

Crafting the Perfect Selfie Using Computer Vision

Aditya Khosla



A young woman with brown hair styled in a bun, wearing a blue denim shirt and large gold earrings, is smiling and holding a blue flip phone up to take a selfie. The background is a textured, brownish-gold surface.

Selfie (n.):

a picture taken of a person
by that person

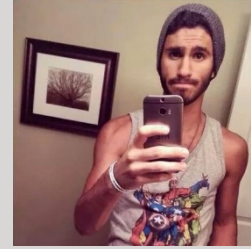












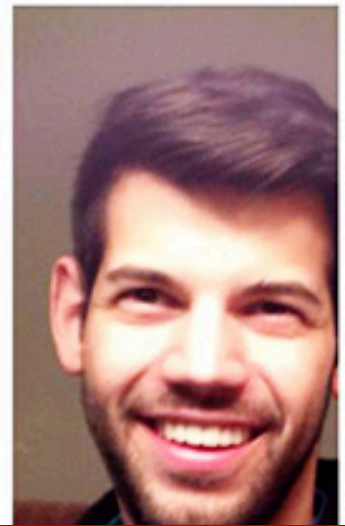
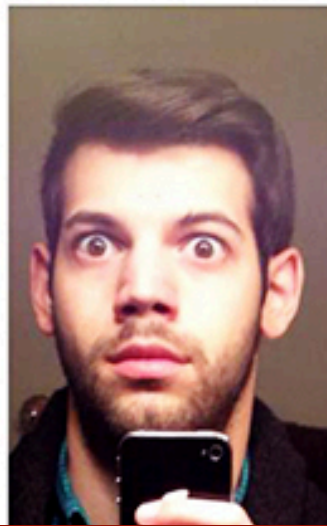
1138
Likes

Awesome
selfie
dude!

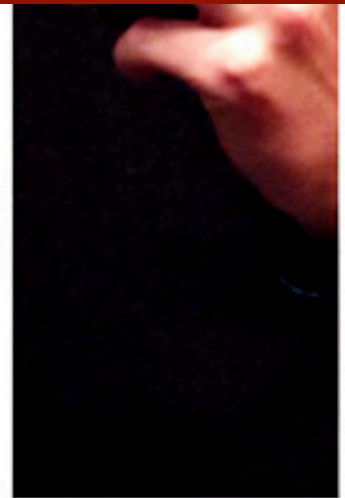
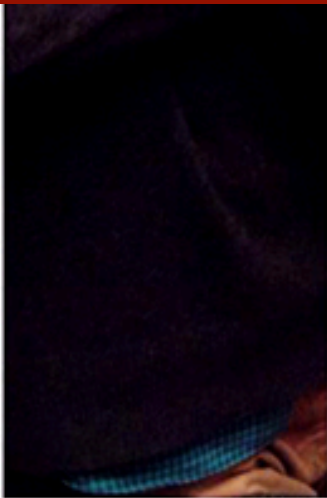
Nobody
loves me



3 Likes



Which one to upload?!



Selfie Selection

- What if it were possible the number of likes before uploading?
- What if you could predict how many people will remember your selfie?
- What if you could modify the image such that more people remembered it?

Why does it matter?

Overview

Predicting popularity



Predicting memorability



Modifying memorability



Perspective



Overview

Predicting popularity



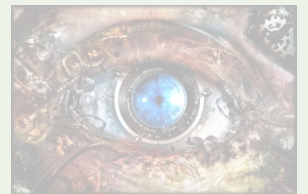
Predicting memorability



Modifying memorability



Perspective



What is image popularity?



Instagram

What is image popularity?



Phil Nadeau

February 7

Last committee meeting — with Ryan Iutzi, Nachiket Desai, Yildiz Koken Sinangil, Katherine Song, Radhika Marathe and Dan Congreve at Jackson Room, MIT.

Like · Comment · Share

👍 Aparna Marathe and 5 others like this.



Jon L'hiver Are those personal 2 liter pops?

February 8 at 8:07am · Like



Ryan Iutzi Yes except the one in front of me is just pure vodka, and that sheet im staring at is just a blank peice of paper

February 8 at 10:40am · Like · 👍 1



Rita Karger Is that Putin's portrait? lol

February 24 at 6:42am · Like · 👍 1



Write a comment...



facebook

What is image popularity?



