# CS4495/6495
Introduction to Computer Vision

4A-L1 *Introduction to "features"*

Text resources

- Forsyth and Ponce: 5.3-5.4
  - Szeliski also covers this well – Section 4 – 4.1.1

The basic image point matching problem

- Suppose I have two images related by some transformation. Or have two images of the same object in different positions.

- How to find the transformation of image 1 that would align it with image 2?
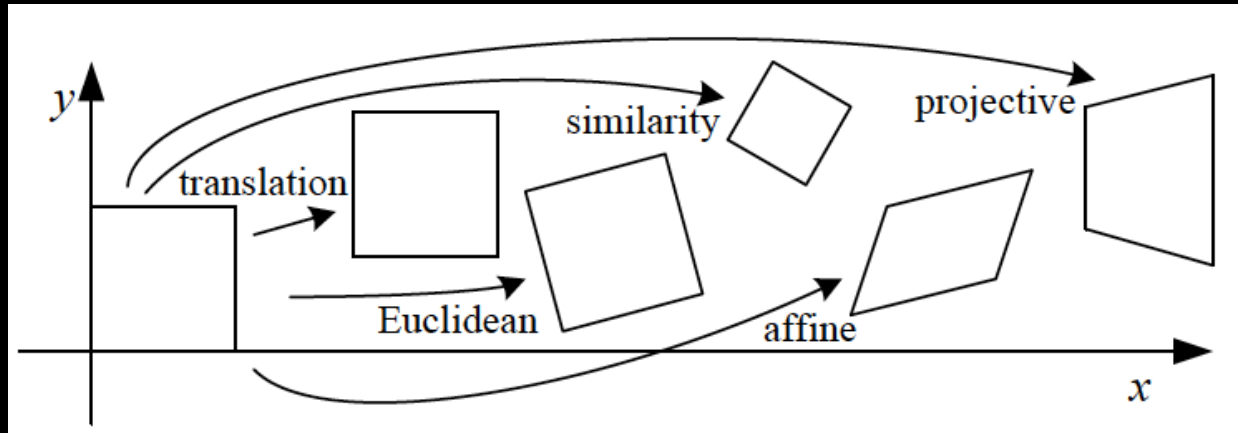
We want *Local*[1] *Features*[2]

- Goal: Find points in an image that can be:
  - Found in other images
  - Found precisely – well localized
  - Found reliably – well matched

We want *Local*[1] *Features*[2]

Why?

- Want to compute a fundamental matrix to recover geometry

- Robotics/Vision: See how a bunch of points move from one frame to another. Allows computation of how camera moved -> depth -> moving objects

- Build a panorama...

Suppose you want to build a panorama

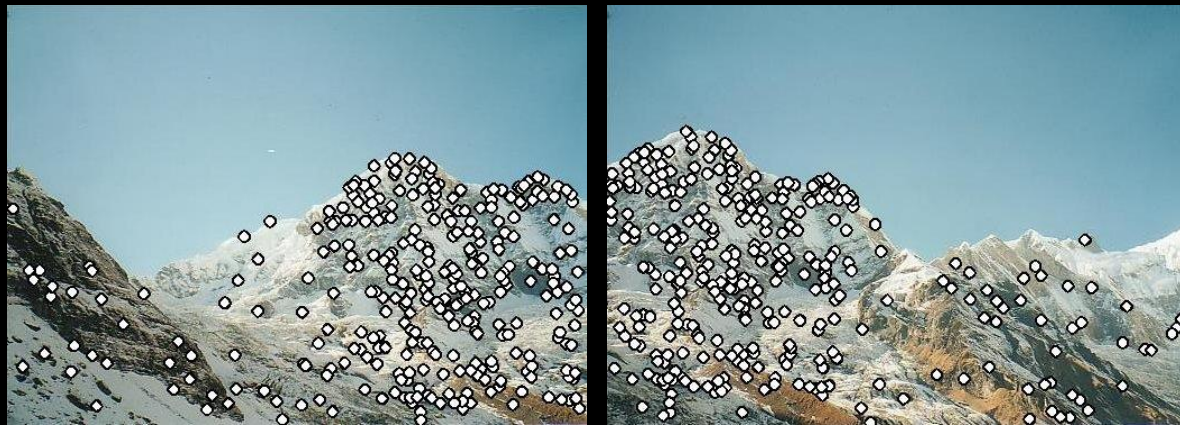M. Brown and D. G. Lowe. Recognising Panoramas. ICCV 2003

How do we build panorama?

