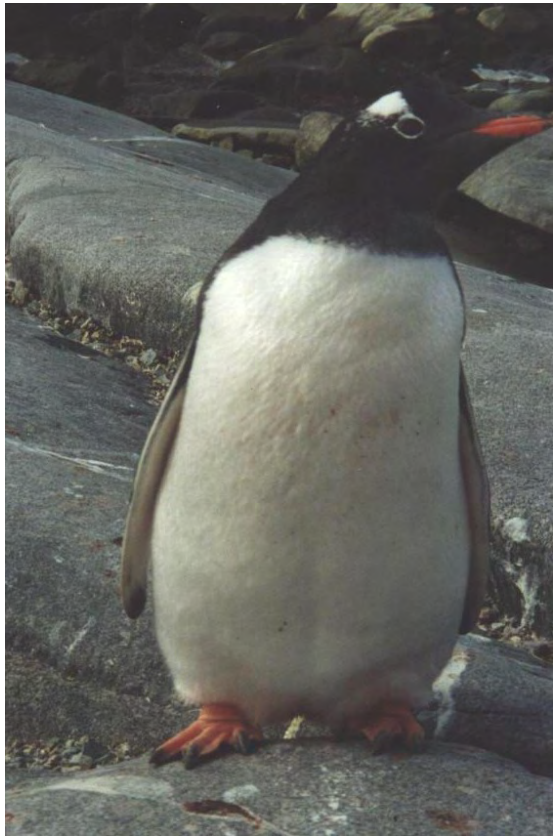
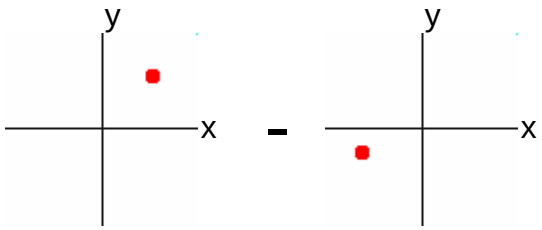
Comparing Images



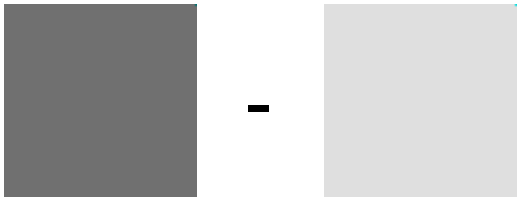
15-463: Computational Photography
Alexei Efros, CMU, Fall 2008

Adopted from Frederic Heger

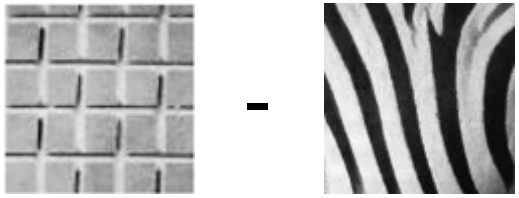
Distance Metrics



= Euclidian distance of 5 units



= Grayvalue distance of 50 values



= ?

Beyond SSD…

?

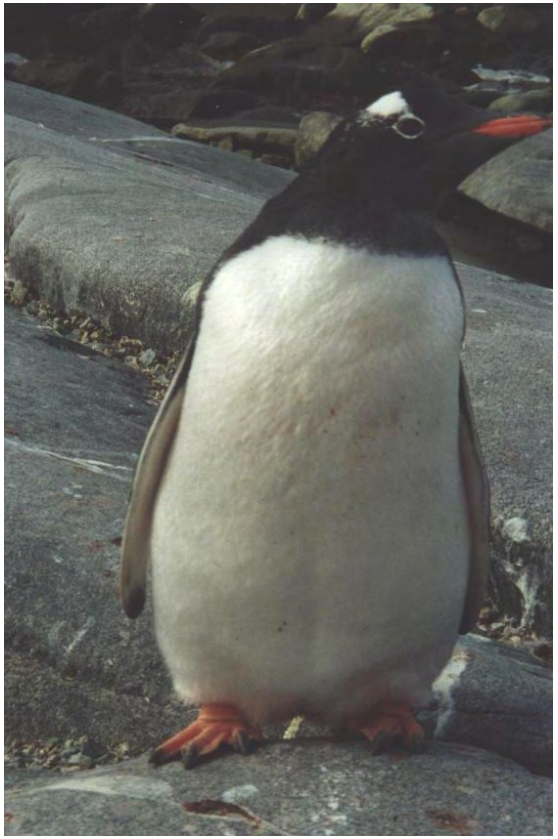
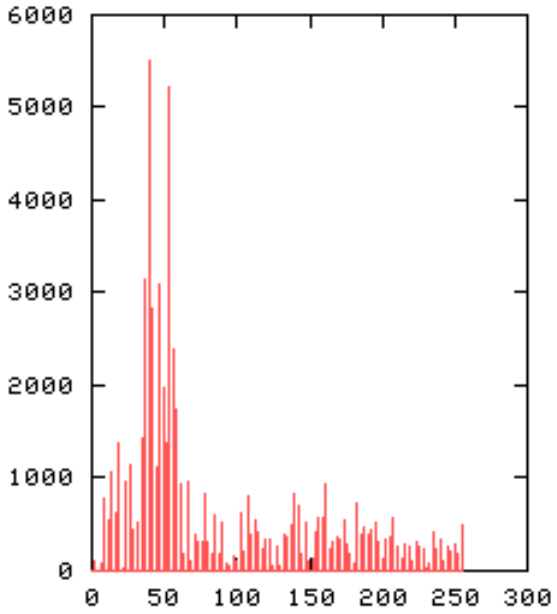
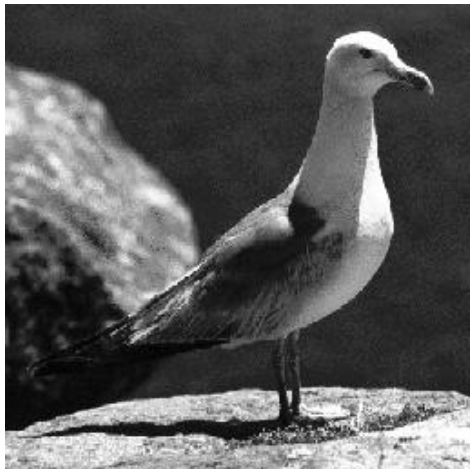


