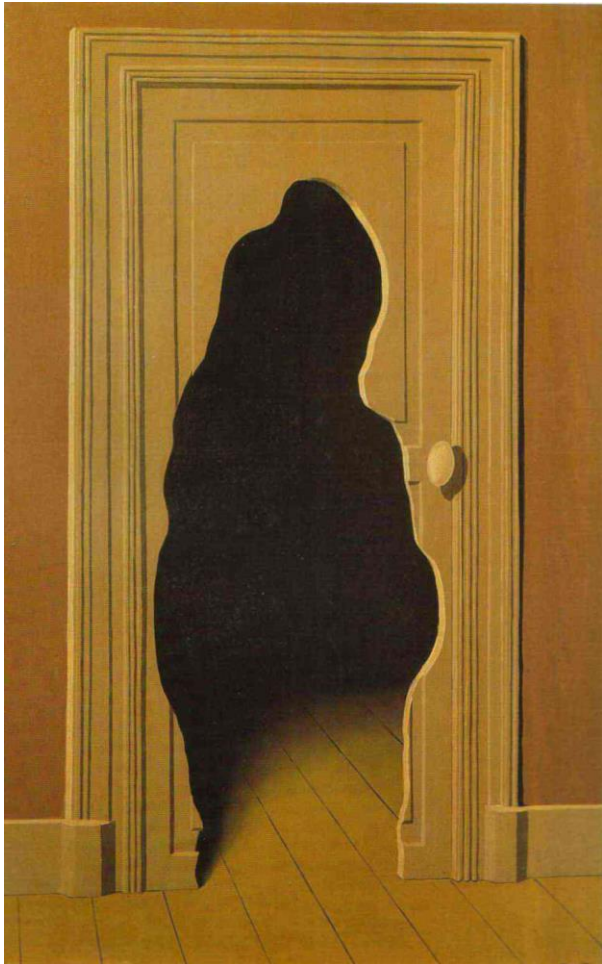


Leveraging Big Data: Photo Completion



René Magritte, "The Unexpected Answer"

CSC320: Introduction to Visual Computing

Slides from Alyosha Efros, Derek Hoiem

Michael Guerzhoy

Google and massive data-driven algorithms

A.I. for the postmodern world:

- all questions have already been answered...many times, in many ways
- Google is dumb, the “intelligence” is in the data



Google Translate



From: English - detected ▼  To: Spanish ▼

My dog once ate three oranges, but then it died.

 Listen

English to Spanish translation

Mi perro se comió una vez tres naranjas, pero luego murió.

 Listen

Chinese Room

- John Searle (1980)





Scene Completion Using Millions of Photographs

James Hays

Alexei A. Efros

Carnegie Mellon University



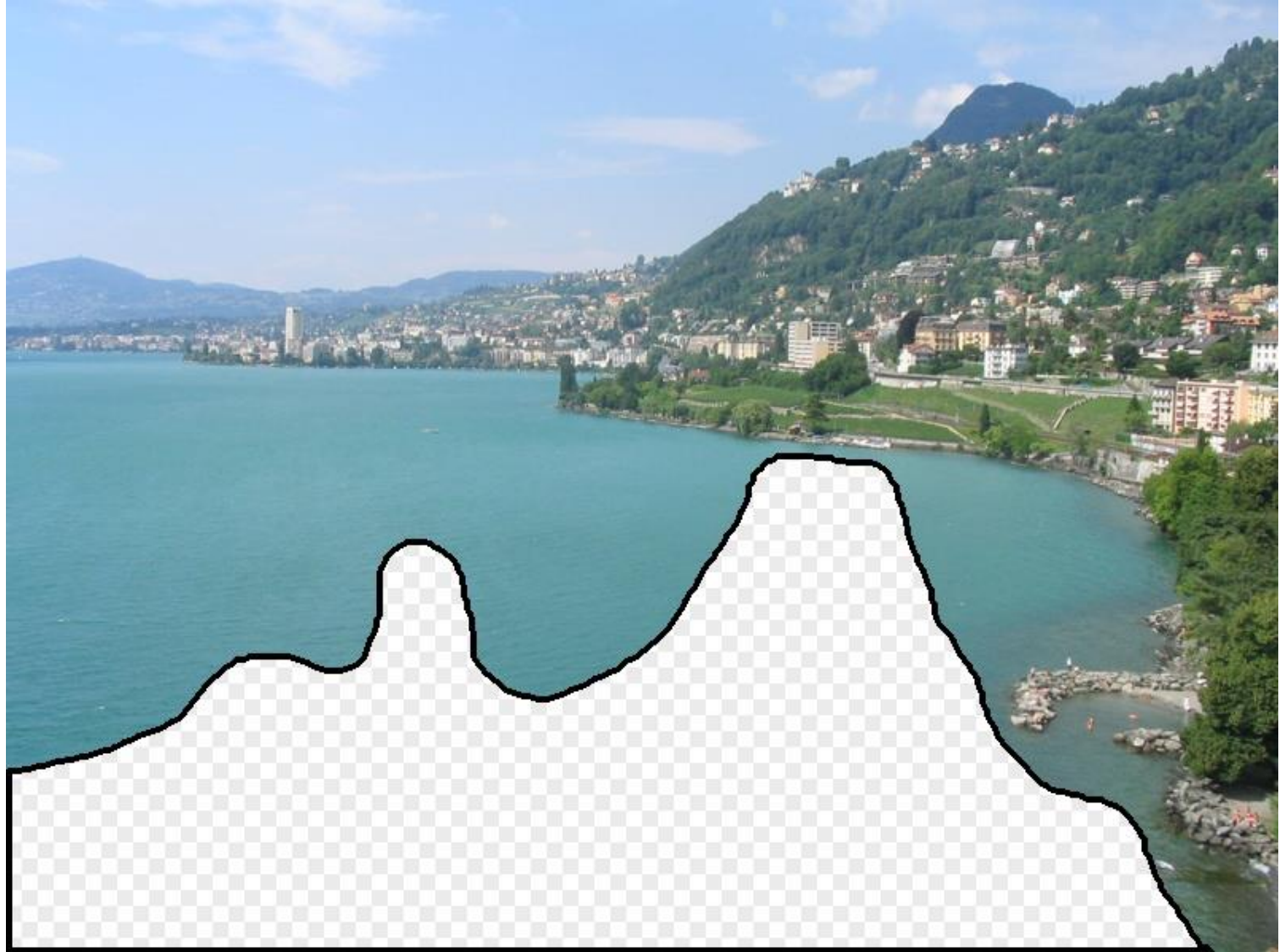
Original Image

Inout

Scene Matches

Output

What should the missing region contain?



