Representation & Description-II

- On completion the students will learn and be able to implement

  - Boundary based descriptors
    - Fourier descriptor
    - Boundary straightness
    - Bending energy
  - Region based shape descriptors
    - Eccentricity
    - Elongatedness
    - Rectangularity
    - Compactness
    - Moments etc.

DFT of $s(k)$ $k = 0, 1, \cdots N-1$.

$$a(u) = \frac{1}{N} \sum_{k=0}^{N-1} s(k)\, e^{-j\frac{2\pi}{N}uk}$$

N no. of $a(u)$ → Fourier Descriptor

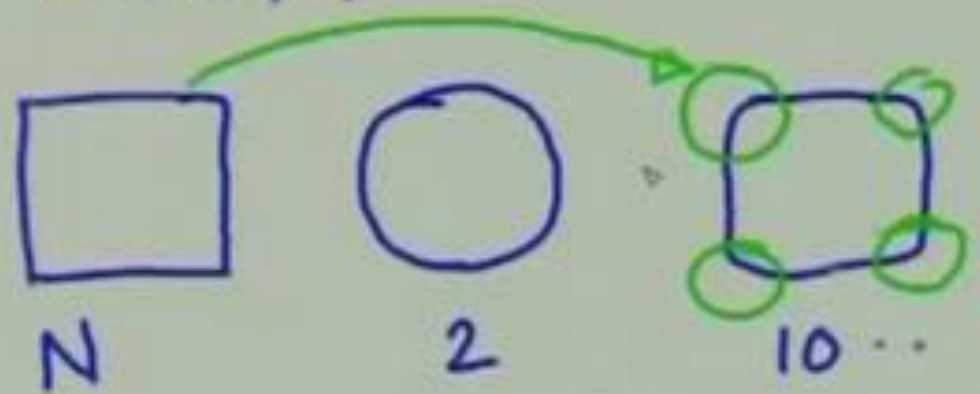
IDF

$$s(k) = \sum_{u=0}^{N-1} a(u)\, e^{j\frac{2\pi uk}{N}}$$

$M < N$

$$\hat{s}(k) = \sum_{n=0}^{M-1} a(n) e^{j \frac{2\pi n k}{N}}$$

$k = 0, 1, \ldots N-1$



Other boundary Descriptors

Boundary Straightness ⇒

$$\frac{\text{no. of pixels where direction of boundary changes abruptly}}{\text{Total no. of boundary points}}$$

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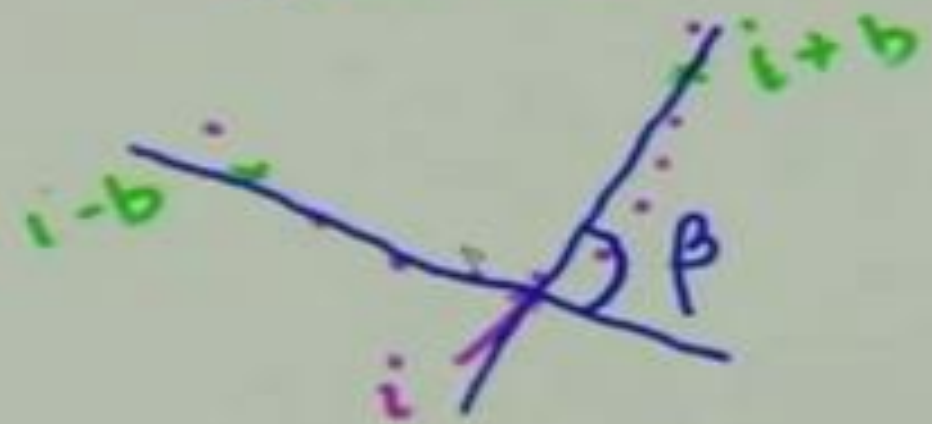


Bending Energy

$c^2(k)$

$$BE = \frac{1}{L} \sum_{k=1}^{L} c^2(k)$$

Region based Shaper Descriptors

Area → total no. of pixels belonging to the region.