PSY @psy_oppa · Mar 22

Very inspiring book by my friend @adambraun about his charity bit.ly/popstory
Fell asleep when I finished it pic.twitter.com/4G0P94XYmT



RETWEETS

1,111


FAVORITES

1,583



twitter 

What is image popularity?



Yoann JEZEQUEL

car
car car

14,073

November 12, 2011

© All Rights Reserved

34 4

flickr

What is image popularity?



flickr

Why does it matter?



content distribution

Why does it matter?



‘selfie selection’

Why does it matter?



advertising

*advert for funeral services

Why does it matter?



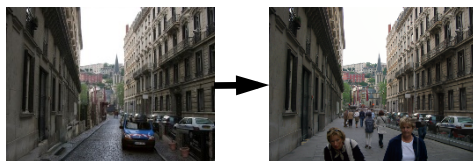
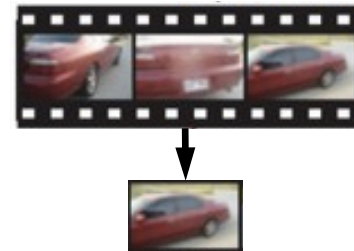
content
distribution

‘selfie
selection’



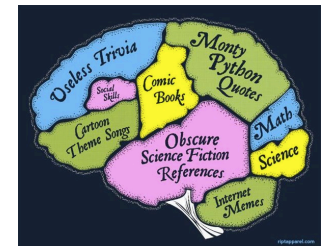
advertising

video
summarization



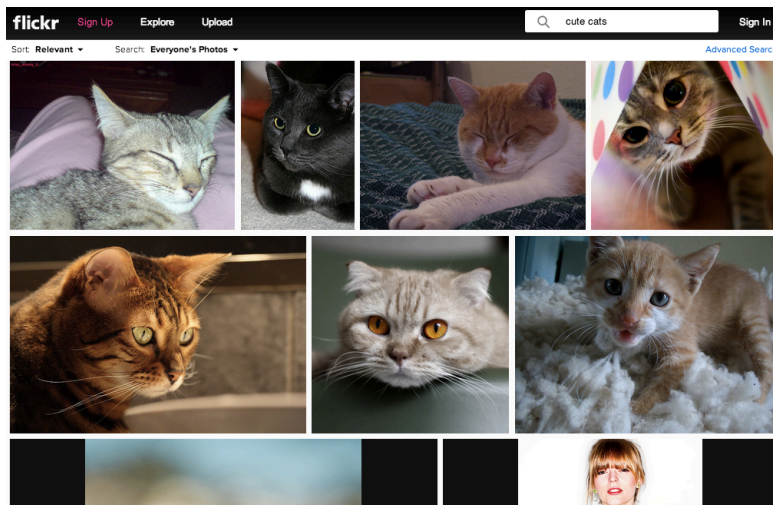
modifying
popularity

understanding
user behavior

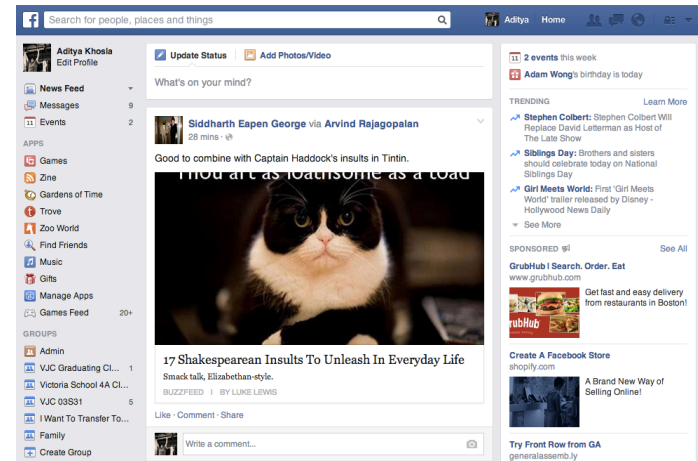


What is image popularity?

