Photo Quality Assessment

CS129 Computational Photography
James Hays, Brown University, Fall 2012

Today

- Project 6 questions
- Wednesday class will be a discussion period
- What makes a good photo?

What Makes a Great Picture?

© Robert Doisneau, 1955

With many slides from Alyosha Efros,
Yan Ke, as annotated by Tamara Berg

Photography 101

- Composition
  - Framing
  - Rule of Thirds
  - Leading Lines
  - Textures and Patterns
- Lighting
  - Color coordination / balance

Framing

“Photography is all about framing. We see a subject -- and we put a frame around it. Essentially, that is photography when all is said and done.”

-- from photo.blorge.com

Frame serves several purpouses:

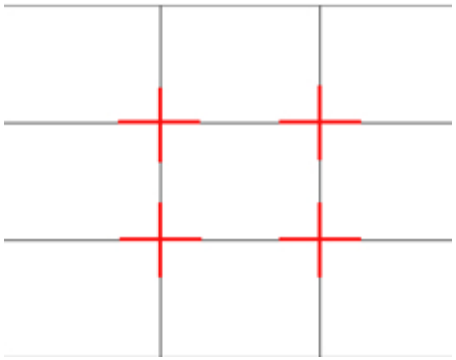
1. It gives the image depth
2. Use correctly, framing can draw the eye of the viewer of an interest to a particular part of the scene.
3. Framing can bring a sense of organization or containment to an image.
4. Framing can add context to a shot.

http://digital-photography-school.com/blog/frame-your-images/

Examples of nice framing

http://flickr.com/photos/paulosacramento/226545698/
http://flickr.com/photos/chrisbeach/13868545/
http://flickr.com/photos/74531485@N00/929270814/
http://flickr.com/photos/freakdog/223117229/
http://flickr.com/photos/cdm/253805482/

Rules of Thirds



http://www.photo96.com/blog/?p=371

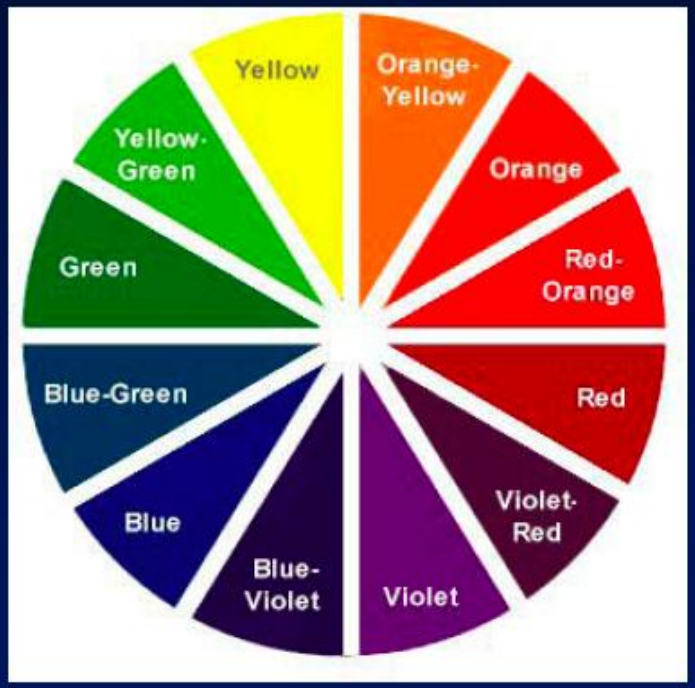
Other examples

Leading Lines

More examples

Textures and Patterns

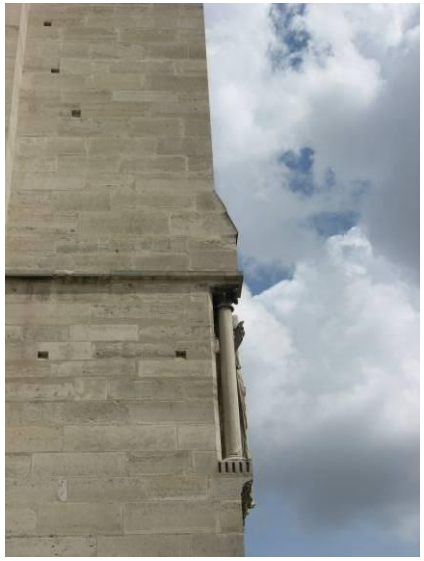
Color Coordination



Complementary colors (of opposite hue on color wheel)

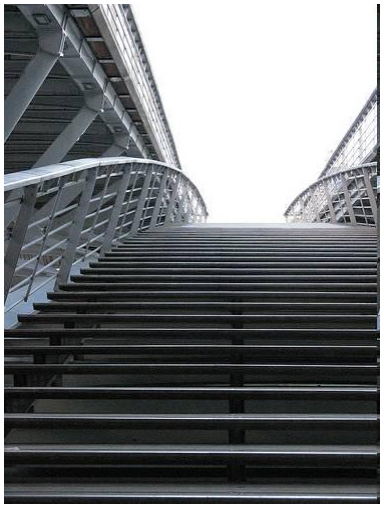
Anyone can take great pictures…

Alyosha claims to be a bad photographer…



…but a pretty good photo critic!




http://flickr.com/photos/aaefros/

# of my Paris photos on Flickr: 32

Total # of Alyosha's Paris photos: ~1250 **~2%**

The Postmodern Photographer

The Old Days: a pre-process

- Load film
- Find subject
- Position camera
- Set all the settings “just right”
- Take a deep breath…
- ...Press buttom!

The New Digital Days: a post-process

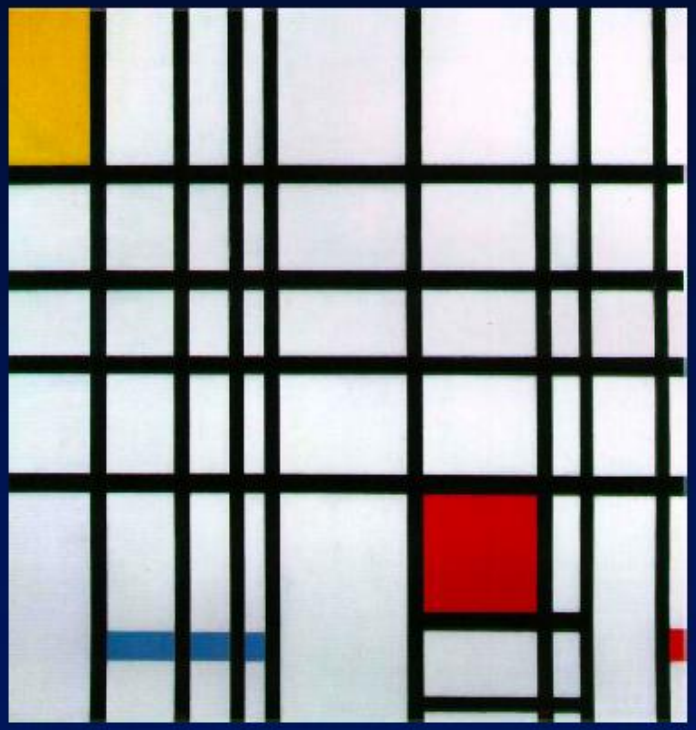
- Get a 16 GB memory cartridge
- Take pictures like there is no tomorrow!!!
- …
- Back home, spend hours of agony trying to find 1-2 good ones

Outline

- Photography 101
- Recognition (CVPR '06)
  - What makes one photo better than another?
  - What features can we extract?
  - How can we measure our performance?

