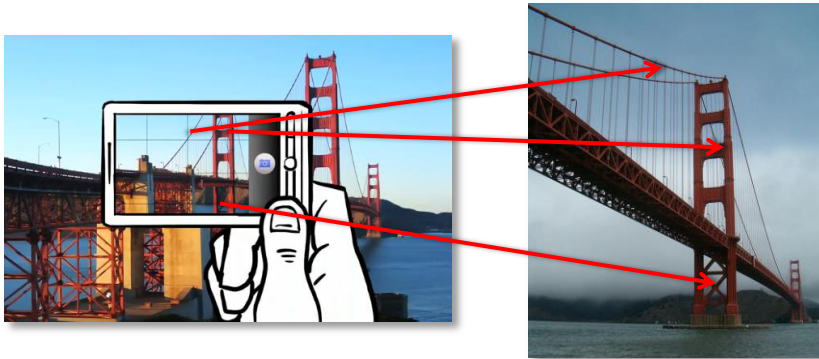


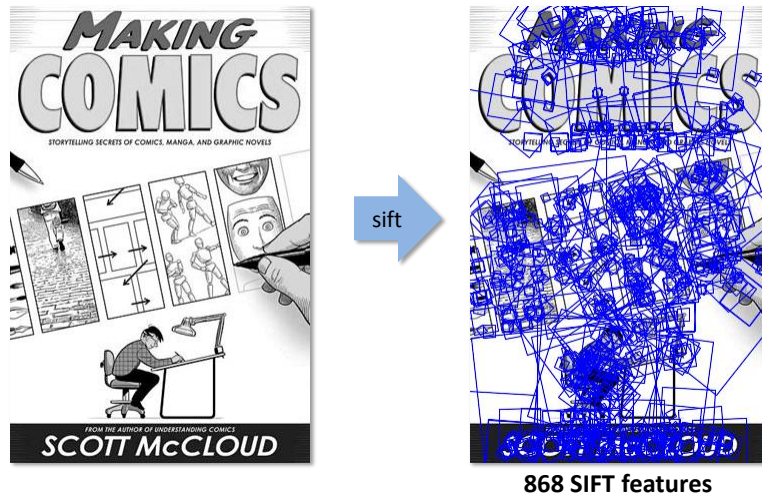
CS6670: Computer Vision

Noah Snively

Lecture 8: Feature matching



SIFT Example



Feature matching

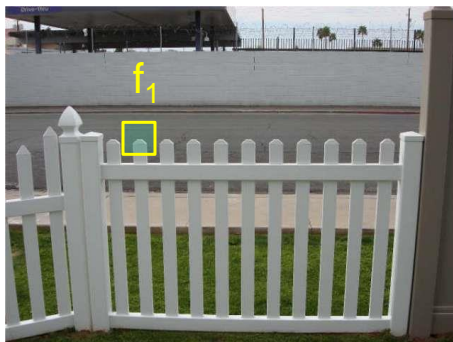
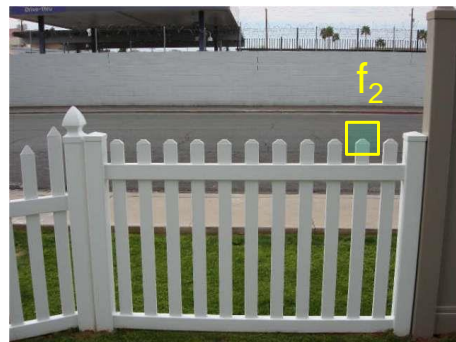
Given a feature in I_1 , how to find the best match in I_2 ?

1. Define distance function that compares two descriptors
2. Test all the features in I_2 , find the one with min distance

Feature distance

How to define the difference between two features f_1, f_2 ?

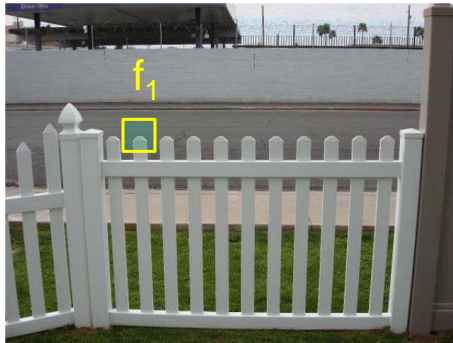
- Simple approach: L_2 distance, $||f_1 - f_2||$
- can give good scores to ambiguous (incorrect) matches

 I_1  I_2

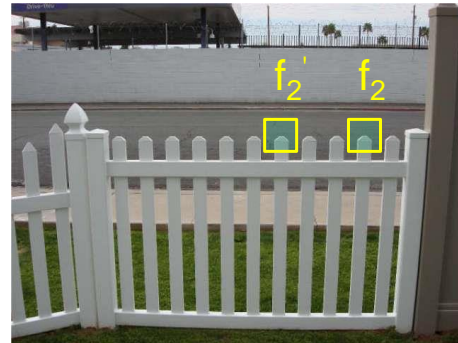
Feature distance

How to define the difference between two features f_1, f_2 ?

