Region Descriptors

Area $A(S)=\sum_x\sum_y I(x,y)$

Perimeter

$$P(S)=\sum_i\sqrt{(x_i-x_{i-1})^2+(y_i-y_{i-1})^2}$$

Compactness $C(S)=\dfrac{4\pi A(s)}{P^2(s)}$

Irregularity $I(S)=\dfrac{\pi\max\left((x_i-\bar{x})^2+(y_i-\bar{y})^2\right)}{A(S)}$

$$IR(S)=\frac{\max\left(\sqrt{(x_i-\bar{x})^2+(y_i-\bar{y})^2}\right)}{\min\left(\sqrt{(x_i-\bar{x})^2+(y_i-\bar{y})^2}\right)}$$

		
(a) circle	**(b)** convoluted region	**(c)** ellipse
$A(S)=4917$ $P(S)=259.27$ $C(S)=0.91$ $I(S)=1.00$ $IR(S)=1.03$	$A(S)=2316$ $P(S)=498.63$ $C(S)=0.11$ $I(S)=2.24$ $IR(S)=6.67$	$A(S)=6104$ $P(S)=310.93$ $C(S)=0.79$ $I(S)=1.85$ $IR(S)=1.91$
(d) circle descriptors	**(e)** descriptors	**(f)** ellipse descriptors

Basic Region Descriptors

Moments

Cartesian $m_{pq}=\sum_x\sum_y x^p y^q I(x,y)$

$$m_{00}=\sum_x\sum_y I(x,y)$$

Centralised

$$\mu_{pq}=\sum_x\sum_y\left(x-\bar{x}\right)^p\left(y-\bar{y}\right)^q I(x,y)$$

		
(a) original ellipse	**(b)** translated ellipse	**(c)** rotated ellipse
$\mu_{02}=2.4947\cdot10^6$ $\mu_{20}=6.4217\cdot10^5$	$\mu_{02}=2.4947\cdot10^6$ $\mu_{20}=6.4217\cdot10^5$	$\mu_{02}=6.4217\cdot10^5$ $\mu_{20}=2.4947\cdot10^6$
(d), **(e)** and **(f)** 2nd order centralised moments		

Describing a Shape by Centralised Moments

Normalised central (info only!)

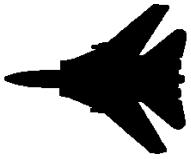
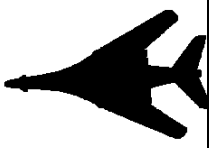
$$\eta_{pq}=\frac{\mu_{pq}}{\mu_{00}^{\gamma}}$$

where $\gamma=\dfrac{p+q}{2}+1 \quad \forall p+q\geq 2$.

Hu Invariant (info only!)

$M1=\eta_{20}+\eta_{02} \quad M2=\left(\eta_{20}-\eta_{02}\right)^2+4\eta_{11}^2$

……..

		
(a) F-14 fighter	**(b)** F-14 rotated and scaled	**(c)** B1 bomber
$M1=0.2199$ $M2=0.0035$ $M3=0.0070$	$M1=0.2202$ $M2=0.0037$ $M3=0.0070$	$M1=0.2764$ $M2=0.0176$ $M3=0.0083$
(d), (e) and **(f)** invariant moments		

Describing a Shape by Invariant Moments

Zernike (Chebyshev and other orthogonal), Velocity, Affine, ……