Y. Ke, X. Tang, and F. Jing. *The Design of High-Level Features for Photo Quality Assessment*. CVPR 2006.

Not Critiquing Art



Piet Modrian

Lothar Wolleh

Not considering semantic measures of what makes a photo good (subject matter, humor, etc).
Professional = those you would frame, snapshot = those that would stay in photo album.

What makes one photo better than another?

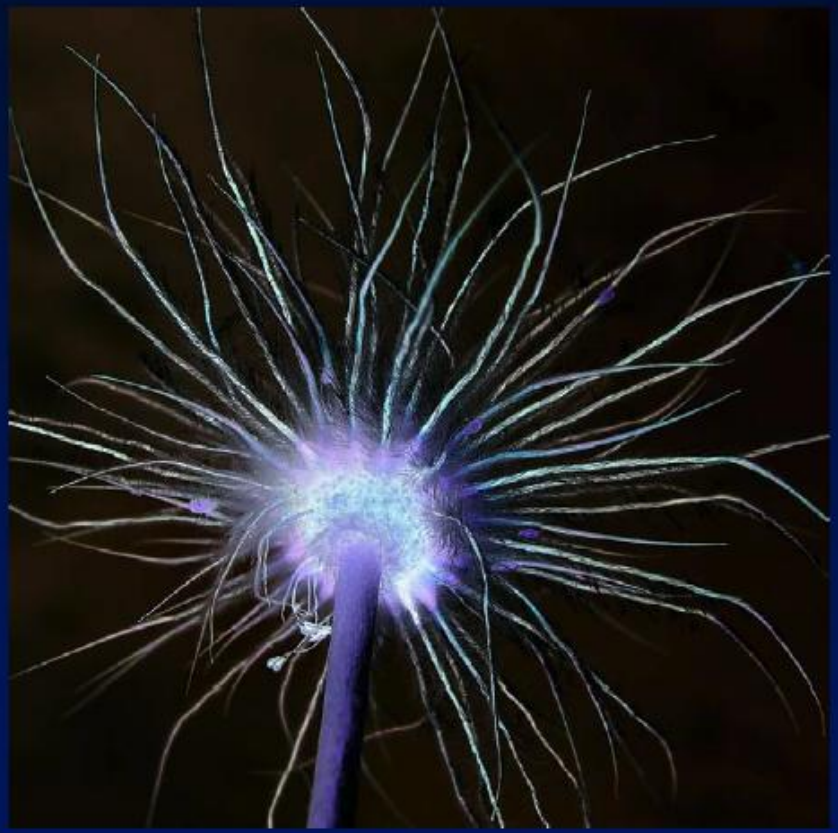
- Simplicity
- Realism
- Basic photographic techniques

Simplicity

"Look Into" by Josh Brown @ Flickr

Prof - Obvious what one should be looking at ie easy to separate subject from the background. Snap – unstructured, busy, filled with clutter.

Simplicity



"alien flower" by Josef F. Stuefer @ Flickr

Simplicity

"Waiting in line!" by Imapix @ Flickr

Basic techniques

- Blur - Snaps – entire photo blurry indicates poor technique. Prof - background out of focus by widening the lens aperture, but foreground in sharp focus.
- Contrast and brightness

Make the subject pop out by choosing complementary colors for subject & background. Isolate the subject by increasing lighting contrast between subject & background.

Abstract concepts - “Good composition, color & lighting”

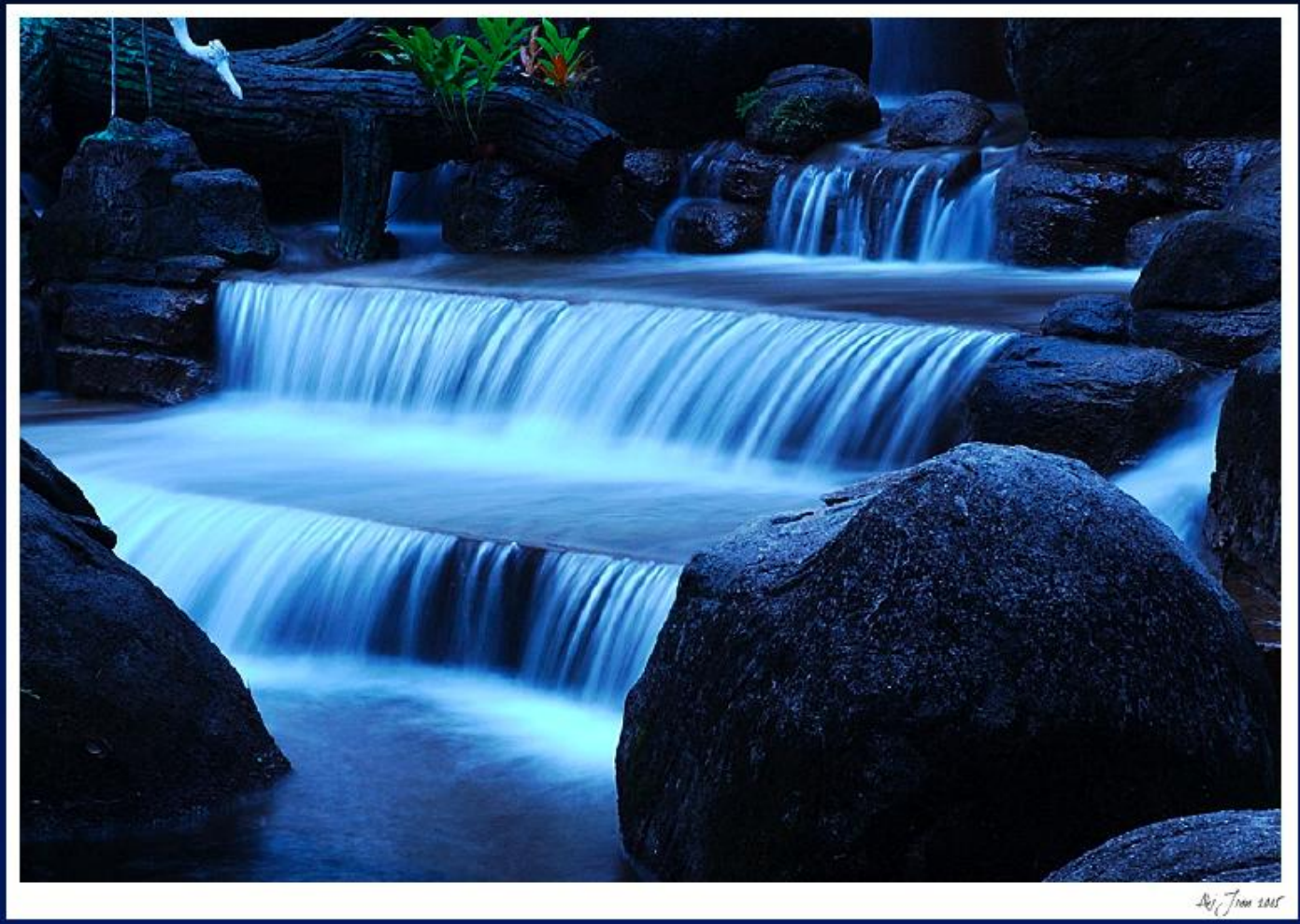
(Sur) Realism

Snaps look real, while prof photos look surreal.