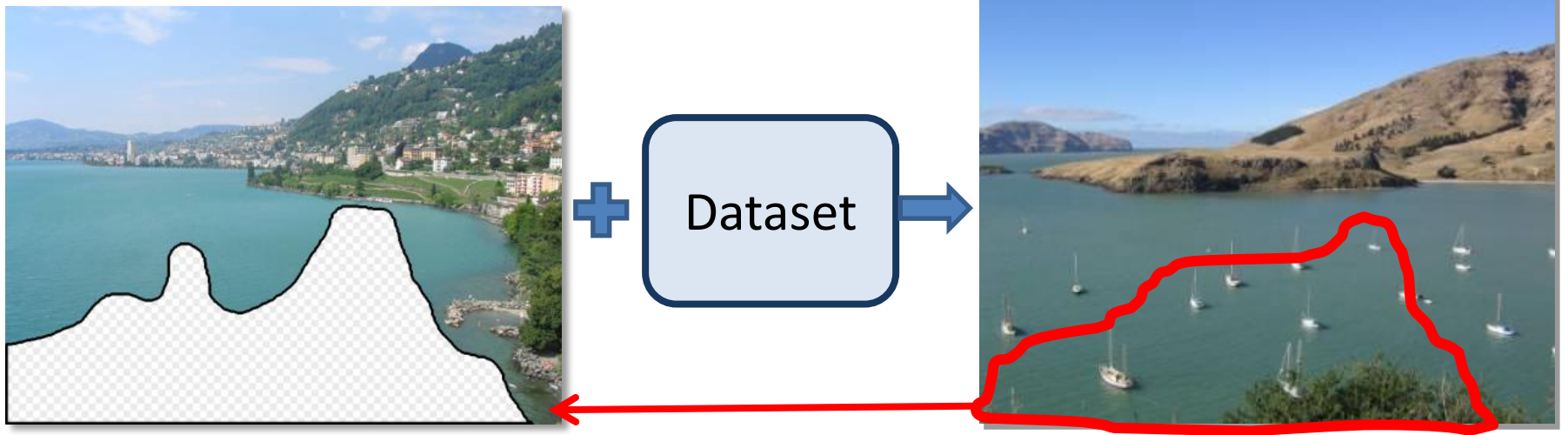




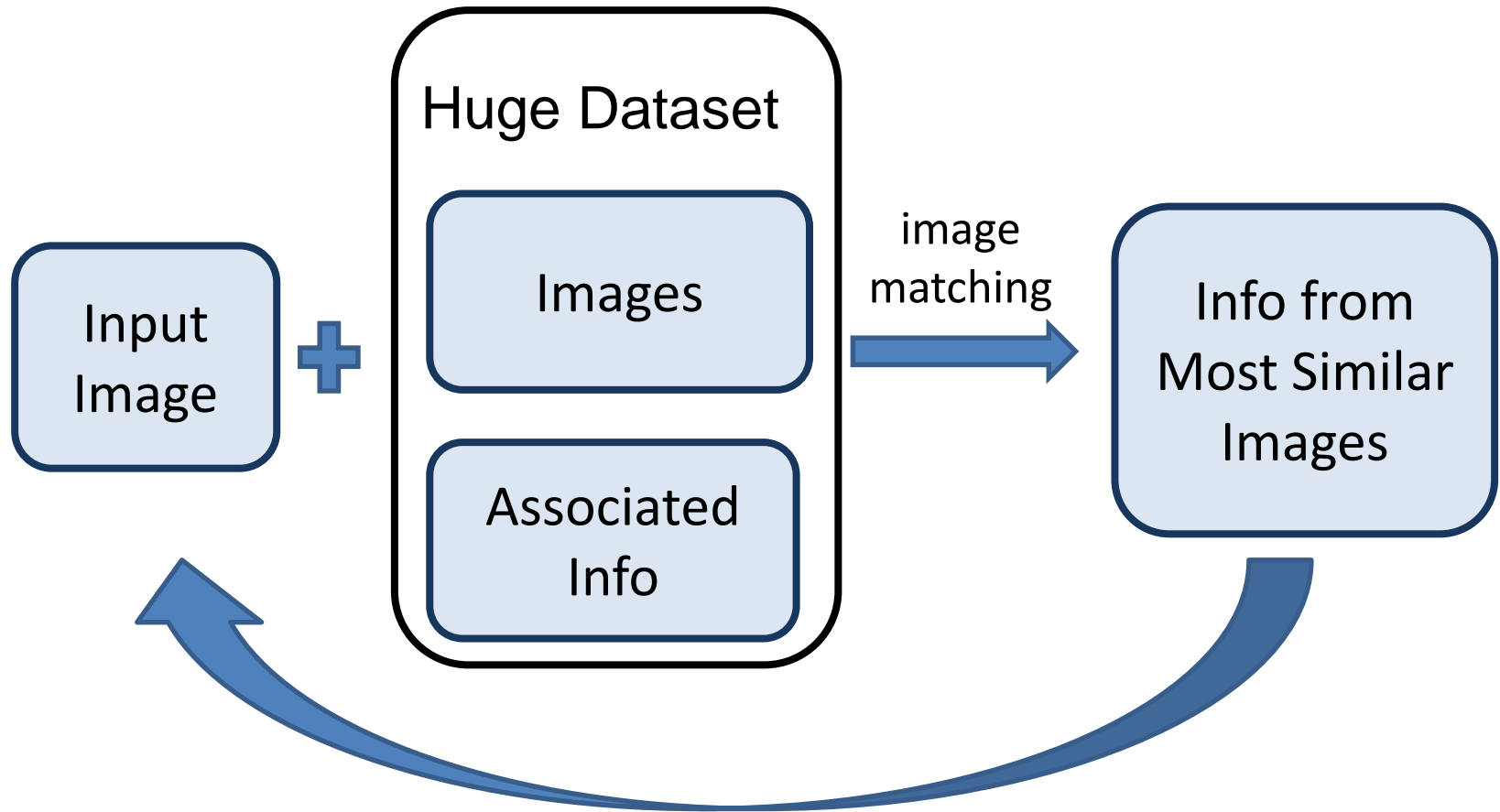


How it works

- Find a similar image from a large dataset
- Blend a region from that image into the hole

