Chapter 6 Contours

Def. 6.1 Edge list; ordered set of edge points
Def. 6.2 Contour; edge list or the curve that has been used to represent the edge list
Def. 6.3 Boundary; closed contour that surrounds a region

6.1 Geometry of curves

6.2 Digital curves

digitized pixels; difficult to compute slope and curvature precisely

6.8.4 Hough transform

* Fitting a straight line

$$y = mx + c$$

$$\Rightarrow \quad c = y - mx$$

in polar coord. to avoid singularity

$$\rho = x\cos\theta + y\sin\theta$$

$\rho > 0$

Algorithm 6.4 Hough transform algorithm

(1) Standard (basic) form (SHT)

(2) Polarized form (PHT)

(3) Weghted polarized form (WPHT)

* Fitting a circle

$$(x-a)^2+(y-b)^2=r^2$$

$$x = a + r\cos\theta$$
$$y = b + r\sin\theta$$

$$a = x - r\cos\theta$$
$$b = y - r\sin\theta$$

=>

$$b = a\tan\theta - x\tan\theta + y$$

Algorithm 6.5 Circle fitting algorithm

1. Quantize the parameter space for the a and b
2. Zero the accumulator array M(a,b)
3. Compute the Gradient magnitude G(x,y) and angle θ(x,y)
4. For each edge point in G(x,y), increment all points in the accumulator array M(a,b) along the line

   $b = a\tan\theta - x\tan\theta + y$
5. Local maxima in the accumulator array correspond to centers of the circles in the image