"Golden Gate Bridge at Sunset" by Buzz Andersen @ Flickr

"Golden Gate 3" by Justin Burns @ Flickr

(Sur) Realism



"Somewhere Only We Know Prt2 (sic)" by Aki Jinn @ Flickr

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Features – Spatial Distribution of Edges

More edges near border due to background clutter

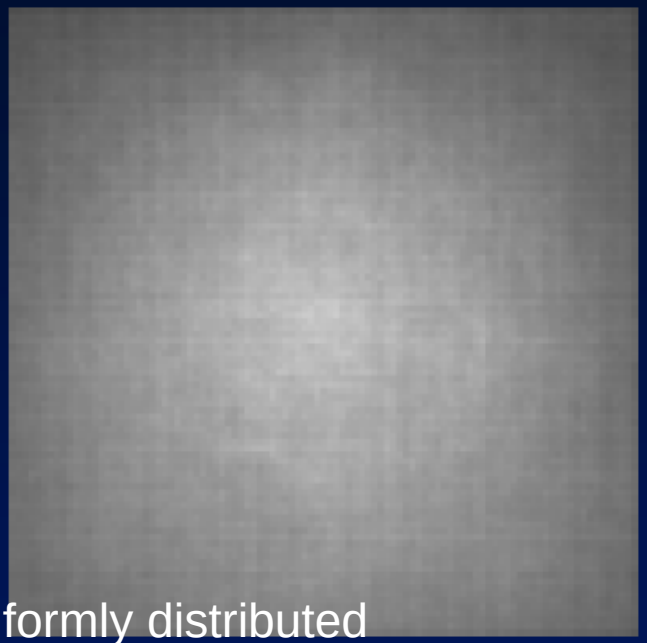
More edges near center of img

"Picture of a picture…" by Ted Johnson @ Flickr

Trying to capture a photo's "simplicity"

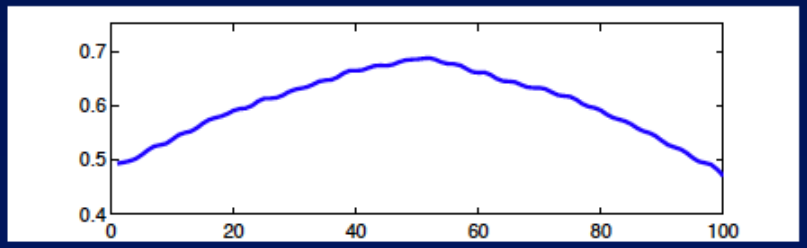
Spatial Distribution of Edges

Mean Laplacian of snapshots



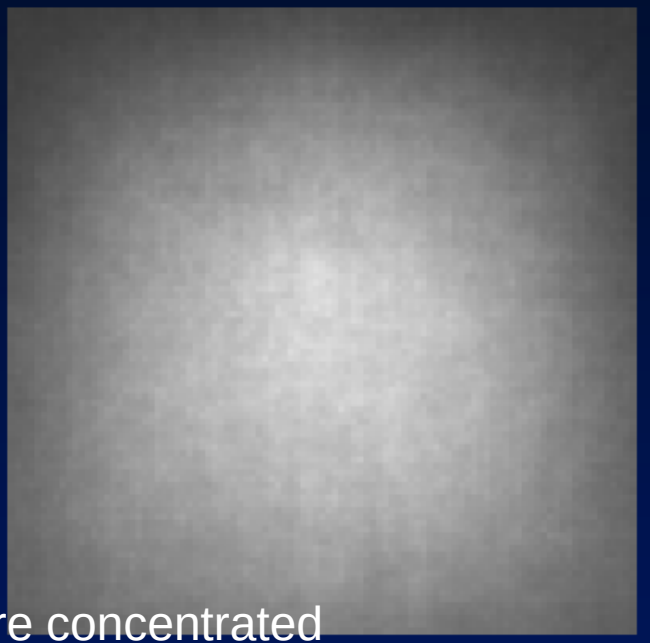
M_s

More uniformly distributed



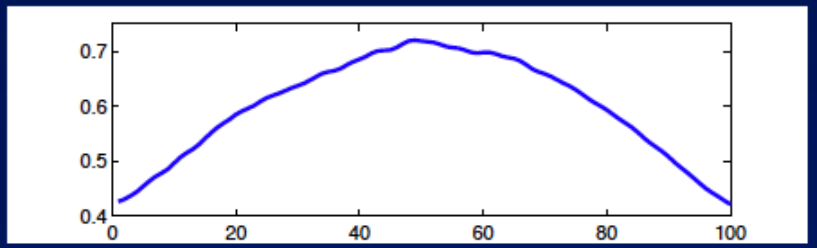
Low quality photos

Mean Laplacian of professional



M_p

More concentrated



High quality photos

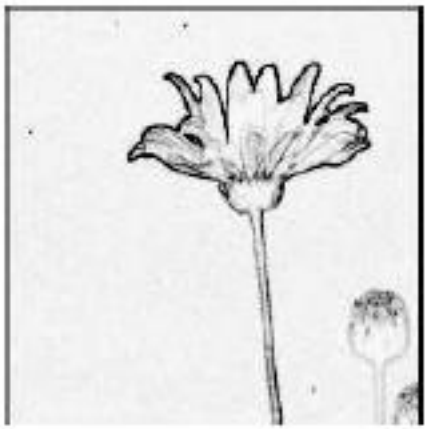
Expect high quality photos to have high spatial frequency edges nearer to center than snapshots

Edge width

Calculate area that edges occupy – width of bounding box covering 96% of edge energy

Cluttered regions should tend to produce a larger bounding box, and well defined subjects should produce a smaller one.