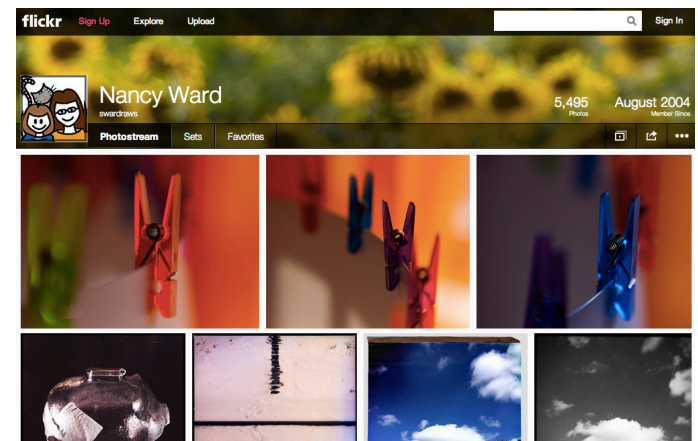
- Context dependent



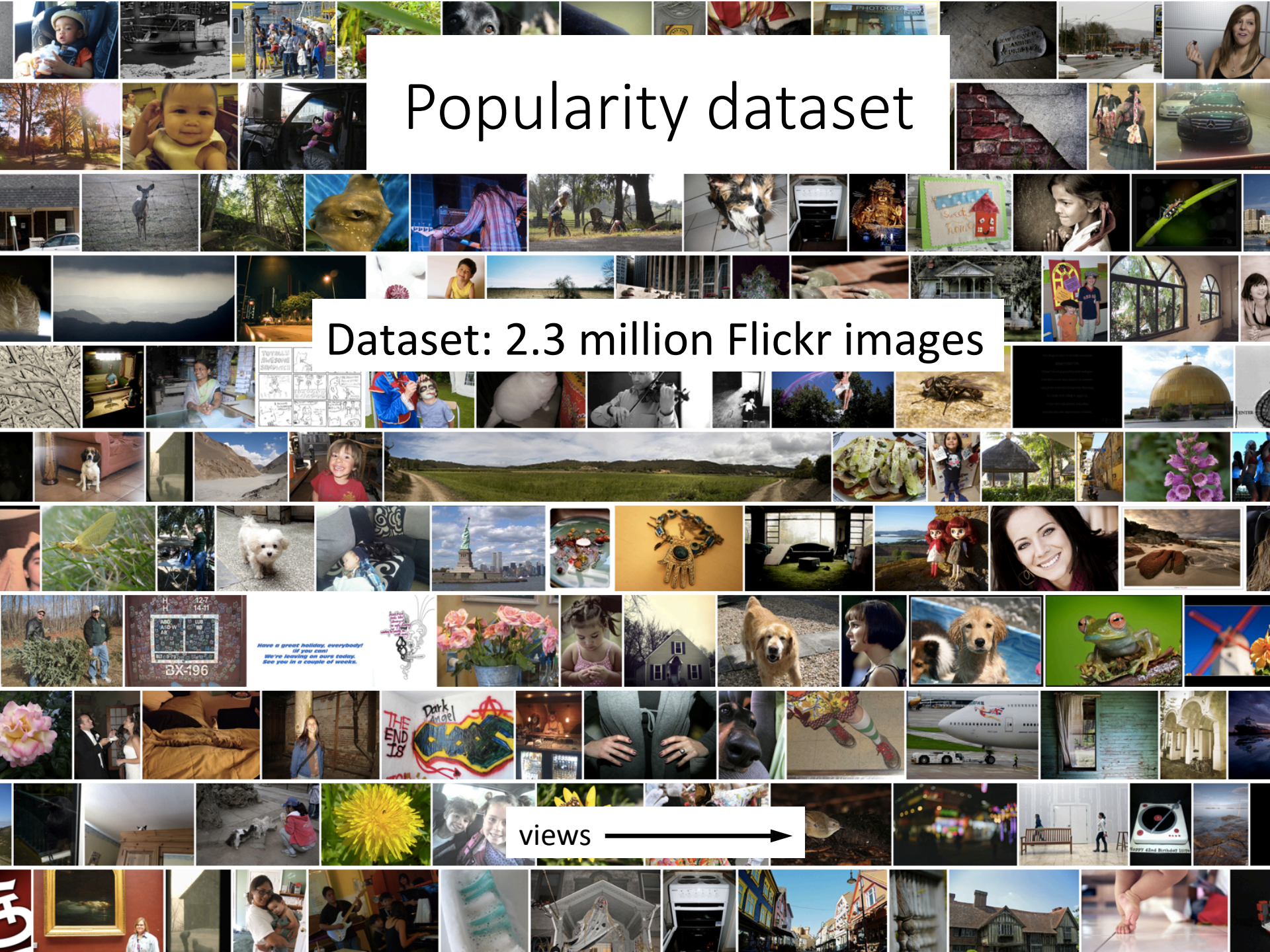
Flickr search results



Facebook newsfeed



Flickr user