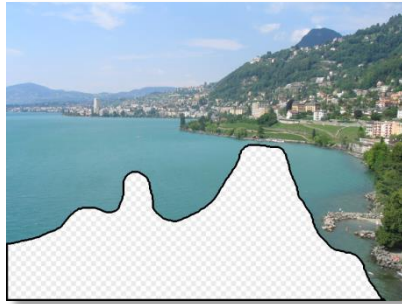


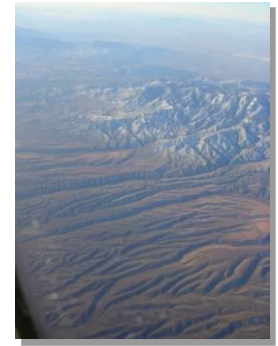
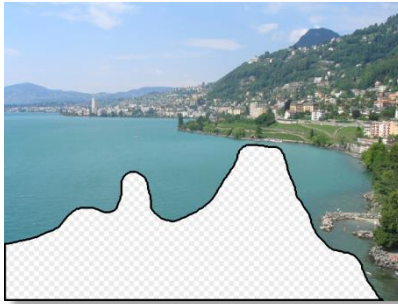
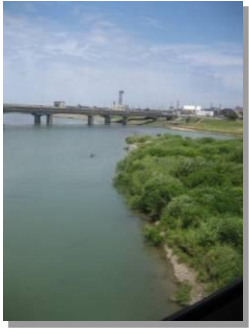
General Principal



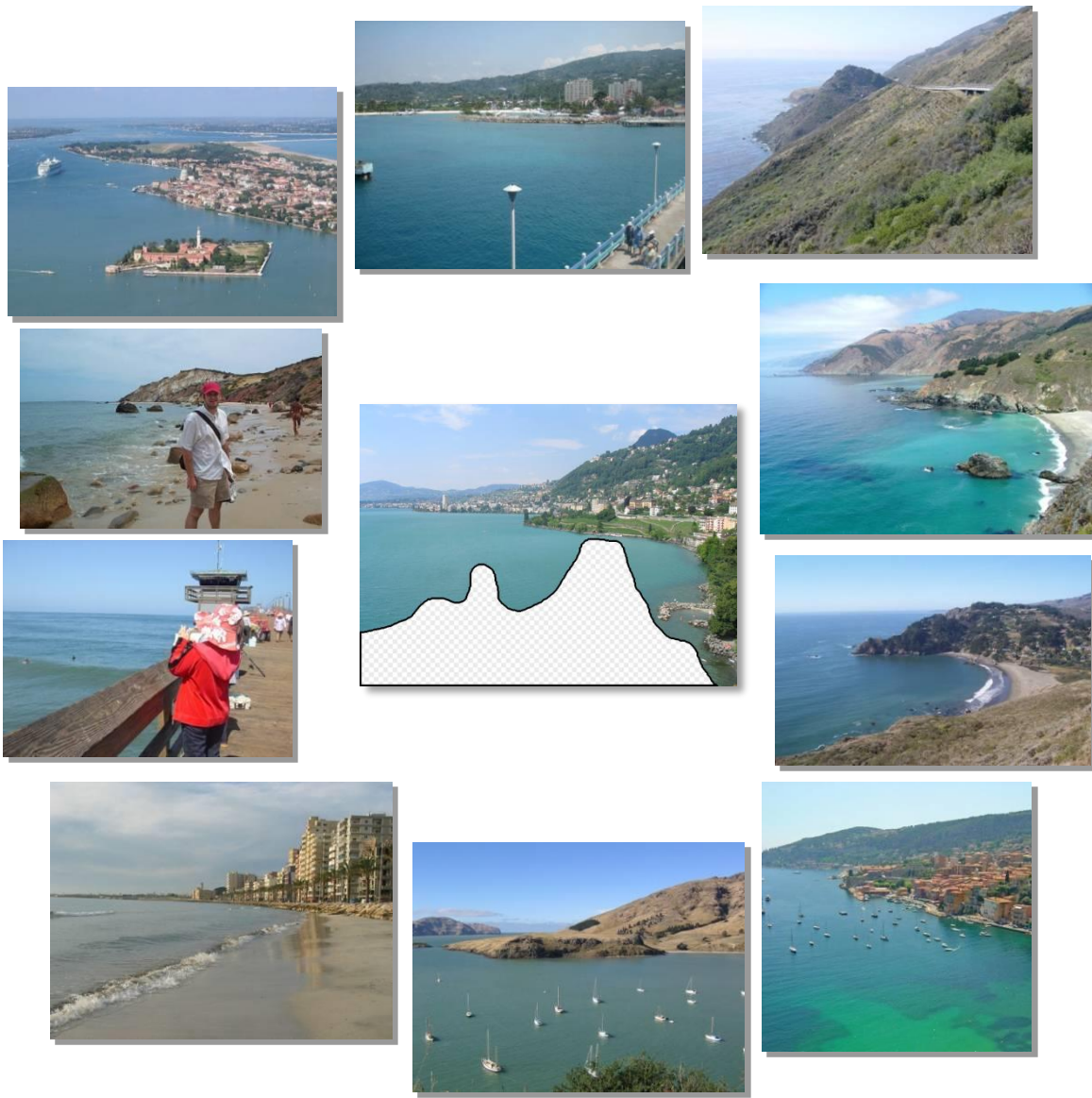
Trick: If you have enough images, the dataset will contain very similar images that you can find with simple matching methods.

How many images is enough?





