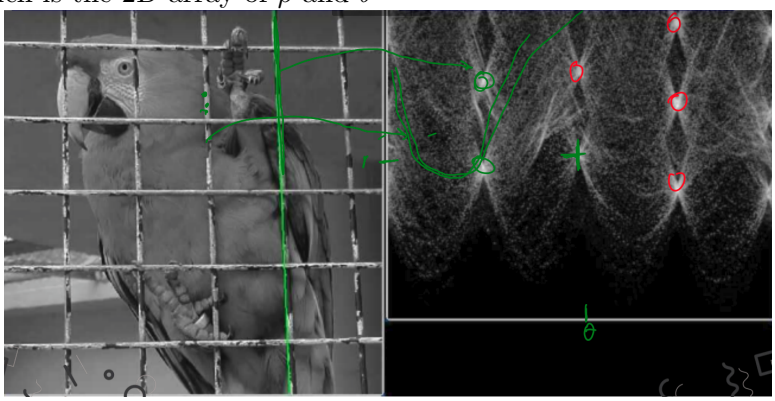
to solve this issue, the same coordinates can be transformed to *polar system coordinate*

$$\rho = x * cos(\theta) + y * cos(\theta) \tag{1}$$

, where in this case, the angle $\theta : 0 - 180^0$.
So with polar system coordHough space is:

- point in image, sinusoid in Hough space

The result of Hough space in polar system is the **Hough accumulator**, which is the 2D array of ρ and θ



2 PClines

https://www.youtube.com/watch?v=ZAJFnafV3oo: "Line detection by Hough transform based on parameterization using parallel coordinates."

In short, interpret Cartesian (x, y, ..) coordinates in Parallel system coordinate (with additional inverse **y** axis (watch video above to see the reason)) and work there with Hough transform

3 Canny algorithm (edge detector)

In short, Canny uses 2 thresholds C_1, C_2 where $C_1 < C_2$, then it detects strong gradients bigger than C_1, proceed with the gradient, rather than filtering until it limits to the lower C_2 threshold.