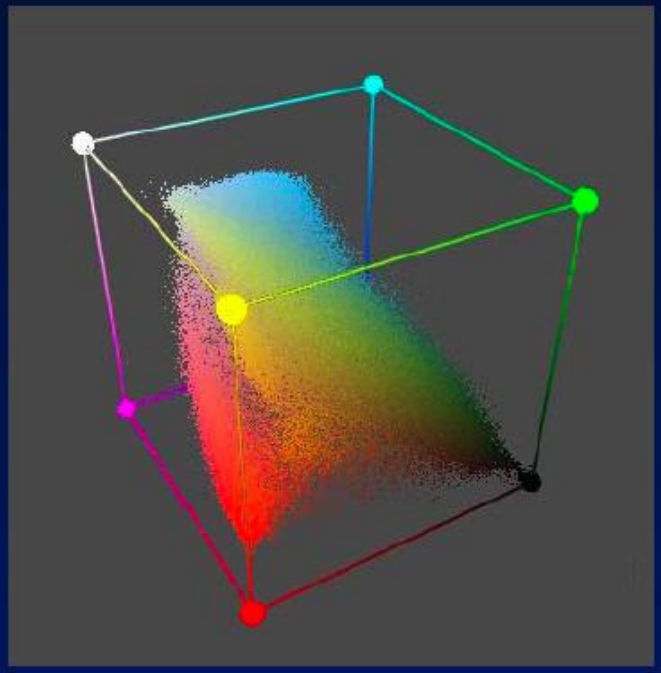
.94

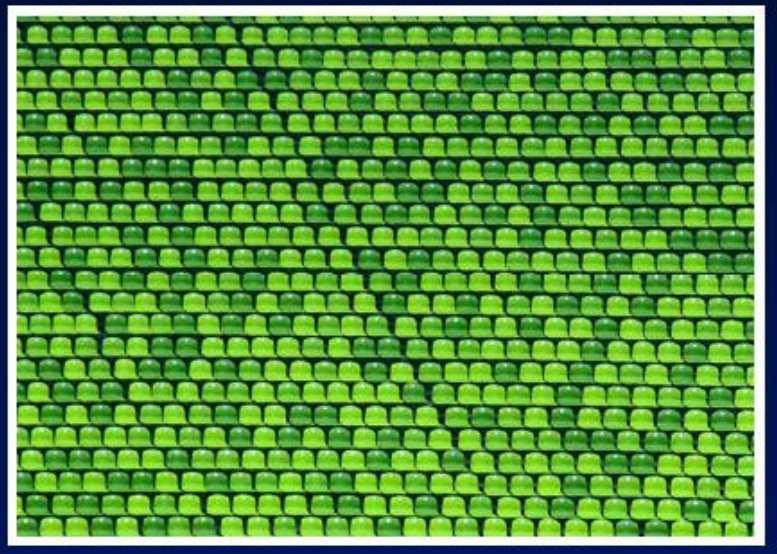


.56

Color Distribution

- K-NN on color histogram



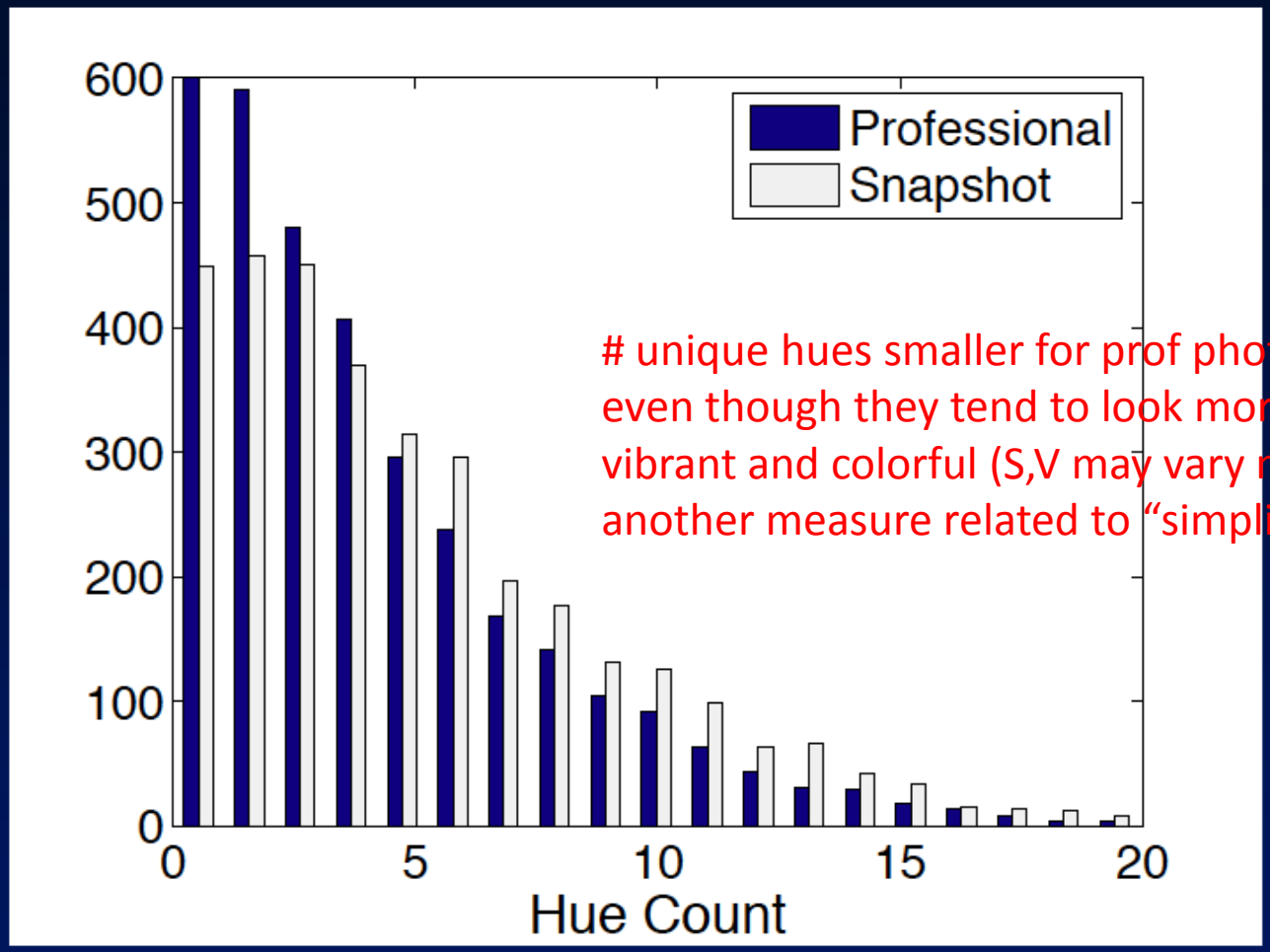


$$q_{cd} = \#professional\_neighbors$$

For query image find k nearest neighbors in training set. Quality = number of prof neighbors in top 5.

20 bin histogram defining possible unique hues

Hue Count



unique hues smaller for prof photos even though they tend to look more vibrant and colorful (S,V may vary more) – another measure related to "simplicity"

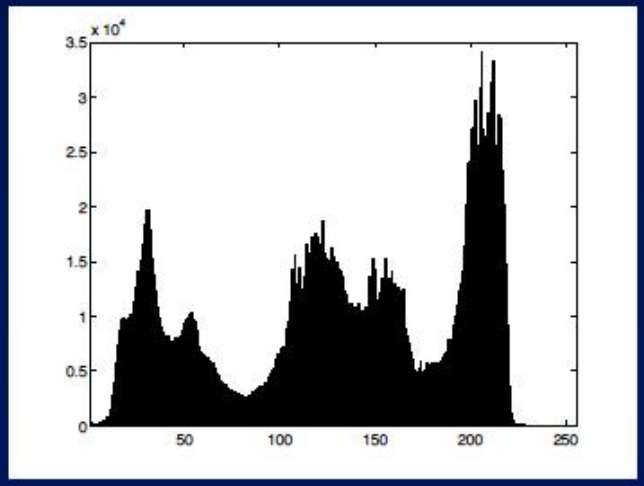
$$q_h = 20 - (\#\ hues > threshold)$$

Blur

- Look at frequency distribution.
- Measure the amount of blur in the sharpest object, instead of the *average* blur.

