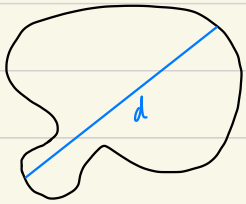
boundary and region description; filtering

shape, texture, matlab: regionprops

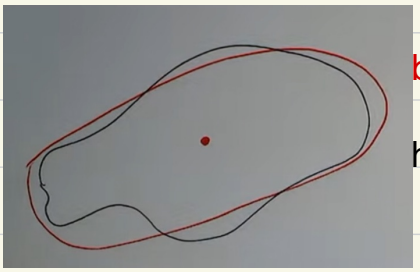


- perimeter
- area
- diameter
- bounding box

compactness: $\frac{(\text{perimeter})^2}{\text{area}}$

$\frac{(2\pi r)^2}{\pi r^2} = 4\pi$

circularity = $\frac{4\pi(\text{area})}{(\text{perim})^2}$



best fit ellipse

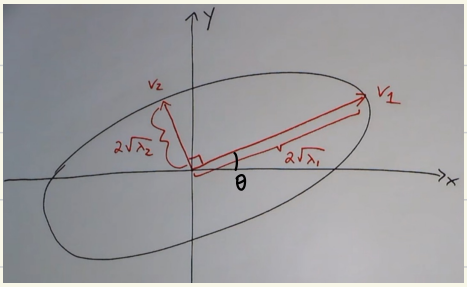
how to get this ellipse

1) $C = \frac{1}{k-1}\sum_{i=1}^{k}(x_i - c)(x_i - c)^T$

C: 2×2 matrix; $(x_i - c)$: 2×1; $(x_i - c)^T$: 1×2

2) $(\lambda_1, v_1), (\lambda_2, v_2)$ eigenvals/vectors

$\lambda_1 \geq \lambda_2$



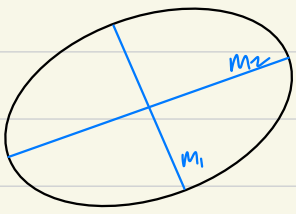
v1: direction of major axis

v2: direction of minor axis

$2(2\sqrt{\lambda_1})$ length of major axis

$2(2\sqrt{\lambda_2})$ length of minor axis

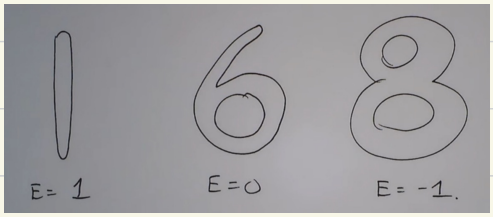
eccentricity

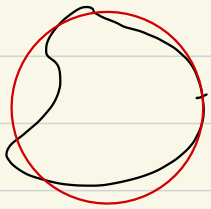


$ECC = \sqrt{1 - (\frac{m_2}{m_1})^2}$

$ECC = 0$

topology: Euler number = (# of connect component) - (# holes)



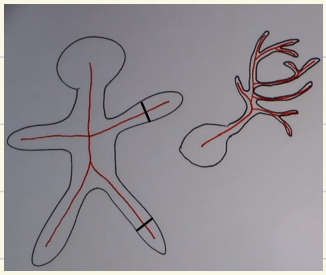


$s(t) = x(t) + jy(t)$

$\{a_k\}$ Fourier Series coefficients

PCA: principal component analysis

training shape



estimation:

1) successive erosions
2) distance transform

definition: points that have more than one nearest neighbor

remember that underlying intensity/colour inside each binary block

The texture can also be filtered

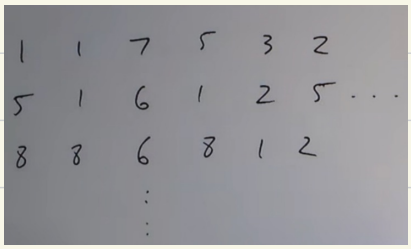
- flat, - noisy, - stripey

statistics on hist of intensity in blob:

- mean intensity
- second moment (variance) => contrast
  - flat => var = 0
  - noisy => var = high
- third moment (skewness)
- entropy (how random)

none of these reflect spatial distribution of intensity

Gray-level co-occurence matrix (GLCM)



1) specify an operator Q (spatial relationship b/w 2 pixels) eg.“1 pixel to right”
if N gray levels, make N*N matrix

P(pixel 1, pixel 2) = (ρ1, ρ2)
according to Q

will have k pixels (# of possible pixel pairs according to Q)
in practice, # gray levels is quantized (eg. 8 or 16)