Nearest neighbors from a collection of 20 thousand images

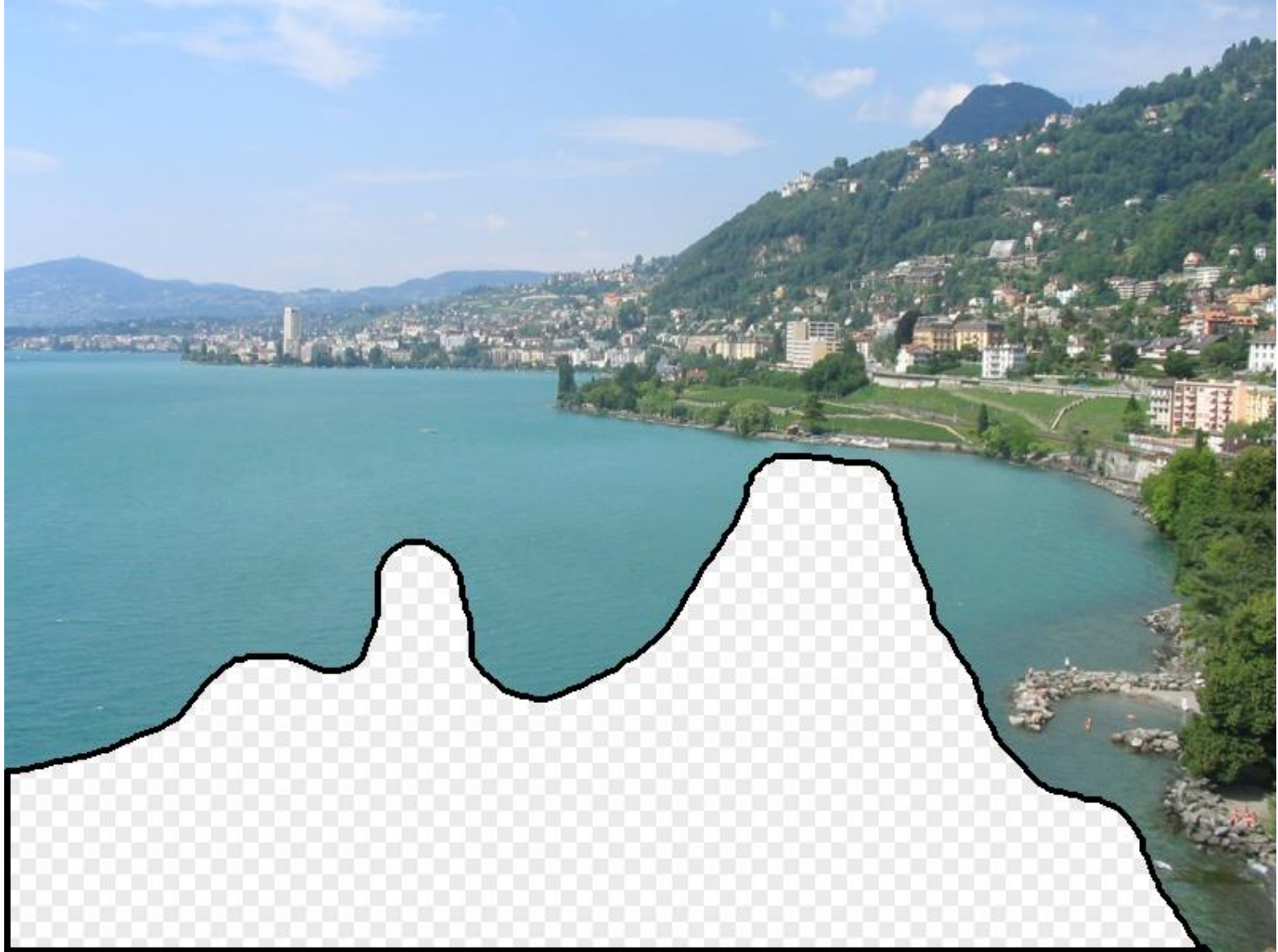


Nearest neighbors from a collection of 2 million images

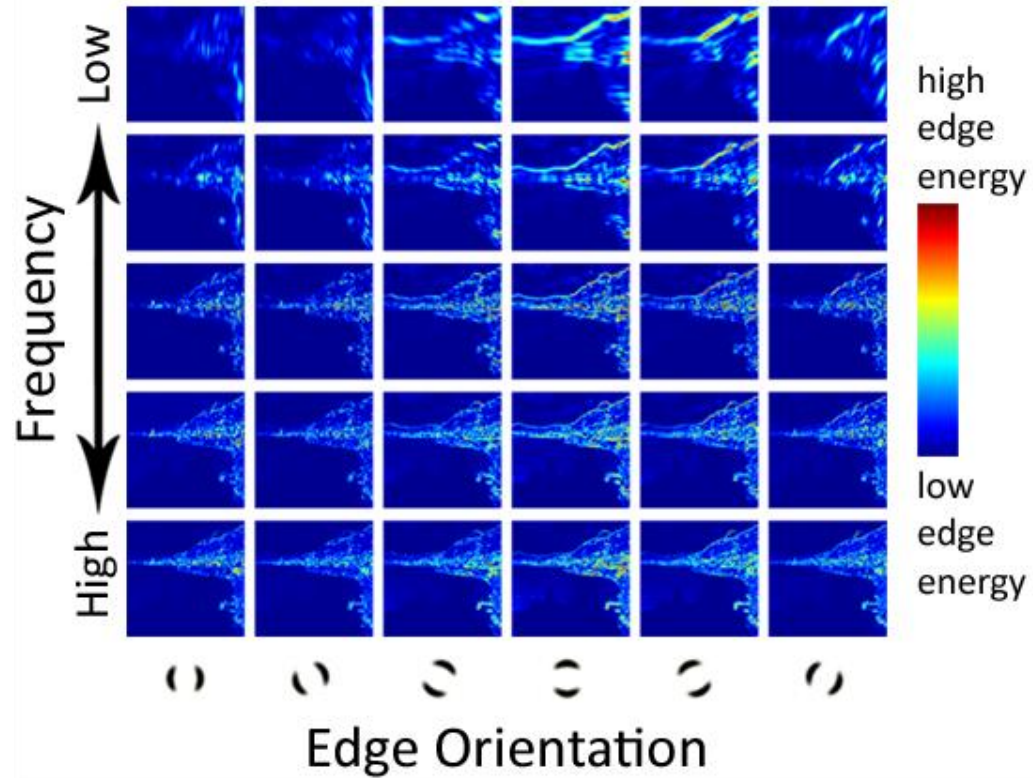
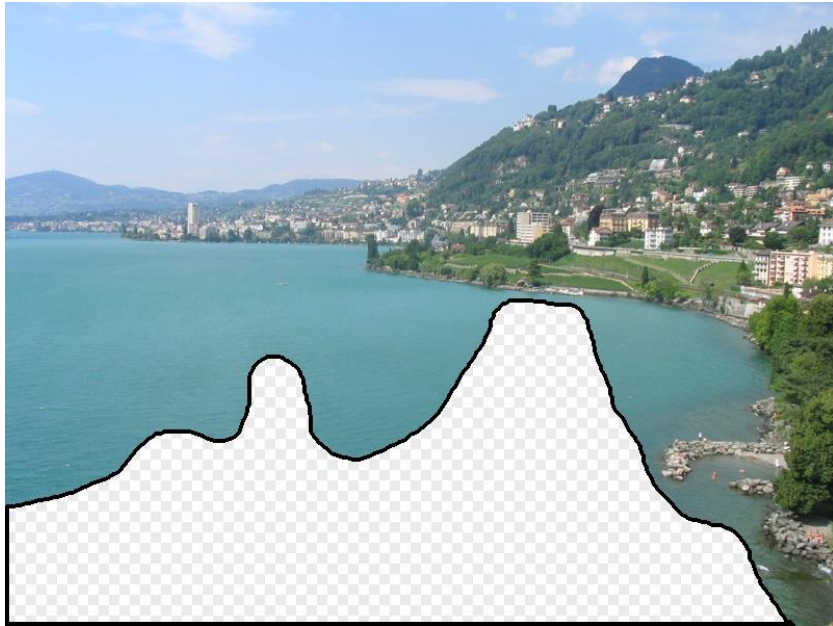
Image Data on the Internet

- Flickr (now)
 - 6 billion images per month