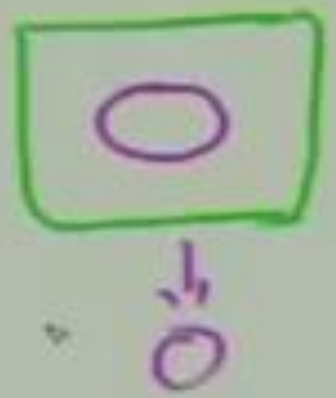
Euler no. →

1

3

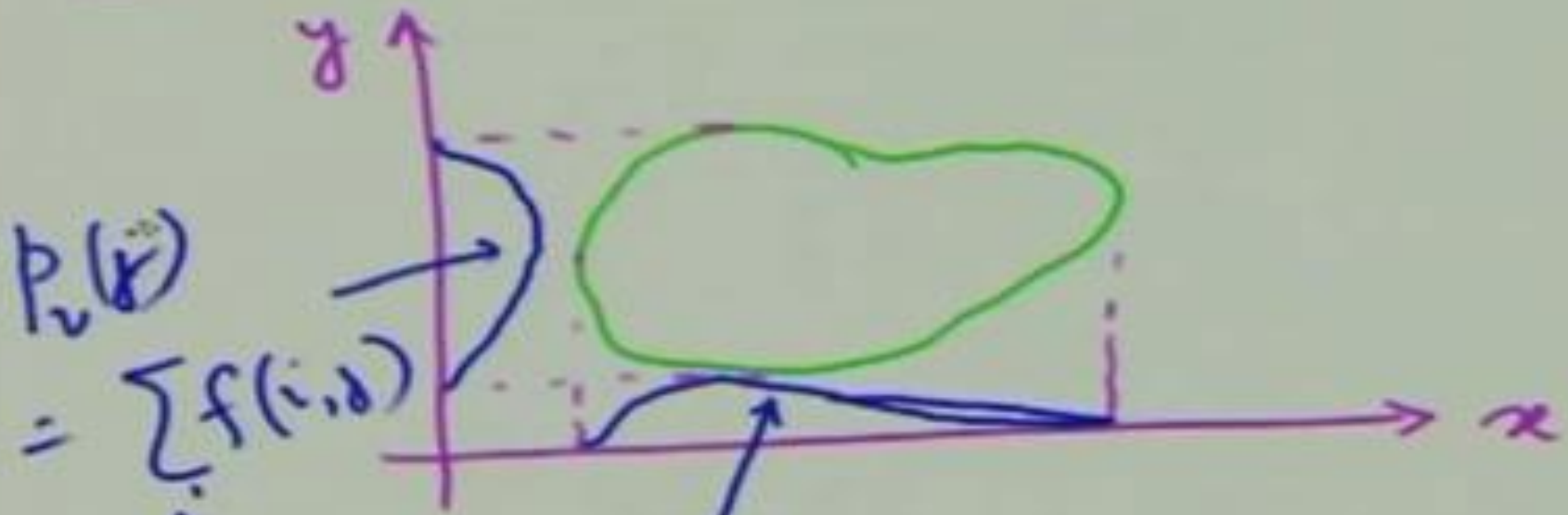
$v = S - N$

$= -2$



0

Horizontal & Vertical Projections.