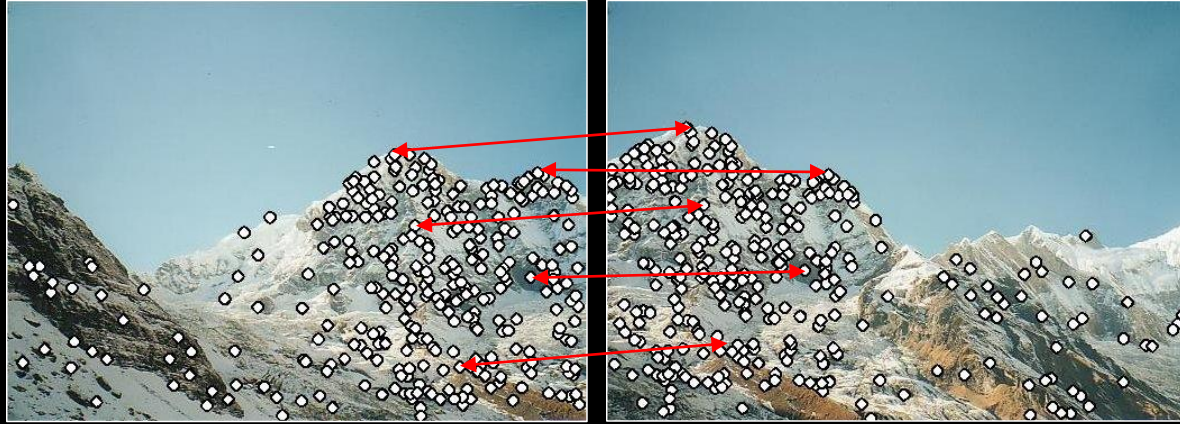- We need to match (align) images

Matching with Features

- Detect features (feature points) in both images

Matching with Features

- Detect features (feature points) in both images

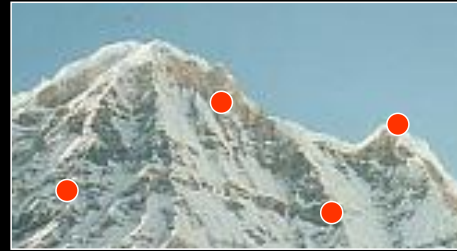- Match features - find corresponding pairs

Matching with Features

- Detect features (feature points) in both images

- Match features - find corresponding pairs

- Use these pairs to align images

Matching with Features

- Problem 1:
  - Detect the same point independently in both images
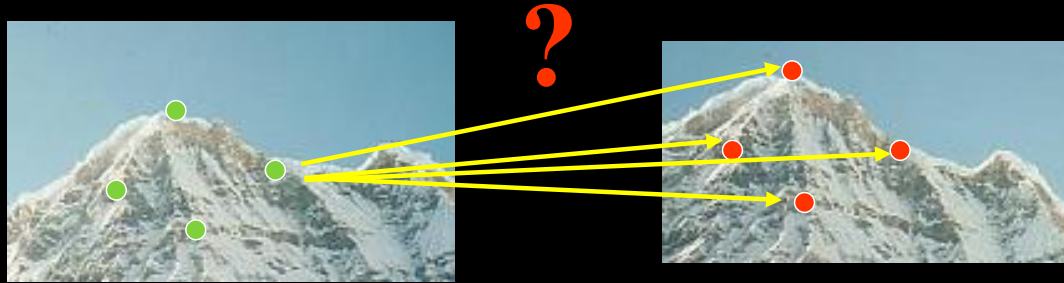

no chance to match!

We need a repeatable detector

Matching with Features

- Problem 2:
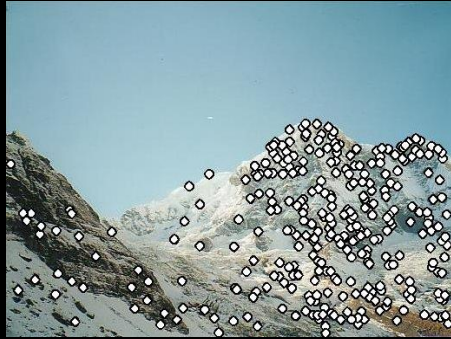 - For each point correctly recognize the corresponding one

