Probabilistic Object Recognition

Robert B. Fisher
School of Informatics
University of Edinburgh

Object recognition key points

- Classification by comparing the relative probability of a shape belonging to different classes
- Properties in a feature vector
- Use Bayes rule to calculate the class probabilities
- Class model is multivariate Gaussian distribution
- Estimate the distribution parameters from the data

The story so far ...

Pre-processing:

1. Capture image
2. Threshold to isolate object
3. Measure properties: $\vec{x} = (f_1, f_2, \ldots, f_n)'$

Probabilistic Object Recognition

$p(c|\vec{x})$ is the probability that c was the class given that we observed evidence $\vec{x}$

We select most probable class c (*i.e.* $p(c|\vec{x})$ is the highest) or perhaps none if the probability for all classes is too low.

Computing $prob(c|\vec{x})$? Bayes Classifier

$p(c)$ is the *a priori* (before any observations) probability of observing class c

$p(\vec{x}|c)$ is the probability that evidence $\vec{x}$ would have been observed if c was the class

Bayes rule:

$$p(c|\vec{x}) = \frac{p(\vec{x}|c)p(c)}{p(\vec{x})} = \frac{p(\vec{x}|c)p(c)}{\sum_k p(\vec{x}|k)p(k)}$$

Advantage: we learn $p(c)$ and $p(\vec{x}|c)$ from examples

Lecture Overview

1. Probabilistic model based on estimating the class probabilities
2. Use Bayes Rule to estimate probability