$$P_V(i) = \sum_j f(i,j)$$

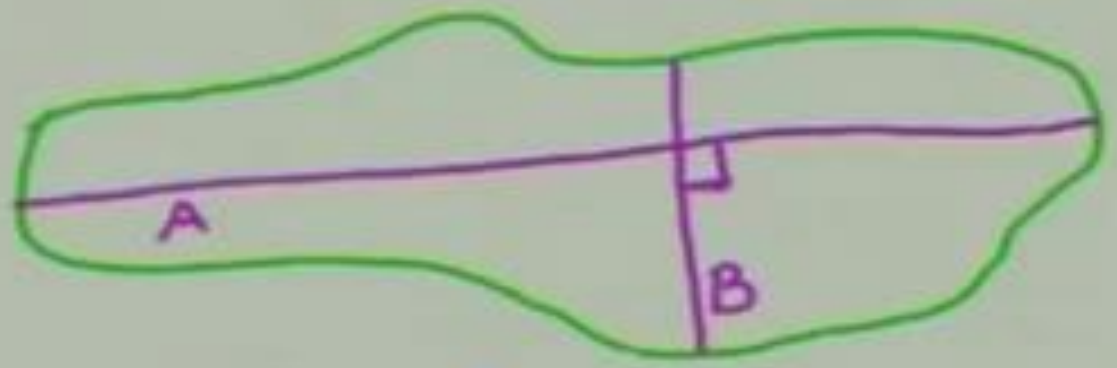
$$P_H(j) = \sum_i f(i,j)$$

Images as Point Sets

$X = \{(2,0), (2,1), (1,2), (3,2) \ldots\}$

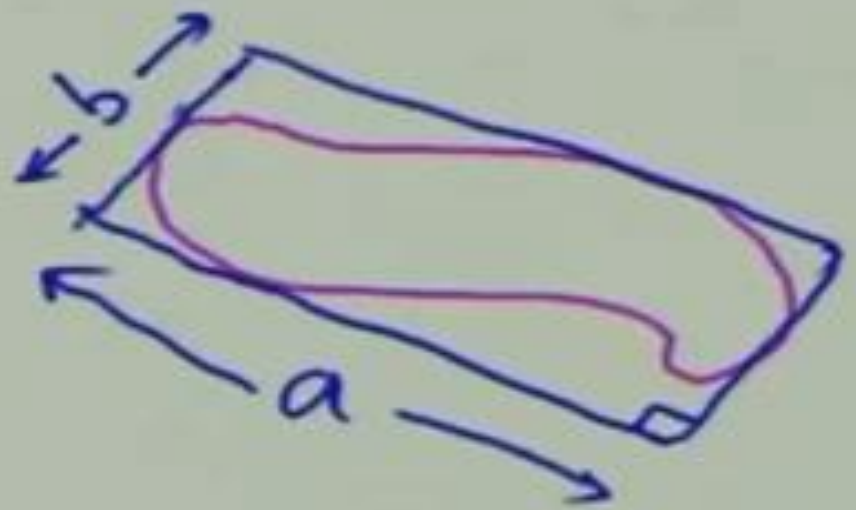
X^c

Eccentricity



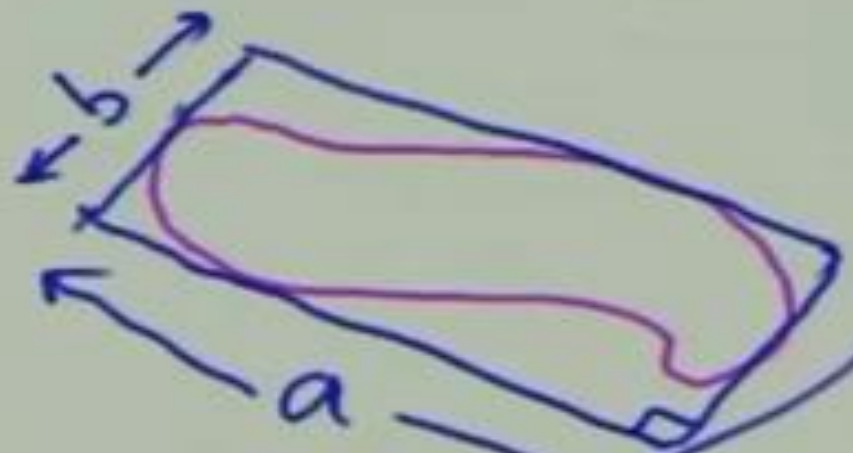
$$\frac{\text{length of A}}{\text{length of B}}$$

Elongatedness



$$\frac{a}{b}$$

Elongatedness



$$\frac{a}{b}$$

$$\frac{\text{area}}{(\text{max. thickness})^2}$$

$$\frac{\text{area}}{(2d)^2}$$

Rectangularity

ratio of region area and the area of a bounding rectangle which is maximum.

$F_k \rightarrow$

$$\text{Rectangularity} = \max_k \{F_k\}$$

Compactness

$$\frac{\text{area}}{\text{perimeter}^2} \qquad \frac{\pi r^2}{(2\pi r)^2}$$

$\frac{1}{4\pi} \Rightarrow$ max

$0 \Rightarrow$ min