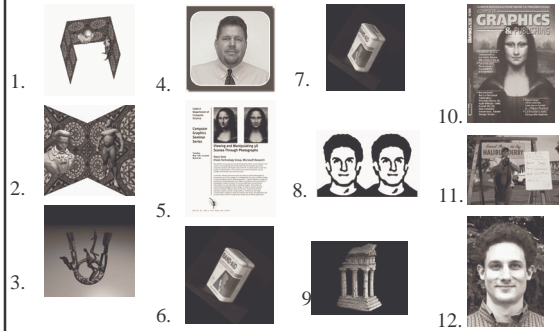




## Content-Based Image Retrieval

Jeff Bigham

## Who is Steve Seitz?



## Goals

- Efficient use of Visual Resources
- Effective Search
- Intuitive Interfaces
- Understanding?

## Image Search Landscape

- Inherits problems of text search
  - Ambiguity
  - Spam
- But vision is hard
  - uses little or no “vision”
  - often reduces to text search
- Rich UI
  - Text
  - Images
  - Video



## Find me an image of a...

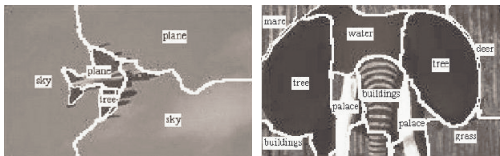
“Pretty girl doing something active, sporty in a summery setting, beach - not wearing lycra, exercise clothes - more relaxed in tee-shirt. Feature is about deodorant so girl should look active - not sweaty but happy, healthy, carefree - nothing too posed or set up - nice and natural looking.”

## images.google.com & flickr.com

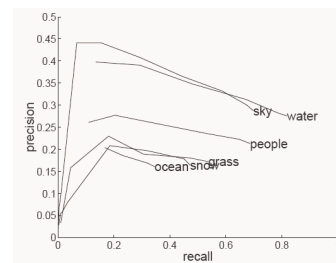
- Collect Associated Text
  - alt, title, longdesc attributes of img tag
  - Information from path (e.g., cow.gif)
  - nearby text on page
- Refinement
  - remove duplicates
  - cluster-based improvement
- Other
  - PageRank, etc.

## Matching Words and Pictures

- Learn text/image segment association
  1. Segment image
  2. Generate feature vector for each segment
  3. Associate text with the segment features
  4. Build generative probabilistic model for text given segmentation features



## Matching Words and Pictures

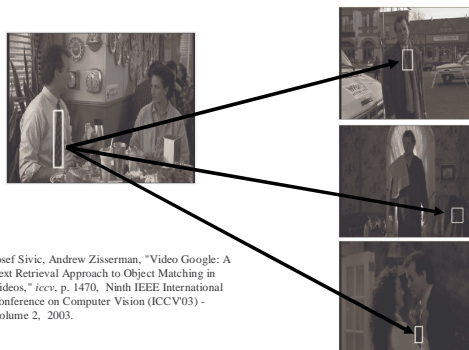


Kobus Barnard, Pinar Duygulu, Nando de Freitas, David Forsyth, David Blei, and Michael I. Jordan, "Matching Words and Pictures", Journal of Machine Learning Research, Vol 3, pp 1107-1135, 2003.

## Other Ways of Searching

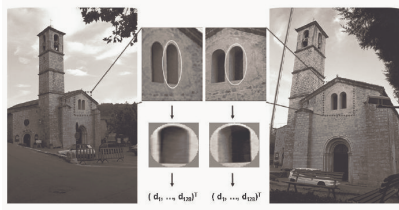
- Search by Text
- Search by Example
- Search by Drawing
- Search by Model

## Other Search Interfaces?



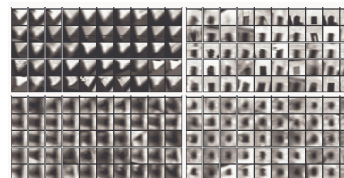
## Video Google

- Viewpoint Invariant Descriptors



## Video Google

- Visual Vocabulary



## Inverted Index

Document 1		Word	Document
Now is the time		aid	1
for all good men	→	all	1
to come to the aid		and	2
of their country.		can	2
		come	1, 2
		country	1
Document 2		for	1
Summer has come	→	good	1
and passed. The innocent		...	...
can never last.		the	1, 1, 2
		...	...

## Video Google

(Demo of Video Google)

## Computer Vision is Hard

- But, humans do it well

**The ESP Game**  
As seen on CNN and  
newspapers around the world

Luis von Ahn

(ESP Game Demo)

## Vision as Security?

- True image search is a hard AI problem



The End