Image Representations: Histograms

Images from Dave Kauchak



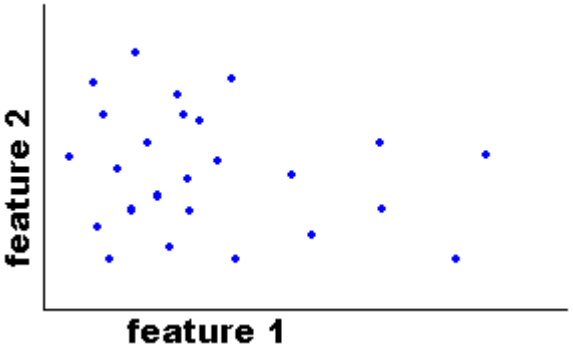


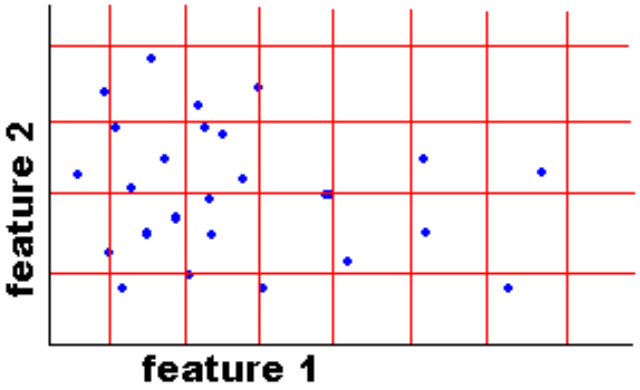
global histogram

- Represent distribution of features
  - Color, texture, depth, …

Image Representations: Histograms

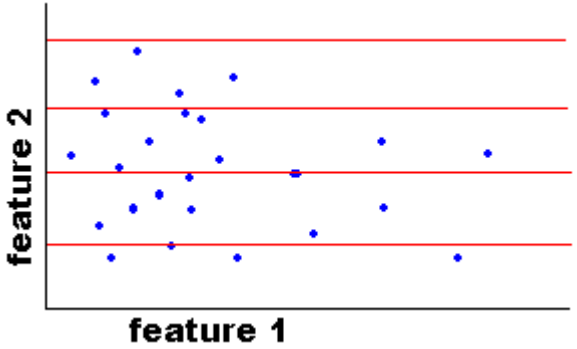
Images from Dave Kauchak

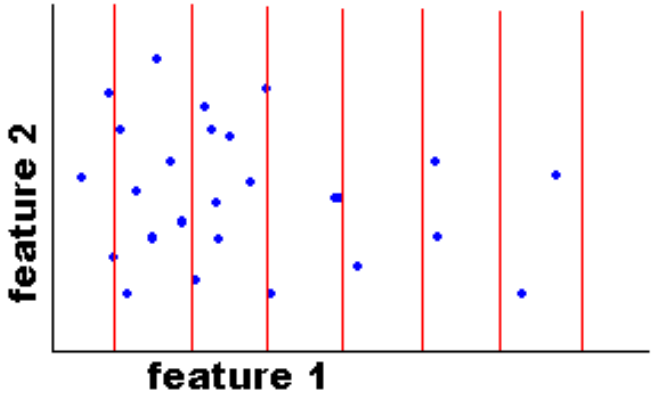




Joint histogram

- Requires lots of data
- Loss of resolution to avoid empty bins



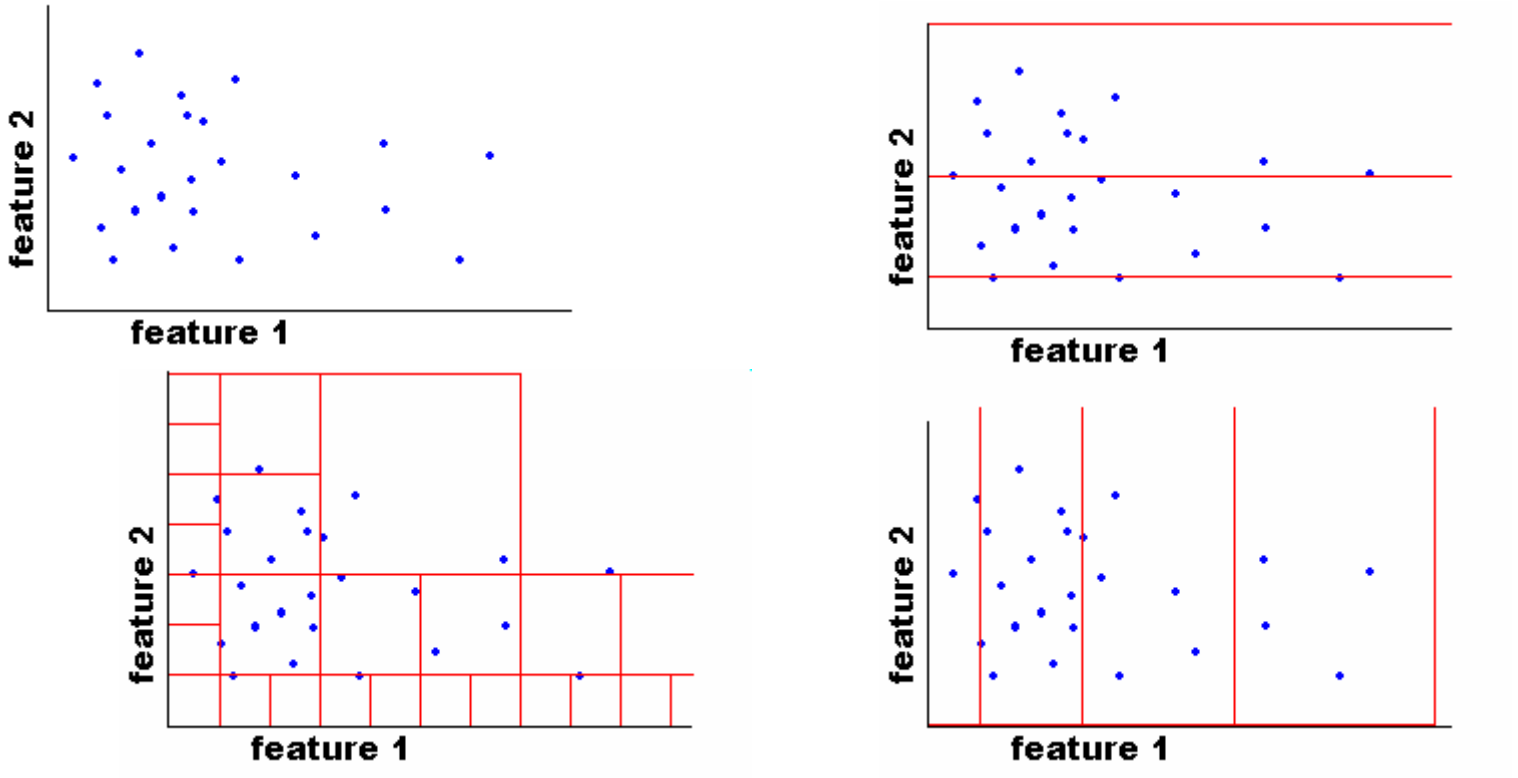