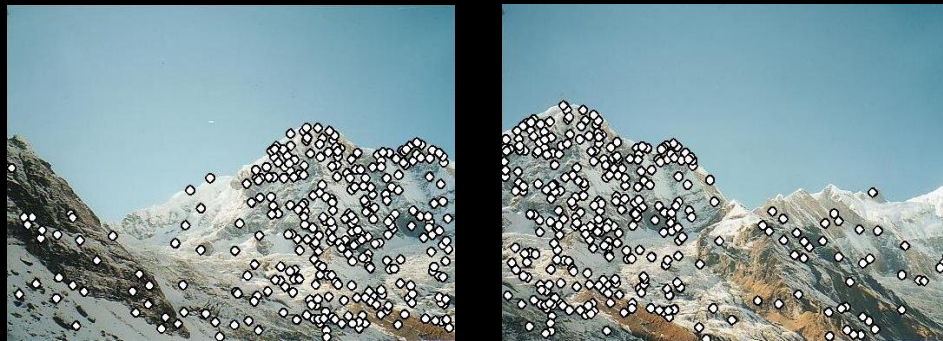We need a reliable and distinctive *descriptor*

More motivation…

- Feature points are used also for:
  - Image alignment (e.g. homography or fundamental matrix)
  - 3D reconstruction
  - Motion tracking
  - Object recognition
  - Indexing and database retrieval
  - Robot navigation
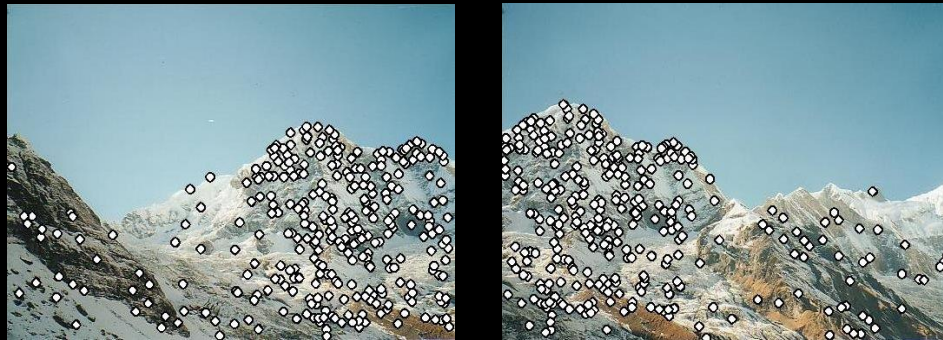 - … other

Characteristics of good features

Characteristics of good features

Repeatability/Precision

- The same feature can be found in several images despite geometric and photometric transformations
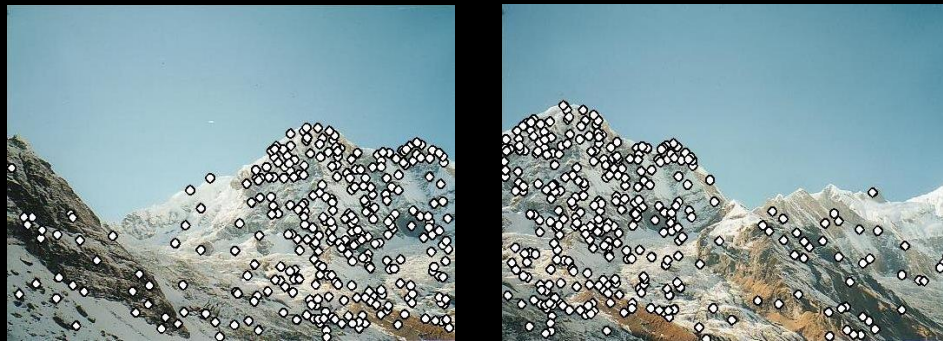
Characteristics of good features

Saliency/Matchability
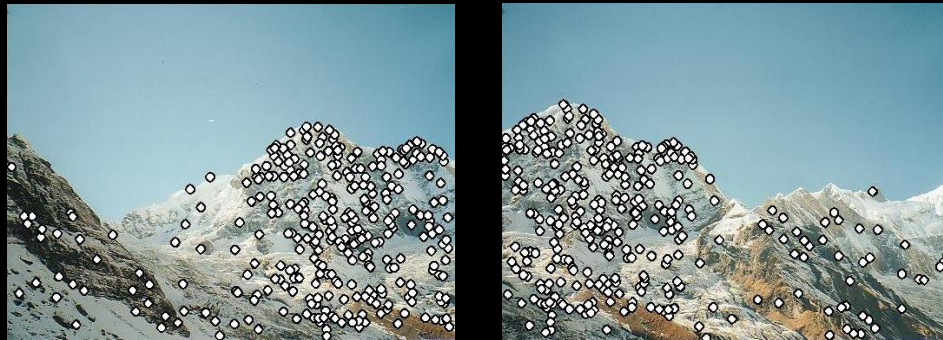
- Each feature has a distinctive description

Characteristics of good features

Compactness and efficiency

- Many fewer features than image pixels

Characteristics of good features

Locality

- A feature occupies a relatively small area of the image; robust to clutter and occlusion