 - More than 100 petabytes of images/video
- Flickr (as of Sept. 19th, 2010)
 - 5 billion photographs
 - 100+ million geotagged images
- Imageshack (as of 2009)
 - 20 billion
- Facebook (as of 2009)
 - 15 billion

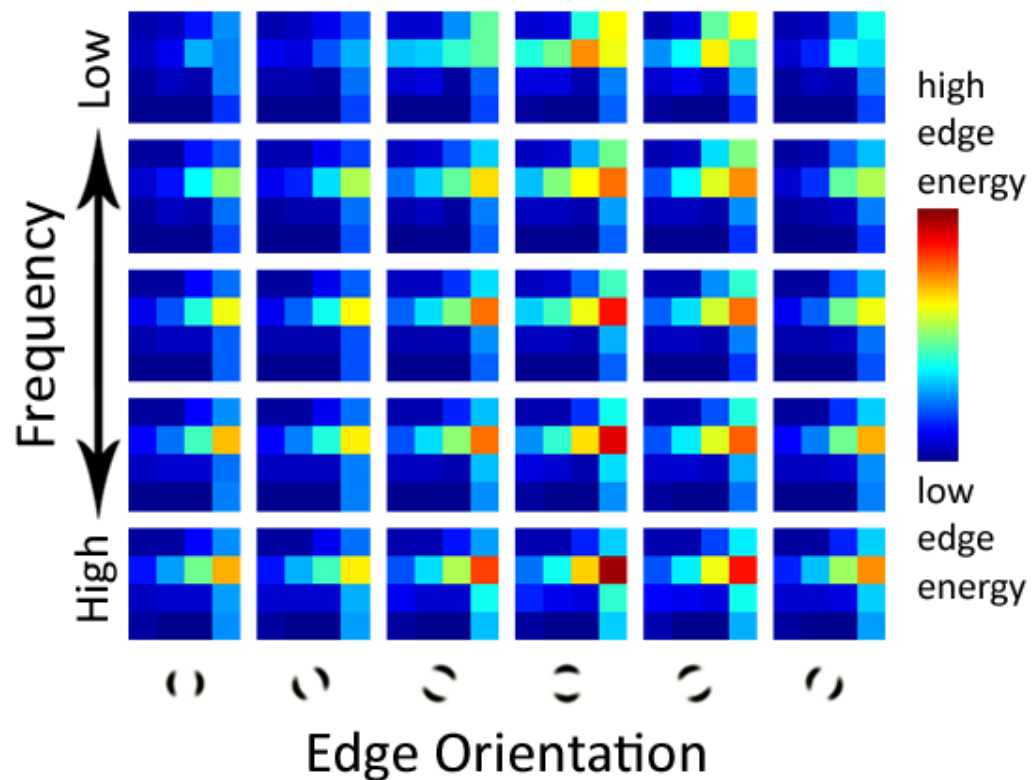
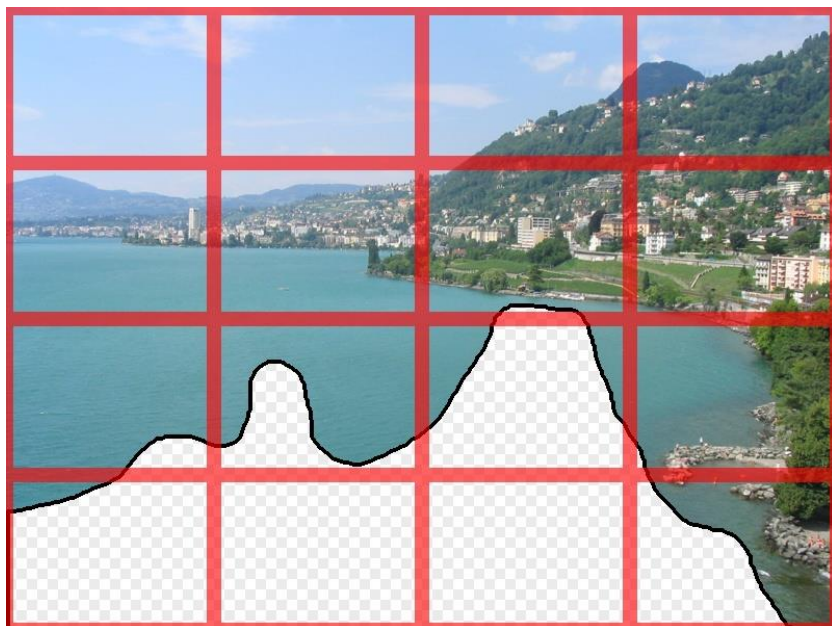
Scene Matching