Popularity dataset

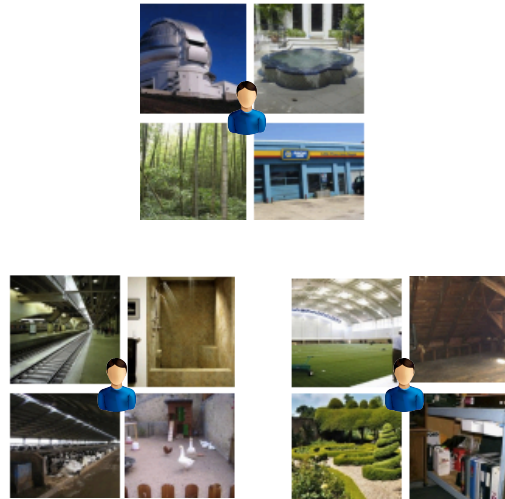
Dataset: 2.3 million Flickr images

views 

Popularity contexts



One-per-user
e.g. Flickr search results

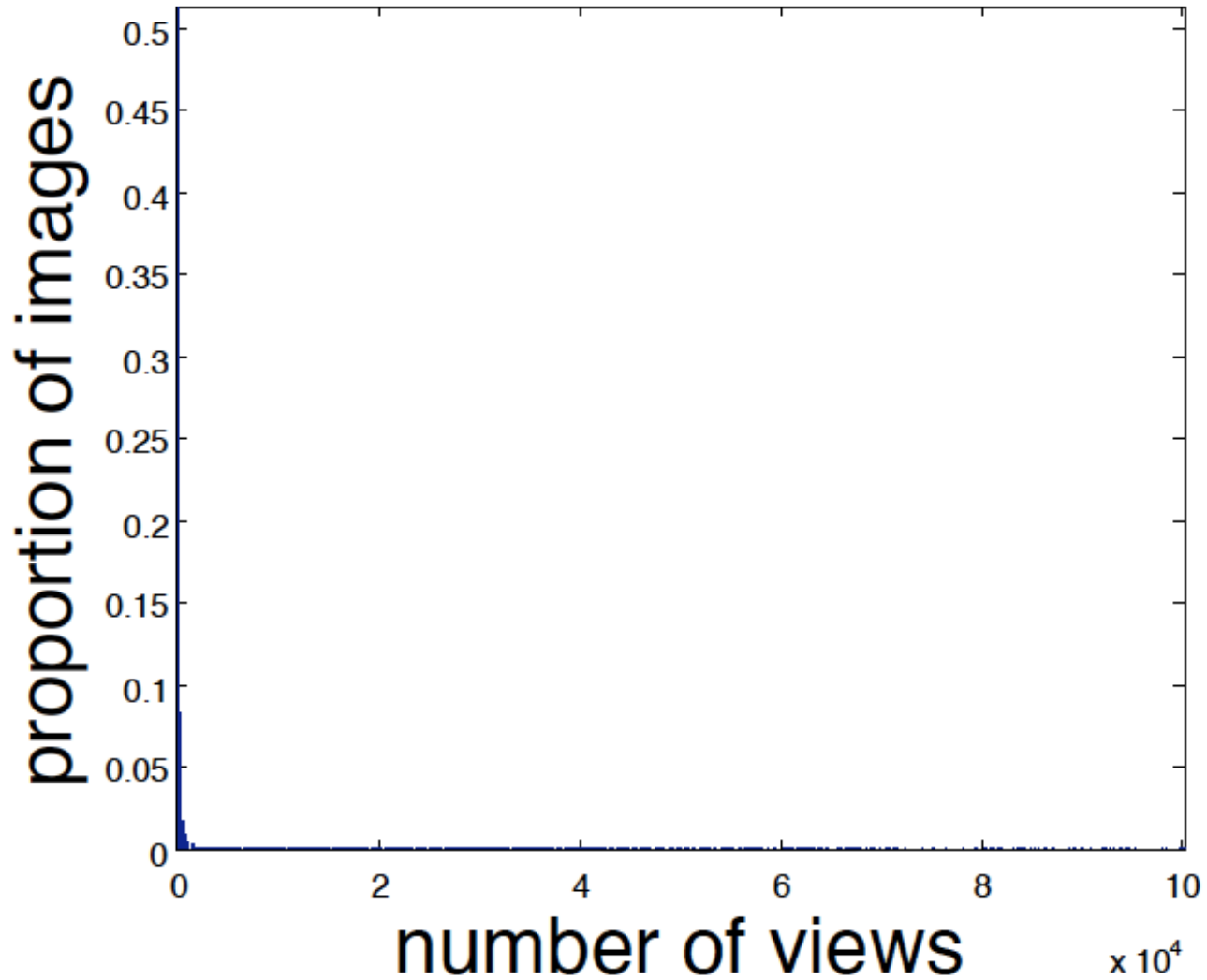


User-mix
e.g. Facebook newsfeed

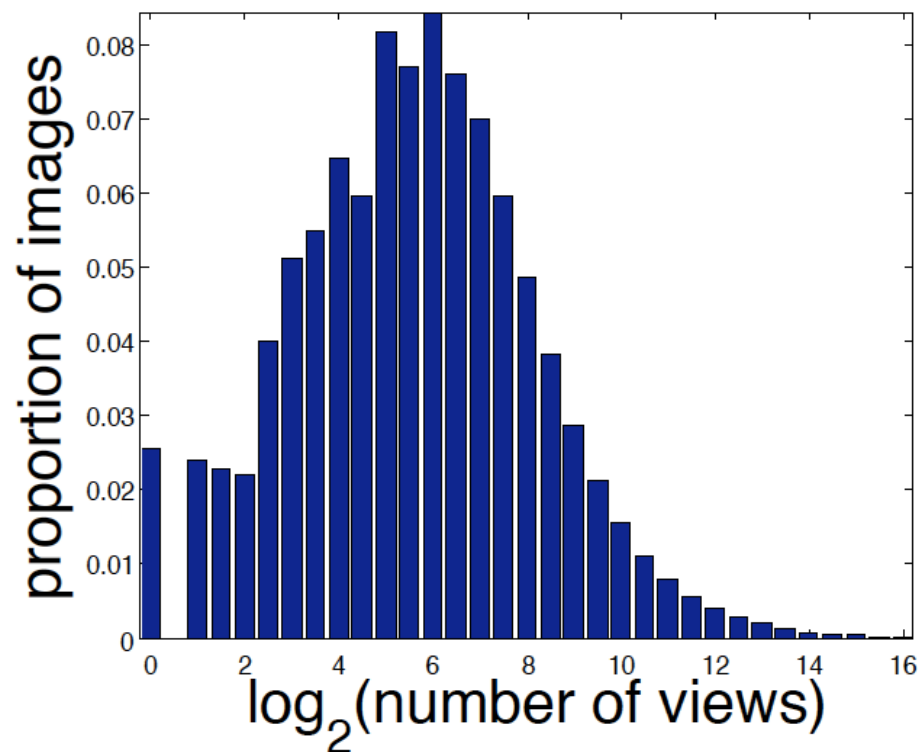
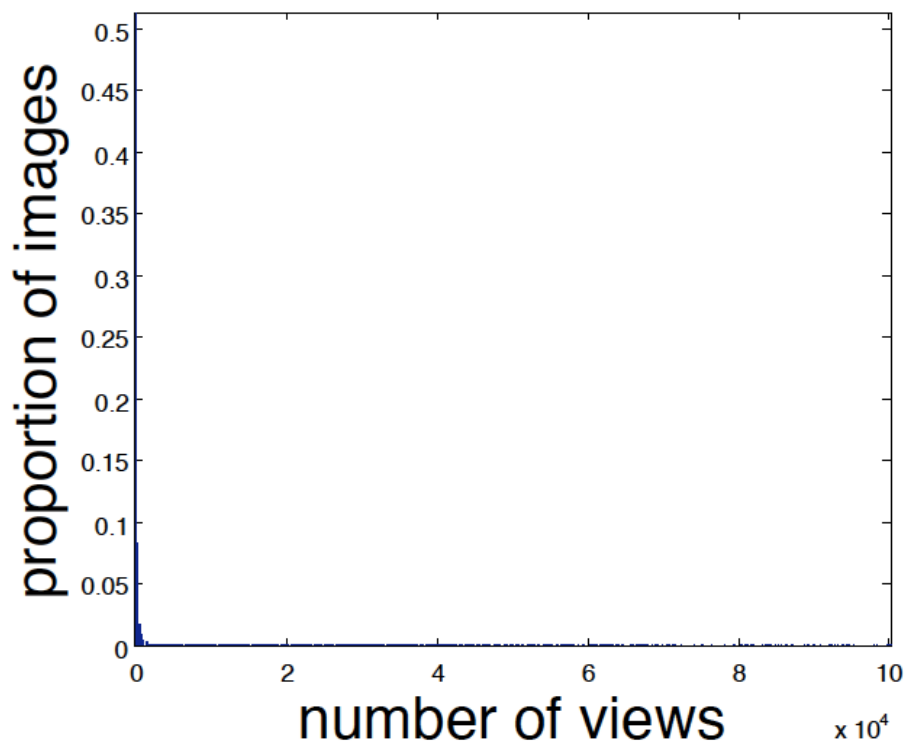