- Better approach: ratio distance = $\|f_1 - f_2\| / \|f_1 - f_2'\|$
 - f_2 is best SSD match to f_1 in I_2
 - f_2' is 2nd best SSD match to f_1 in I_2
 - gives large values for ambiguous matches

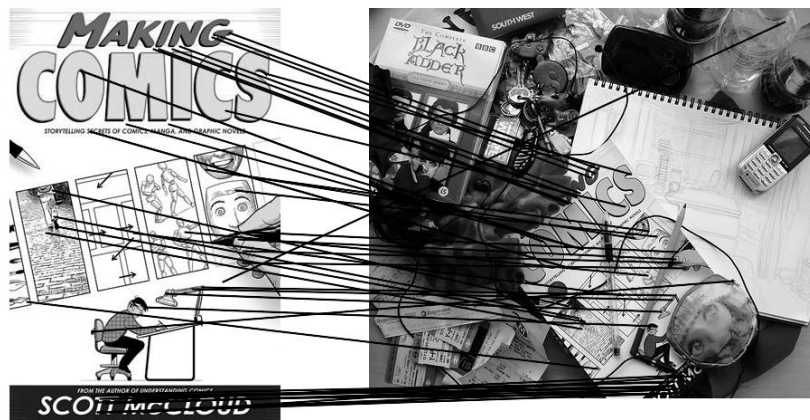


I_1



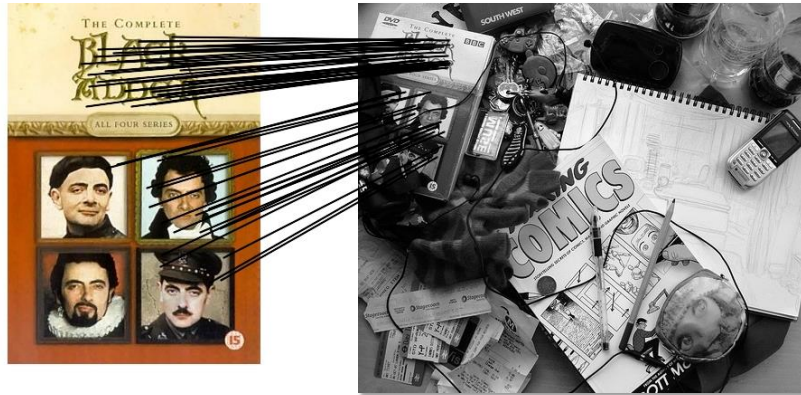
I_2

Feature matching example



51 matches

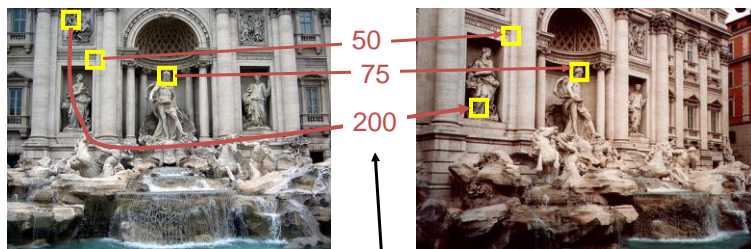
Feature matching example



58 matches

Evaluating the results

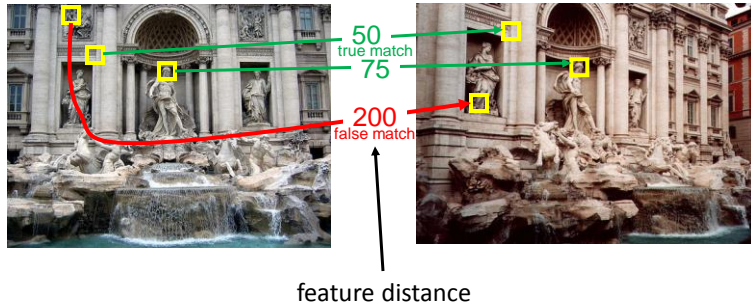
How can we measure the performance of a feature matcher?



feature distance

True/false positives

How can we measure the performance of a feature matcher?

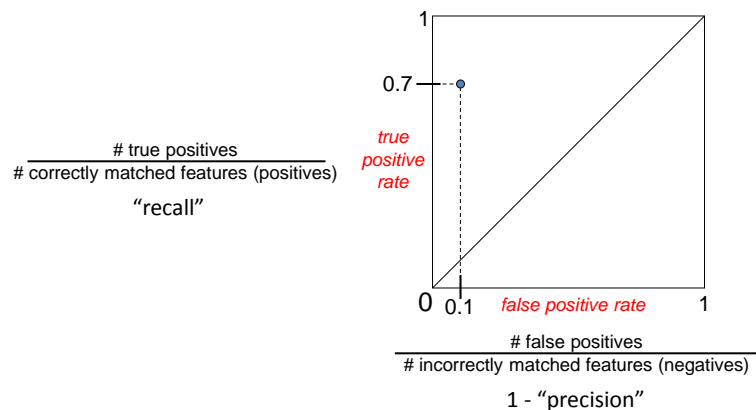


The distance threshold affects performance

- True positives = # of detected matches that are correct
 - Suppose we want to maximize these—how to choose threshold?
- False positives = # of detected matches that are incorrect
 - Suppose we want to minimize these—how to choose threshold?