Scene Descriptor

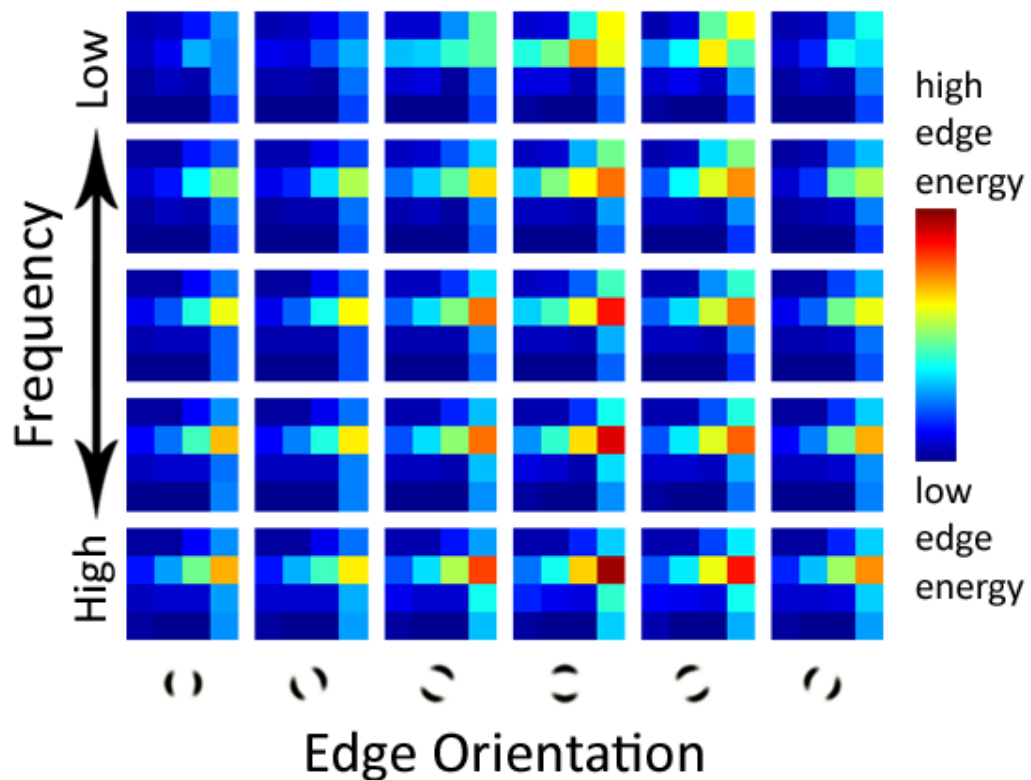
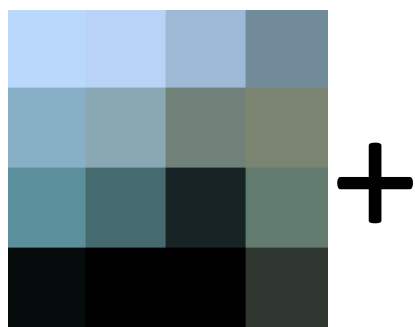


Scene Descriptor



Scene Gist Descriptor
(Oliva and Torralba 2001)

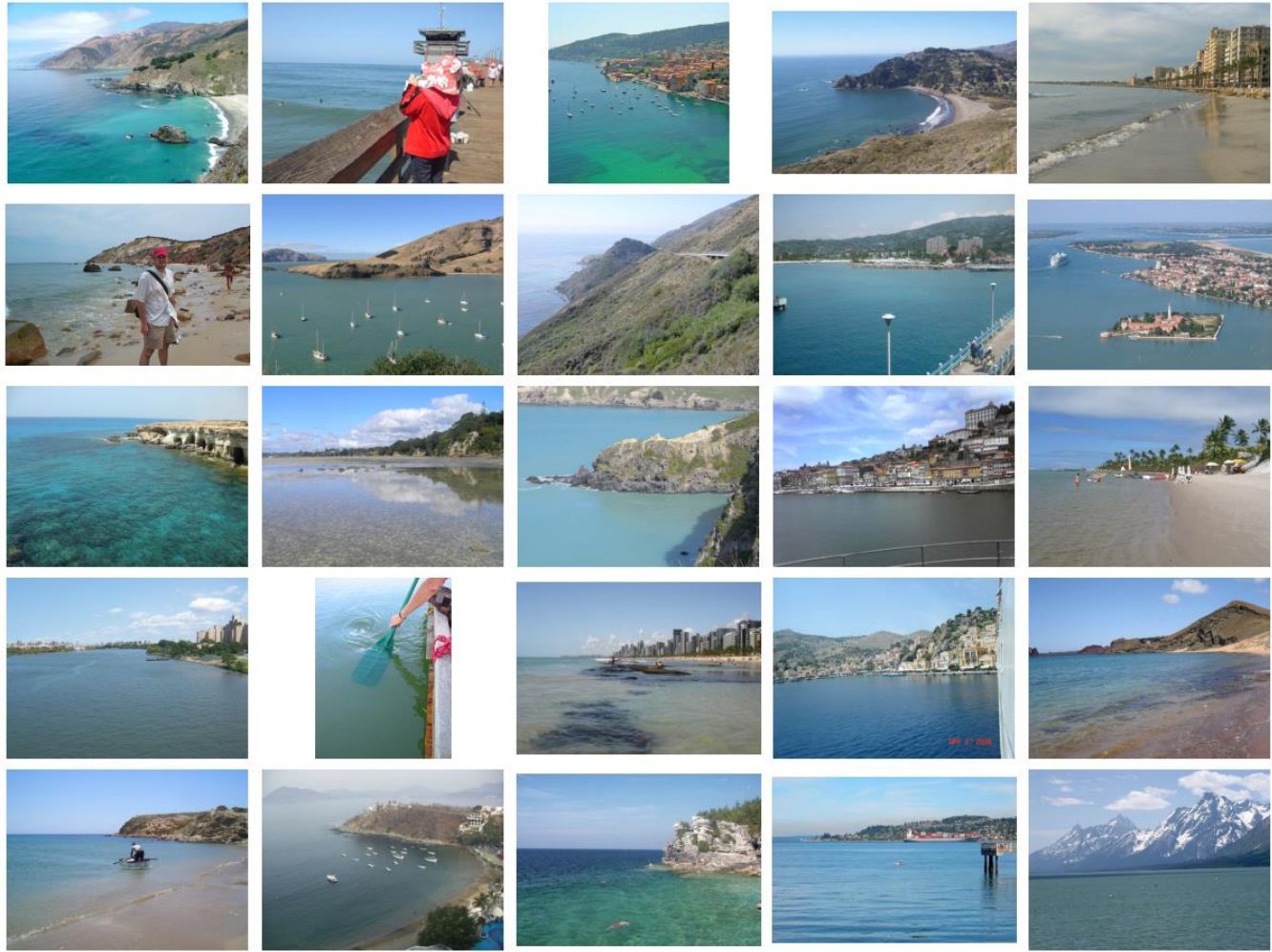
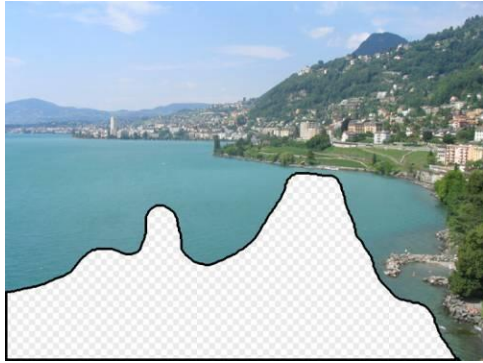
Scene Descriptor