User-Specific
e.g. individual users

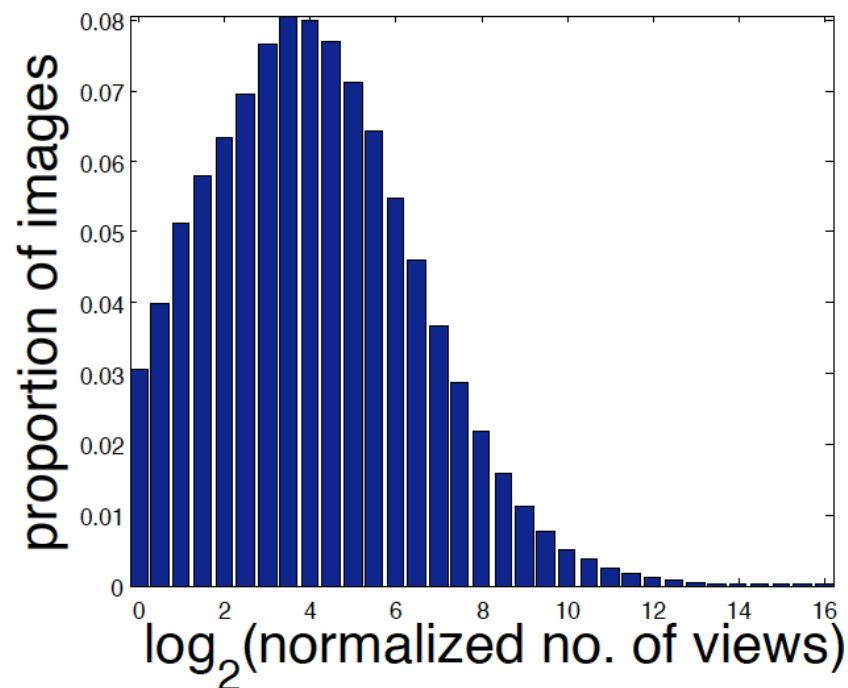
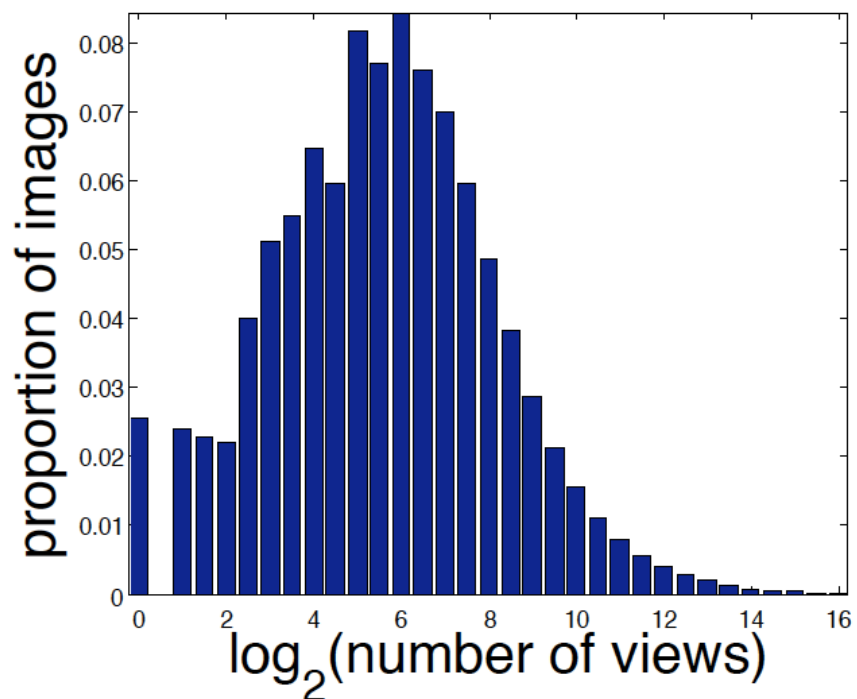
Popularity metric