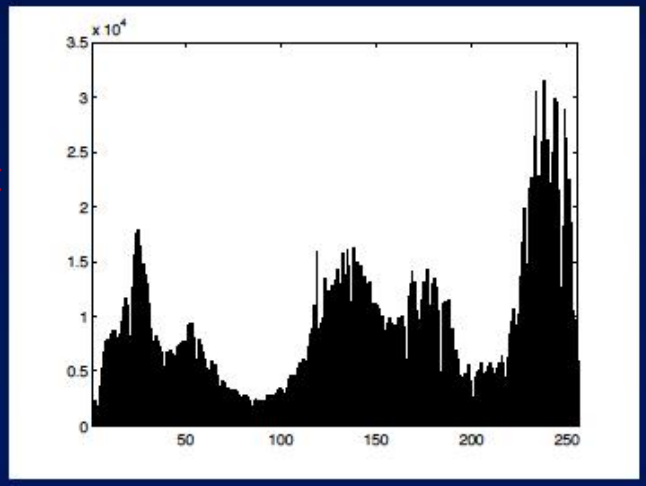
Prof photos should have some part of photo in sharp focus

Low Level Features - Contrast

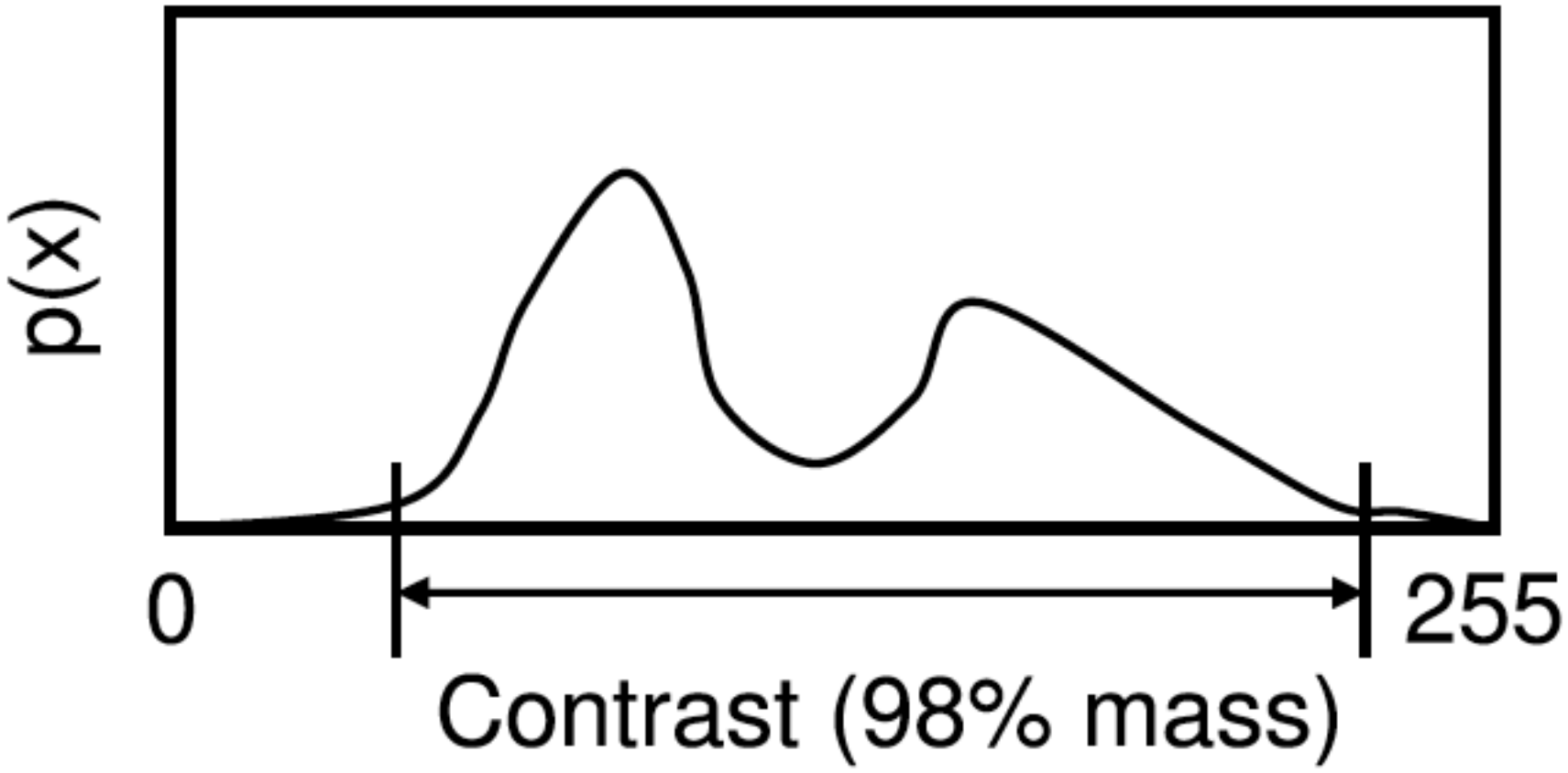


Prof photos usually have higher contrast

Contrast = width of middle 98% mass of hist



Contrast



Low Level Features – Avg. Brightness

Professional photographers may adjust exposure to be correct on subject only so subj pops from bkd. Cameras tend to adjust brightness to average at 50% gray, but prof photos might deviate significantly. Use ave brightness as feature.

Classifier

- Naives Bayes
- We assume independence of the features
- We achieve better results with added features even though they are not independent.

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Dataset – DPChallenge.com

Use photos average rating as ground truth quality measure

Use only top 10%, bottom 10% as dataset.

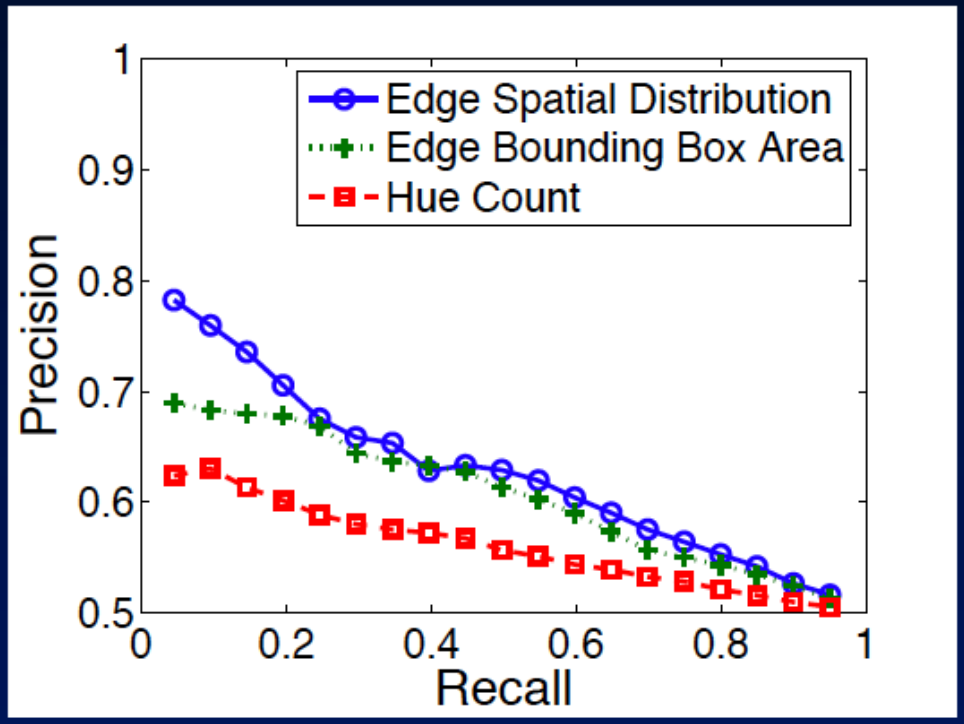
Use half for training/half for testing.