Scene Gist Descriptor
(Oliva and Torralba 2001)

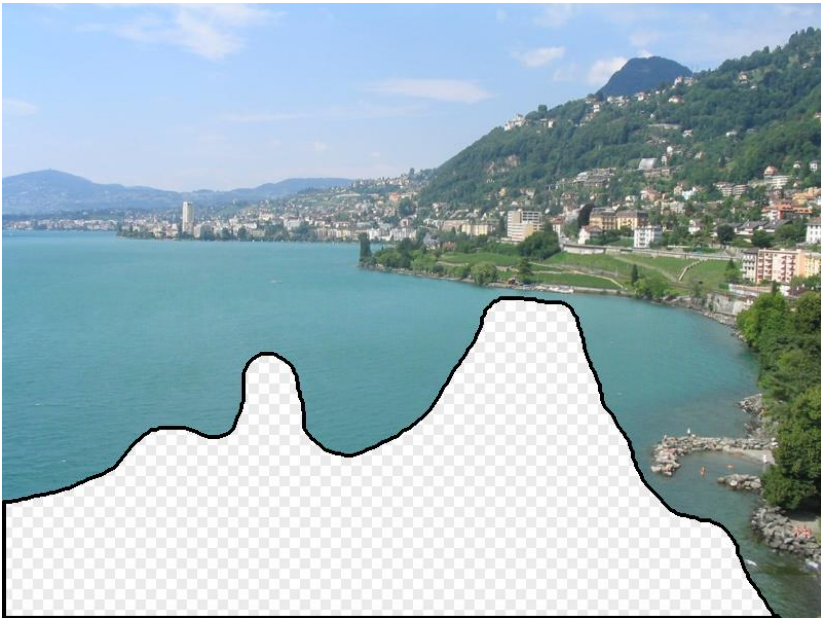
2 Million Flickr Images

The background of the slide is a dense, colorful mosaic of small, square image thumbnails. The thumbnails are arranged in a grid-like pattern, creating a complex, multi-colored texture. The colors are varied, including shades of blue, green, red, yellow, and grey, suggesting a wide range of image content. The overall effect is a rich, textured field of tiny visual elements.