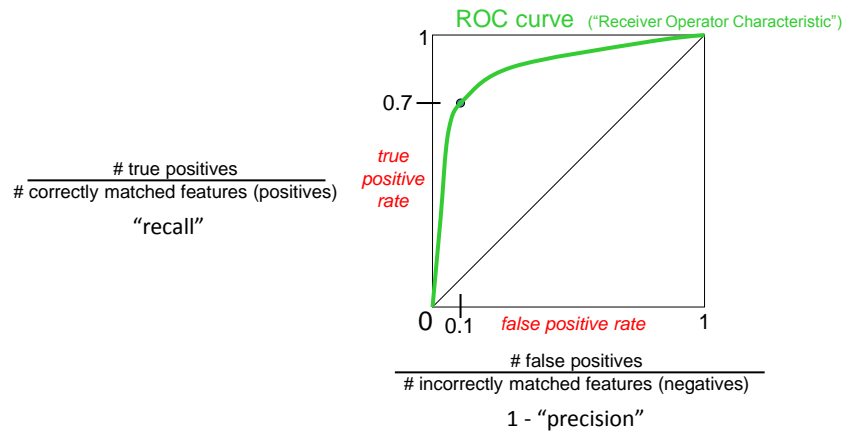
Evaluating the results

How can we measure the performance of a feature matcher?



Evaluating the results

How can we measure the performance of a feature matcher?

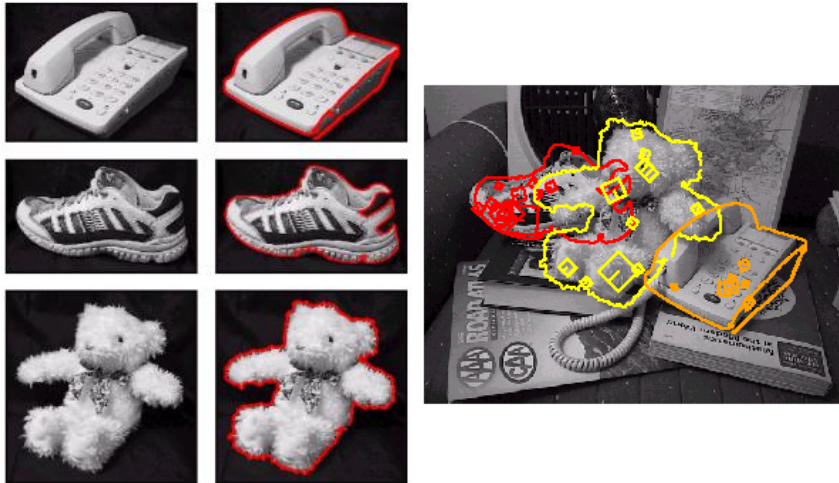


Lots of applications

Features are used for:

- Image alignment (e.g., mosaics)
- 3D reconstruction
- Motion tracking
- Object recognition (e.g., **Google Goggles**)
- Indexing and database retrieval
- Robot navigation
- ... other

Object recognition (David Lowe)



3D Reconstruction



Internet Photos ("Colosseum")

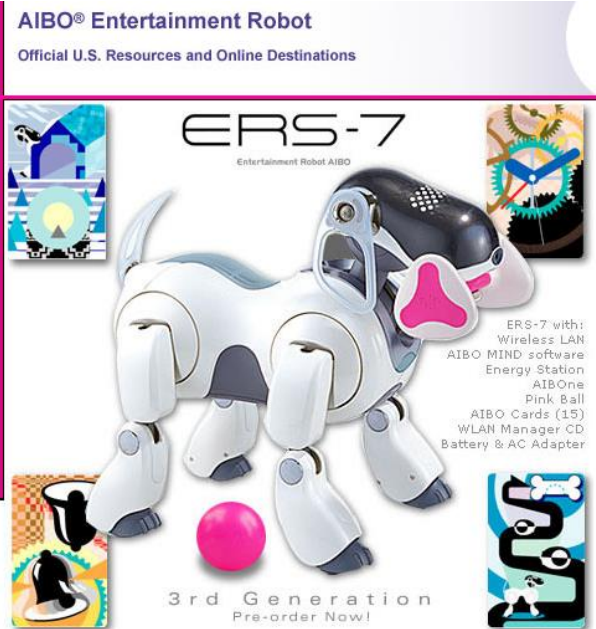


Reconstructed 3D cameras and points

Sony Aibo

SIFT usage:

- Recognize charging station
- Communicate with visual cards
- Teach object recognition



Questions?