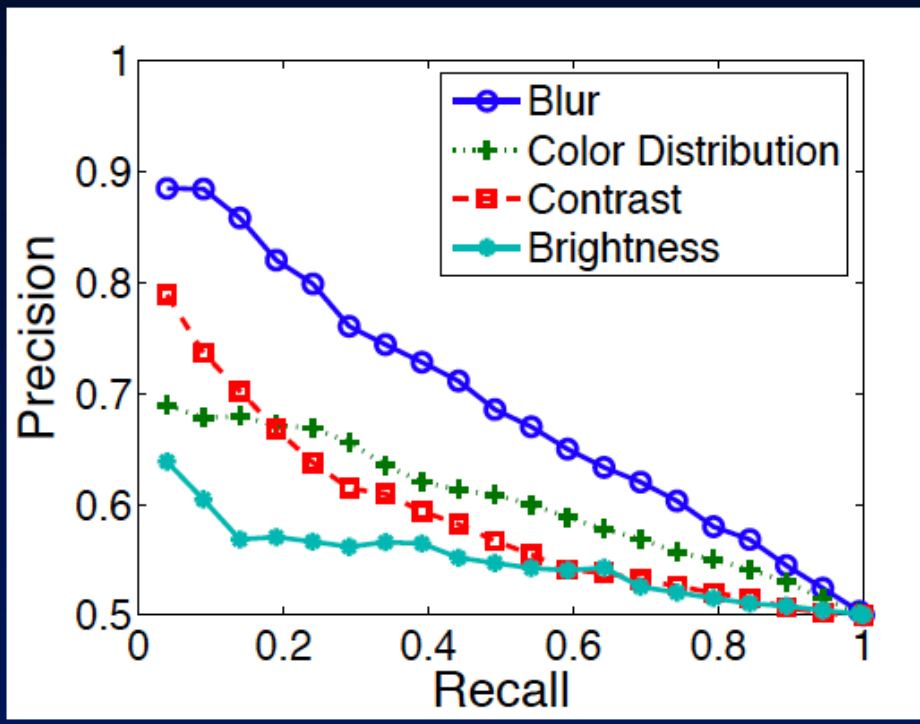
Statistics	Voting Breakdow
Place: 1 out of 829	1 0
Avg (all users): 7.987	2 1
Avg (commenters): 8.805	3 2
Avg (camera): 7.998	4 5
Avg (no camera): 6.333	5 24
Views since voting: 6597	6 54
Views during voting: 1003	7 89
Votes: 478	8 109
Comments: 190	9 89
Favorites: 133 (view)	10 105
Add this photograph to your favorites!	

Photo contest website, user rated

60K photos
40K photographers
10/90 percentile

Results





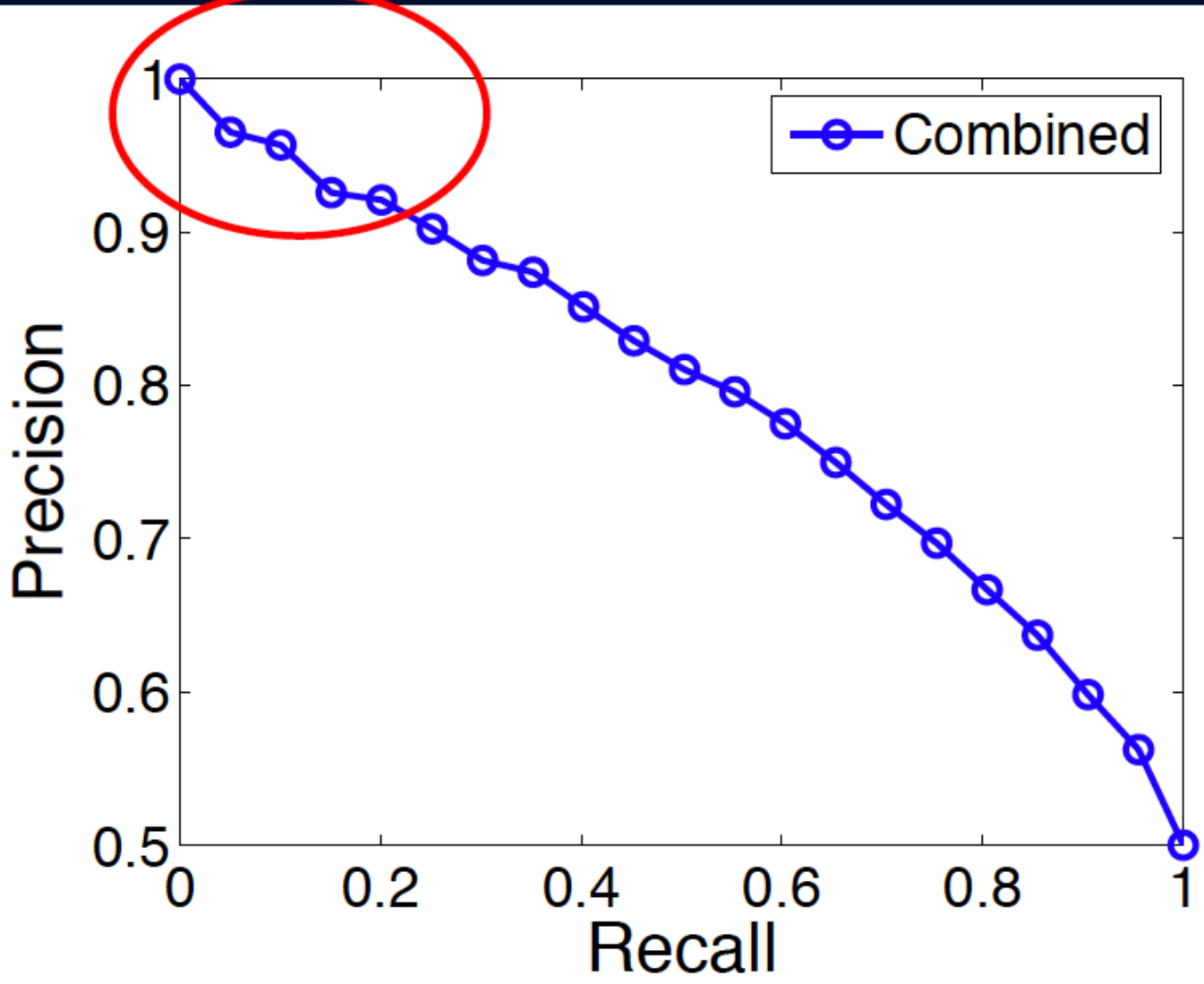
$$recall = \frac{\#\ professional\ photos\ above\ threshold}{total\ \#\ professional\ photos}$$

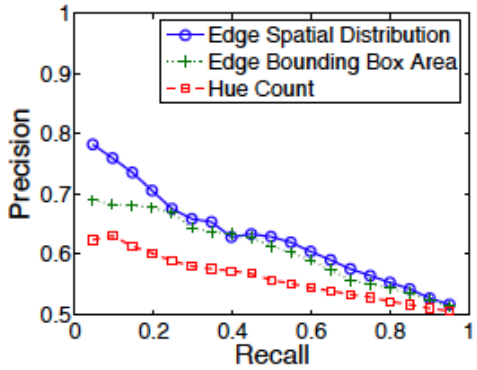
$$precision = \frac{\#\ professional\ photos\ above\ threshold}{\#\ photos\ above\ threshold}.$$

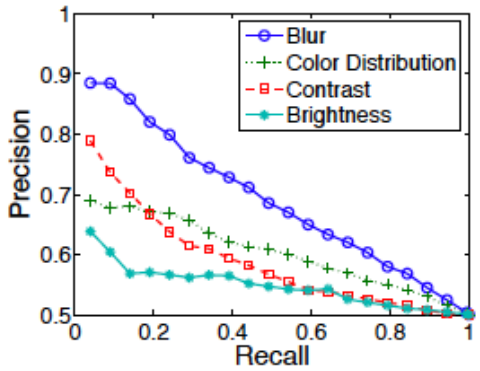
Most Distinctive Feature: Blur

- A *badness* metric, rather than a *goodness* metric.