... 200 total

Context Matching





Find the best seam + blend

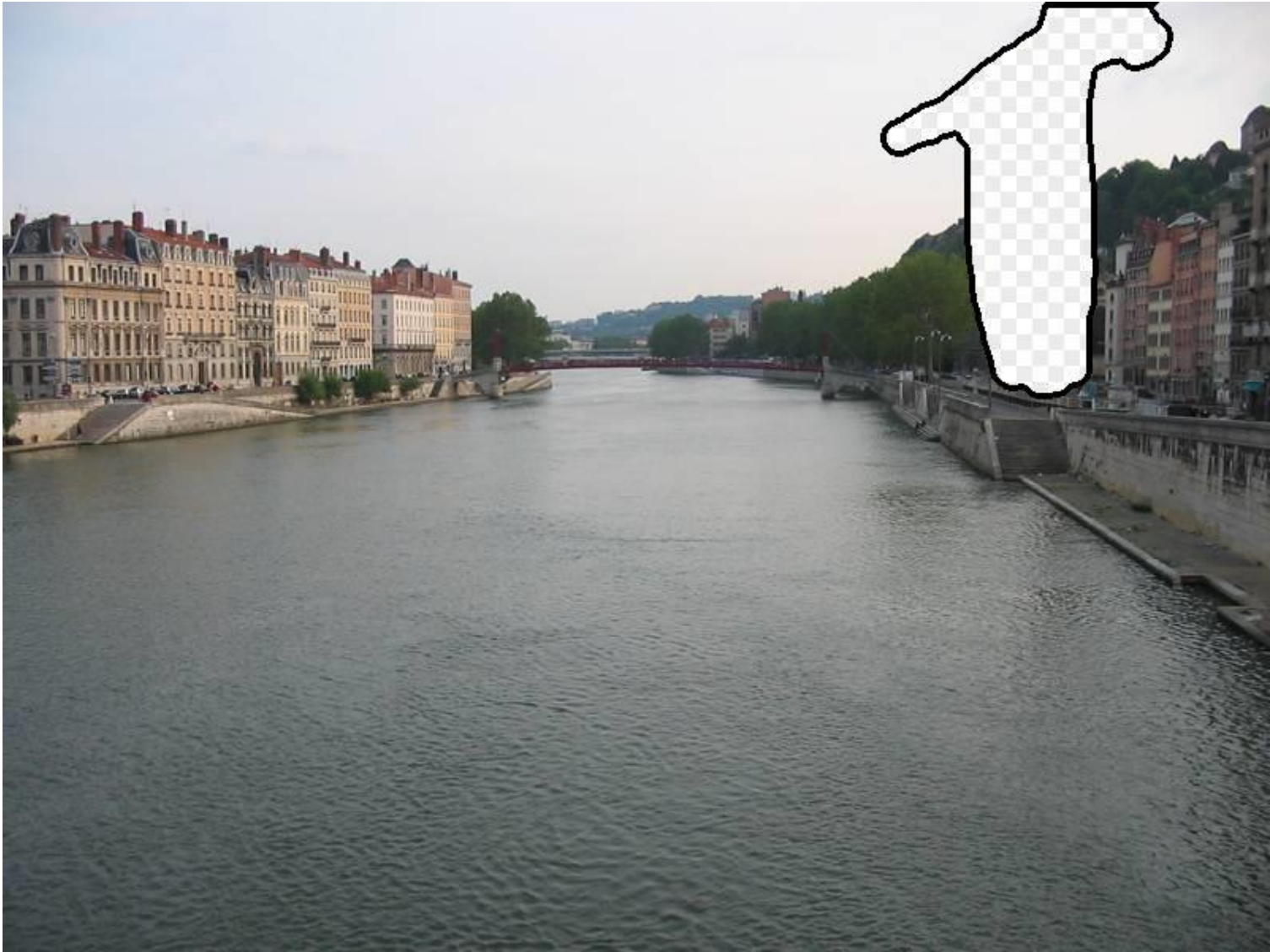




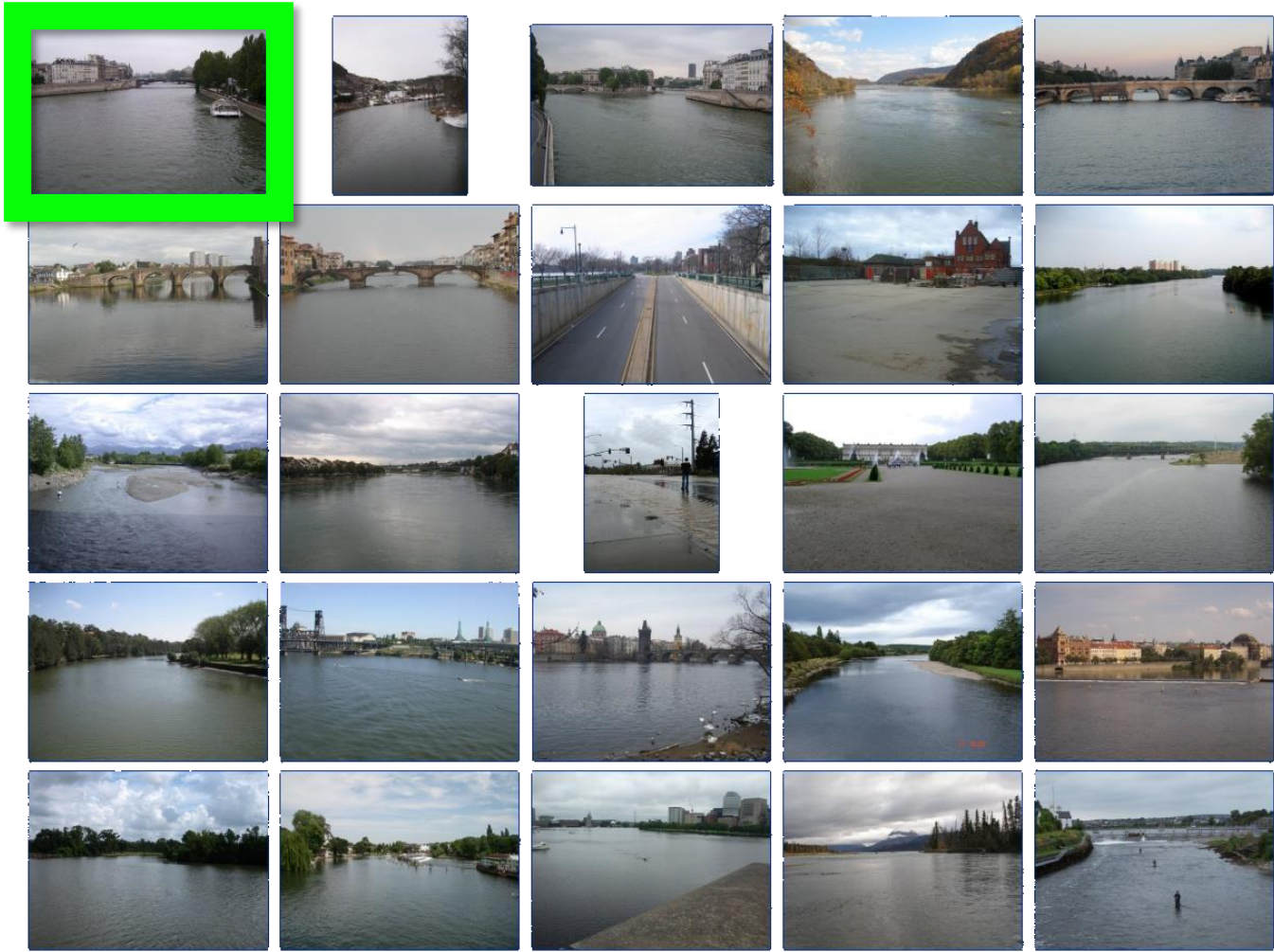












... 200 scene matches