Popularity metric



Popularity metric



Task: predict log normalized views

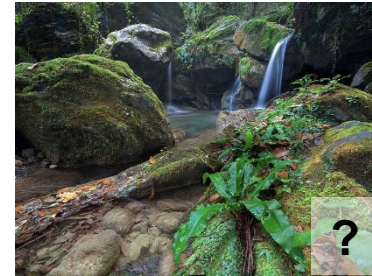
Measure: rank correlation (ρ)

Predicting popularity

training images



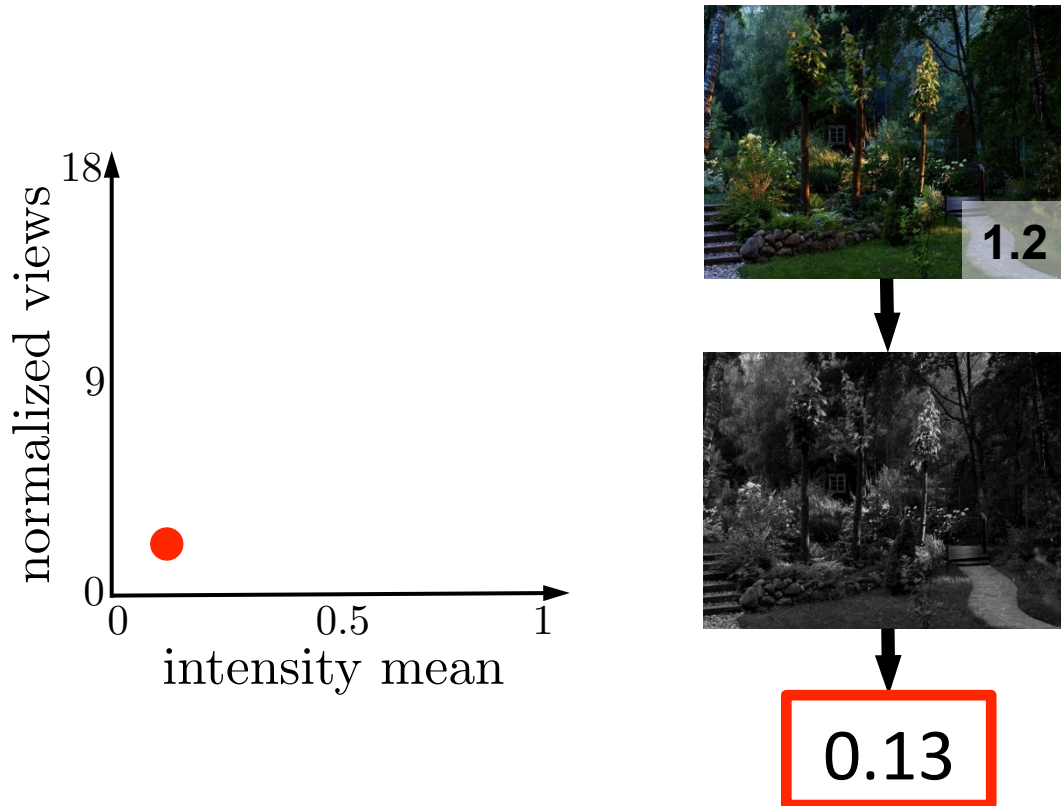
...