Results







72% classification rate

Web Retrieval Results



...



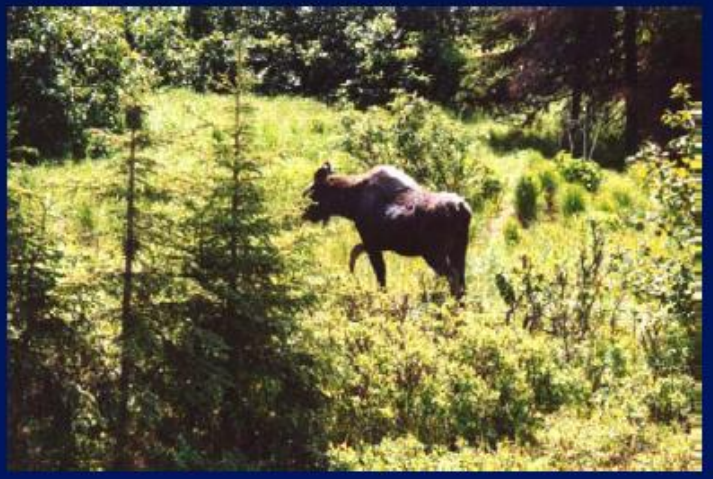
Web Retrieval Results



...



Web Retrieval Results



Summary

- Yan Ke's method and several closely related publications tend to answer the question *"Is this photo well composed?"* and not *"Is this photo interesting?"*.
- They focus on hand-formulated, mid-level cues and not high level considerations
- More recent works move towards higher-level reasoning.

Why is this photo awesome?

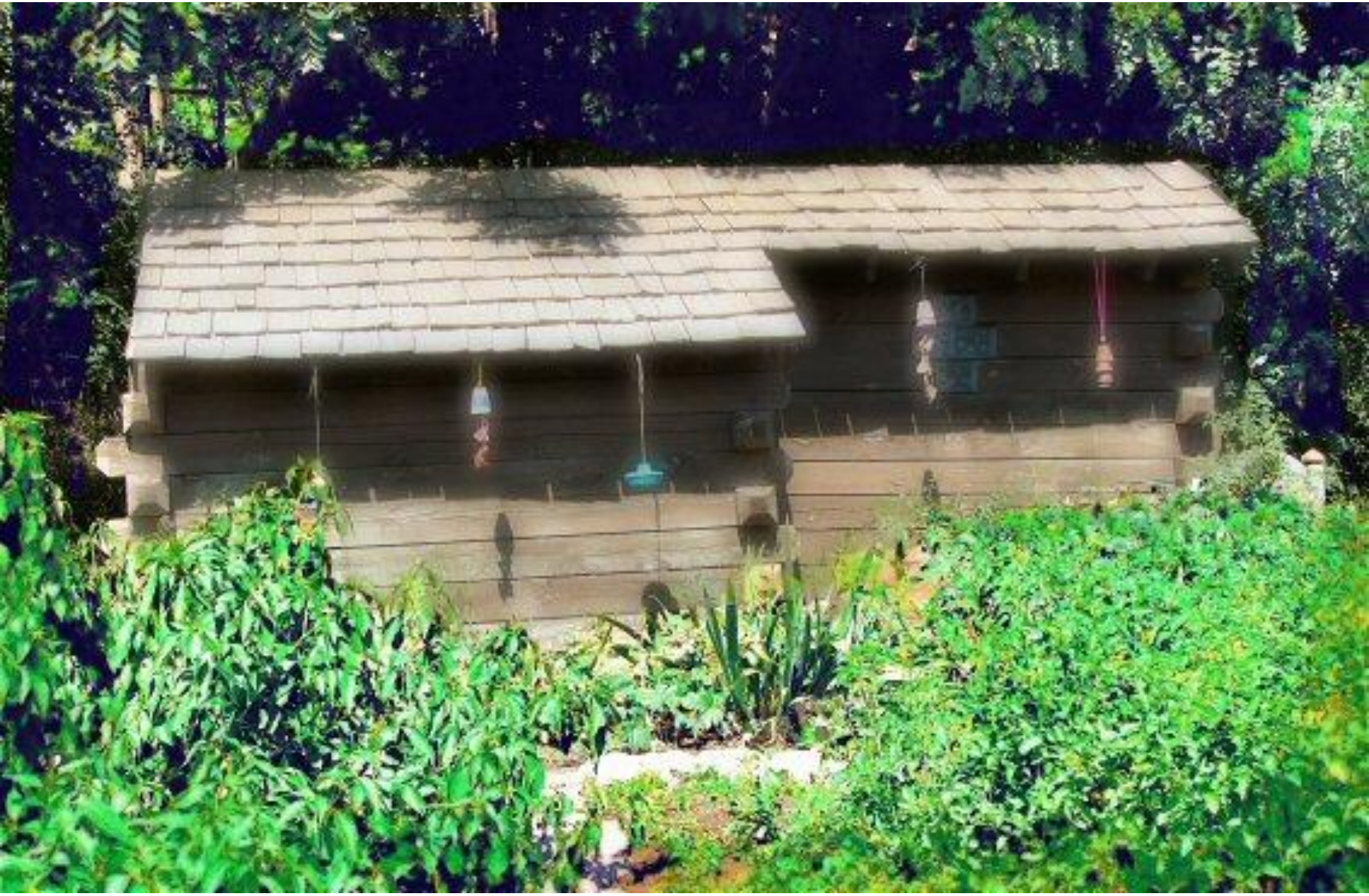
Why did this photo win a Pulitzer prize?

Omaha Beach, Normandy, France. Robert Capa, 1944

Damon Winters, New York Times.
2009 Pulitzer Prize for Feature Photography.

Smiley N. Pool, Dallas Morning News.
2006 Pulitzer Prize for Breaking News Photography.

Test – Are these good or bad?