Marginal histogram

- Requires independent features
- More data/bin than joint histogram

Image Representations: Histograms

Images from Dave Kauchak

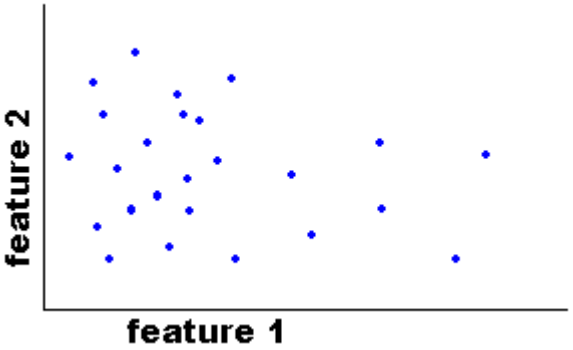


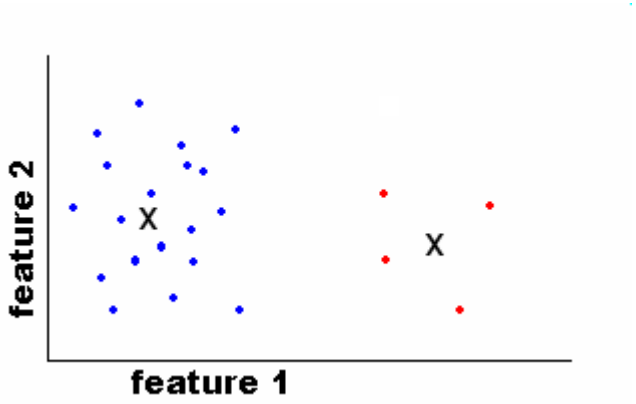
Adaptive binning

- Better data/bin distribution, fewer empty bins
- Can adapt available resolution to relative feature importance

Image Representations: Histograms

Images from Dave Kauchak

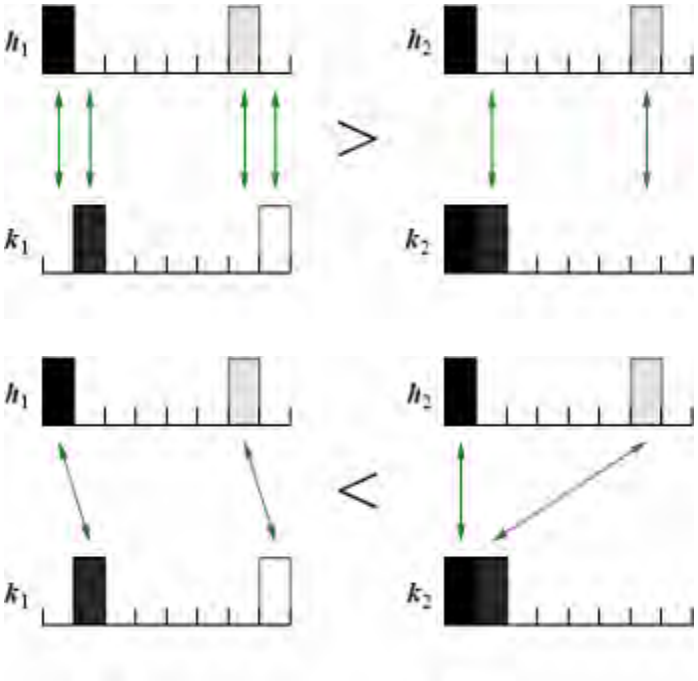




Clusters / Signatures

