

h

More HTs & Arbitrary Shapes 271-279

i. HT for circles

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

Points (x,y) centre (x_0,y_0) radius r

points ~~points~~

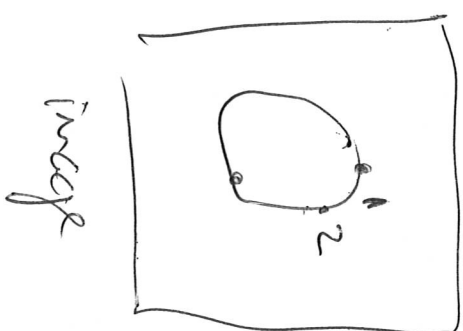
(x_0,y_0)

~

(x,y)

~

~



circle of votes
centre ~

circle of votes
centre ~

ii) Ellipses?

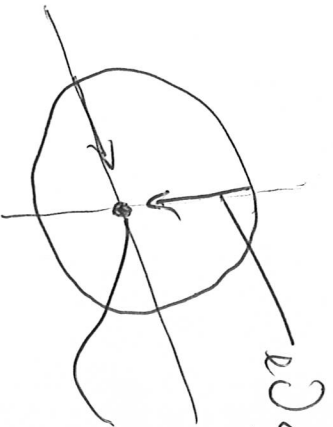
$$\frac{(x-x_0)^2}{a^2} + \frac{(y-y_0)^2}{b^2} = 1$$

4D space + rotation = 5D

e.g. 100 values for each parameter gives

accumulates ~~10¹⁰~~
virtually impossible, so many trials.

e.g. use edge direction
direction in circles



edge direction intersect
at centre
afterwards find radius.

ii) arbitrary shapes — use specialised Hoyle transform.
 no equation. use template.
 called R-template.

form R-template?



if find centre

ii) use distance & direction to edge points
 R-template use edge points

$$\begin{matrix} \phi_1 & \phi_2 & \phi_3 \\ (d_1, \theta_1) & (d_2, \theta_2) & (d_3, \theta_3) \end{matrix}$$

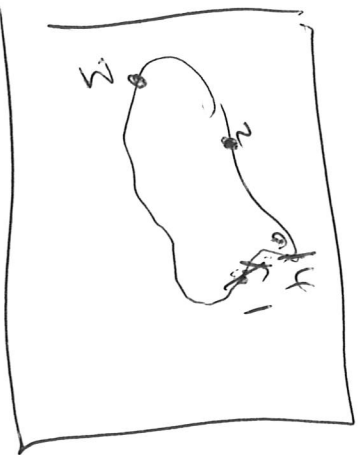
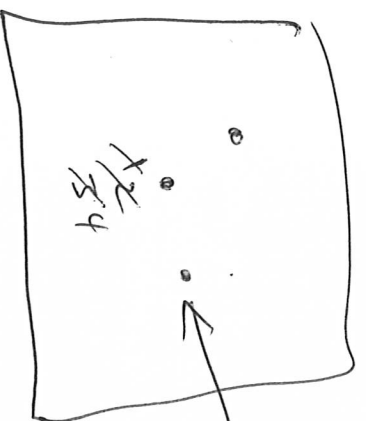


image.



accumulator

detect points direction
(measure edge & vote)
look up d, θ & vote).

still slow & there are many other techniques

$\forall x, y \in \text{inset}$ | look at all points

if $\text{edge}(x, y) \geq \text{threshold}$ | is the pair significant

$\forall r \in r_{\min}, r_{\max}$

| all values of radius
| vote in a circle

$\forall \theta \in 0, 359$

| get coordinates

$$\begin{cases} x' = x + r \cos \theta \\ y' = y + r \sin \theta \end{cases}$$

accum(x', y', r) puts 1 | vote in accum.

afterwards $\text{argmax}(\text{accum})$ gives circle parameters
speed ~~&~~ no of edge points and it tests than
template matching, and same results.