Flickr’s Most Interesting

pot hill
From *Cinnamon

Rock and Ether
From vorlich

Where youll find me, where youll find;
From Taylor-Tomorrow

Untitled
From .ultraviolett

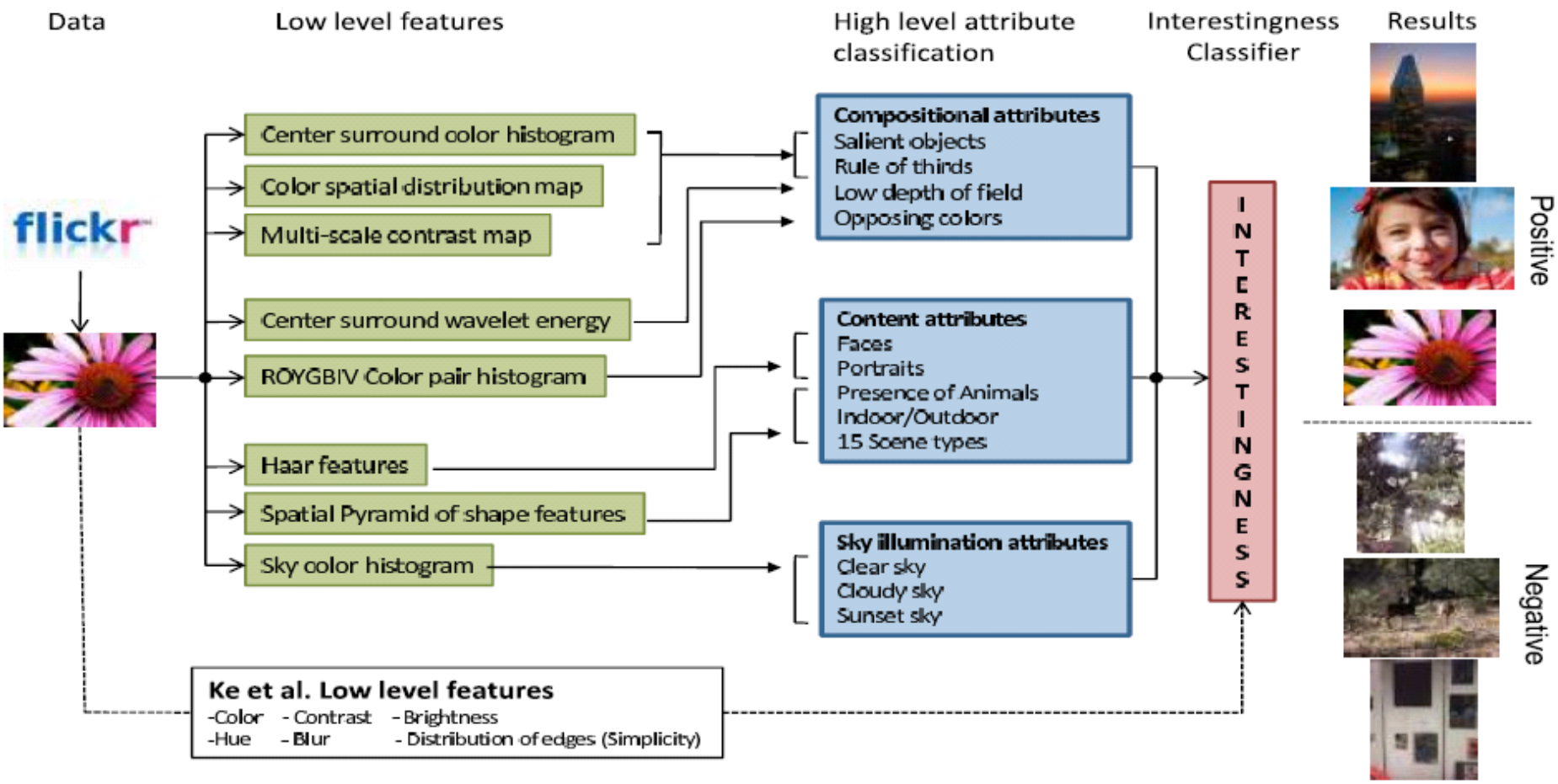
summer 's leaving
From HanslH

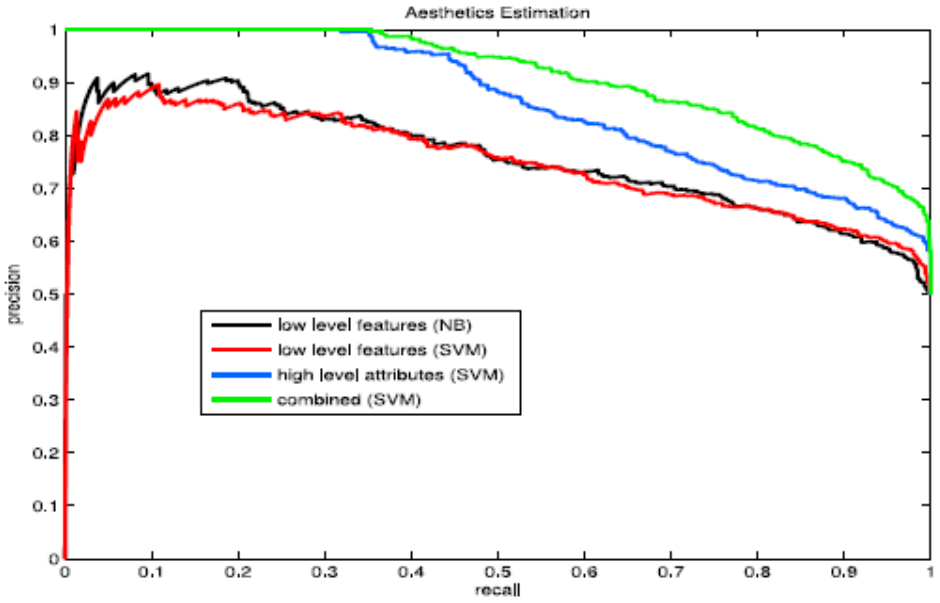
Olden fjord, Norway
From Kenny Muir

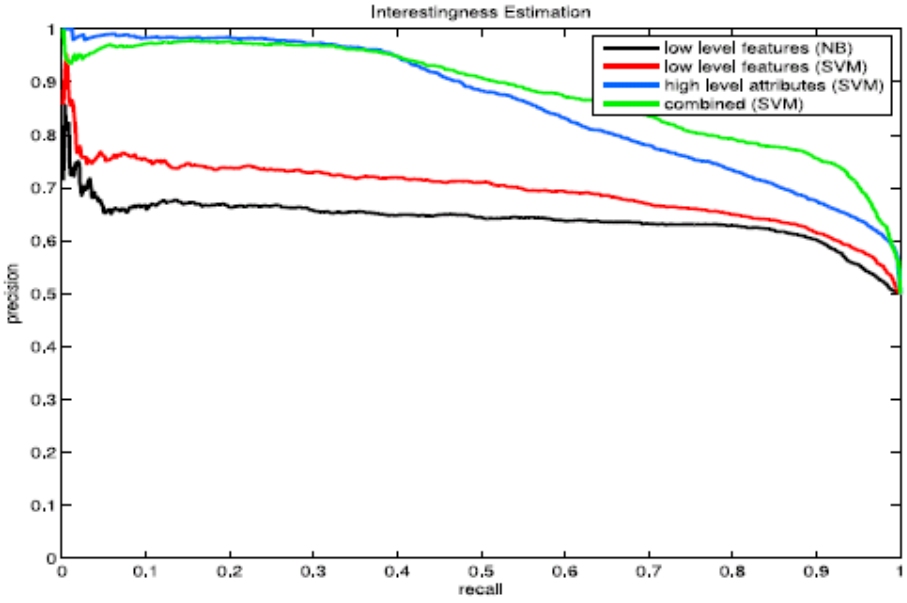
Quality vs. Interest

- Quality and Interestingness are correlated, but they are different concepts.

- **High Level Describable Attributes for Predicting Aesthetics and Interestingness**
  Sagnik Dhar, Vicente Ordonez, Tamara L. Berg,
  IEEE Conference on Computer Vision and Pattern Recognition (CVPR) 2011


Data
Low level features
High level attribute classification
Interestingness Classifier
Results
flickr
Center surround color histogram
Color spatial distribution map
Multi-scale contrast map
Center surround wavelet energy
ROYGBIV Color pair histogram
Haar features
Spatial Pyramid of shape features
Sky color histogram
Compositional attributes
Salient objects
Rule of thirds
Low depth of field
Opposing colors
Content attributes
Faces
Portraits
Presence of Animals
Indoor/Outdoor
15 Scene types
Sky illumination attributes
Clear sky
Cloudy sky
Sunset sky
INTERESTINGNESS
Positive
Negative
Ke et al. Low level features
-Color - Contrast - Brightness
-Hue - Blur - Distribution of edges (Simplicity)





- Green – proposed method
- Black – Ke et al. features with Naïve Bayes