- “super-adaptive” binning
- Does not require discretization along any fixed axis

Issue: How to Compare Histograms?

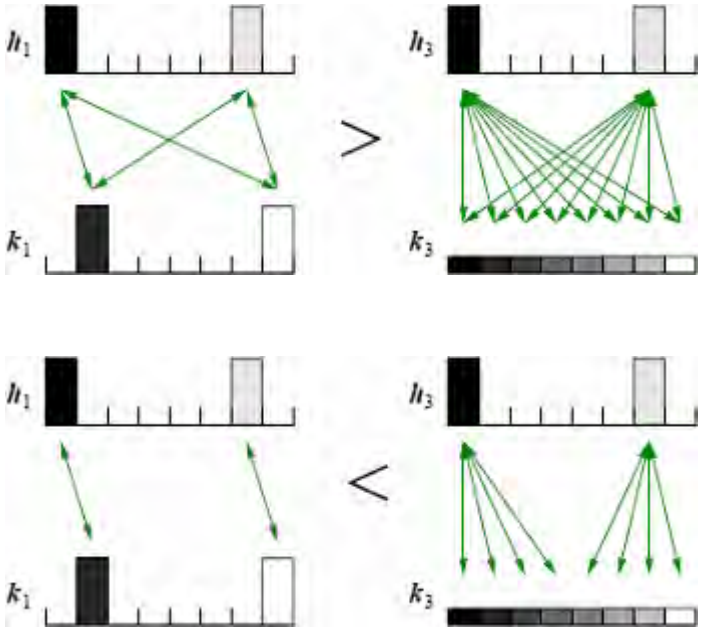


Bin-by-bin comparison

Sensitive to bin size.

Could use wider bins …

… but at a loss of resolution



Cross-bin comparison

How much cross-bin influence is necessary/sufficient?

Red Car Retrievals (Color histograms)

$$\chi^2(h_i, h_j) = \frac{1}{2}\sum_{m=1}^{K}\frac{[h_i(m) - h_j(m)]^2}{h_i(m) + h_j(m)}$$

Histogram matching distance