Describing Shapes for Recognition

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What is a shape?

- A set of points in the plane (no 3D in this lecture)
- A continuous outline (silhouette)
Why care about shape?

Cues from **interior** vs cues from **boundary**

Some classes are defined purely by shape (interior bears no information)

Some classes are defined purely by texture/color (boundary bears no information)

Some classes are defined by both
Tasks: correspondence and recognition

point-to-point correspondences

recognition as member of a class

Some methods compute point correspondences as a step towards recognition (but not all)
Challenges

invariance to rigid transformations: (translation, rotation, scale) → similarities

correspondences unknown

tolerance to non-rigid deformations (without confusing classes!)
Simple global descriptors

Convexity
Perim(convex hull) / Perim(shape)

\[ \text{conv} = \frac{P_{\text{hull}}}{P_{\text{shape}}} \]

Compactness
Perim(circle with equal area) / Perim(shape)

\[ \text{comp} = \frac{2\sqrt{A\pi}}{P} \]

Elongation
ratio of principal axis; principal axis cross at centroid with length = eigenvals of cov. matrix

\[ \text{pr}ax = \frac{c_{yy} + c_{xx} - \sqrt{(c_{yy} + c_{xx})^2 - 4(c_{xx}c_{yy} - c_{xy}^2)}}{c_{yy} + c_{xx} + \sqrt{(c_{yy} + c_{xx})^2 - 4(c_{xx}c_{yy} - c_{xy}^2)}} \]
Simple global descriptors

Cope with challenges
+ invariance to translation/rotation/scale
+ robust to shape deformations
- no point correspondences

Advantages
+ simple
+ fast to compute

Disadvantages
- little discriminative power
Lecture Overview

• A variety of simple descriptions: area, compactness, ...
• Many invariant to different transformations, e.g. translation
• These don’t require correspondences between model and data instances

Slides credit: Bob Fisher & Vittorio Ferrari & others