2.3

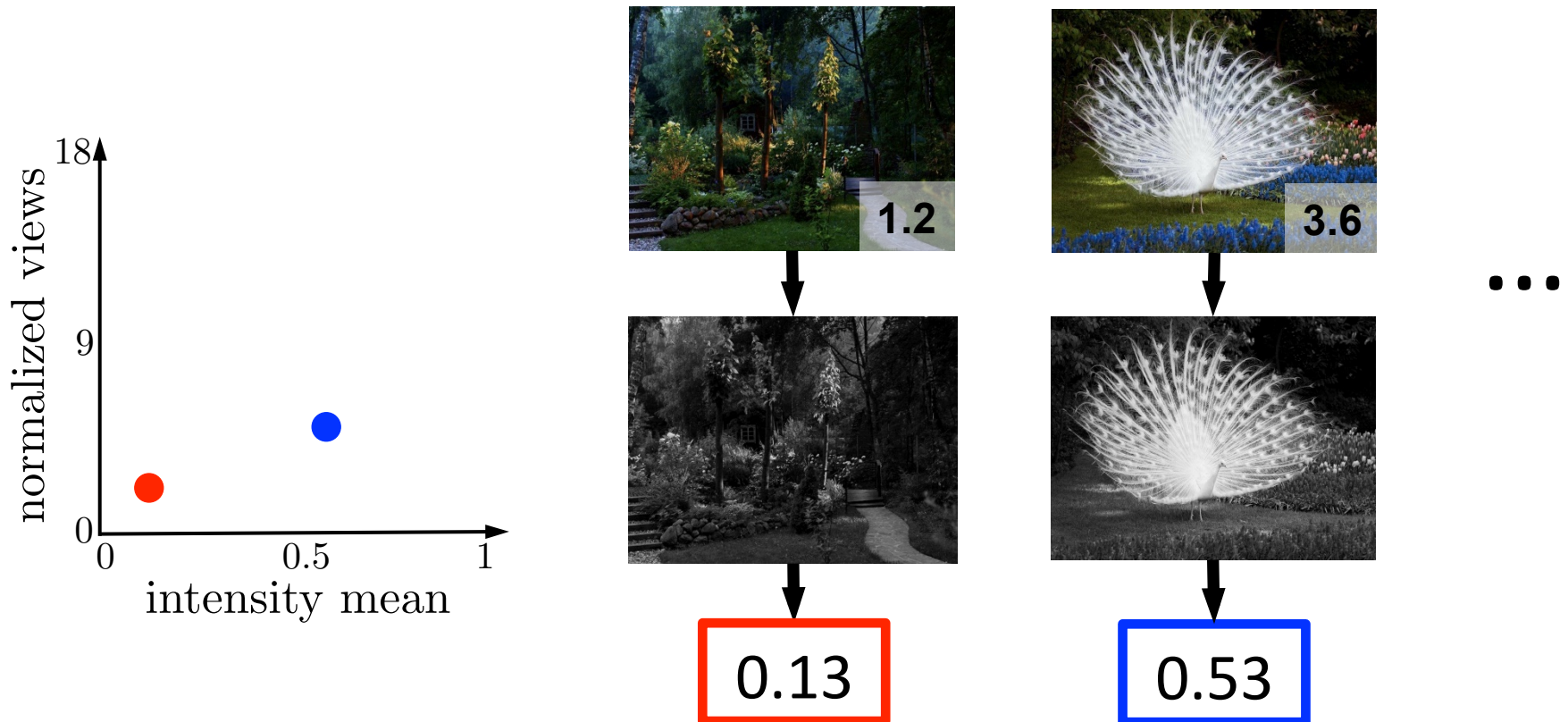
Predicting popularity

- Simple image feature: image intensity



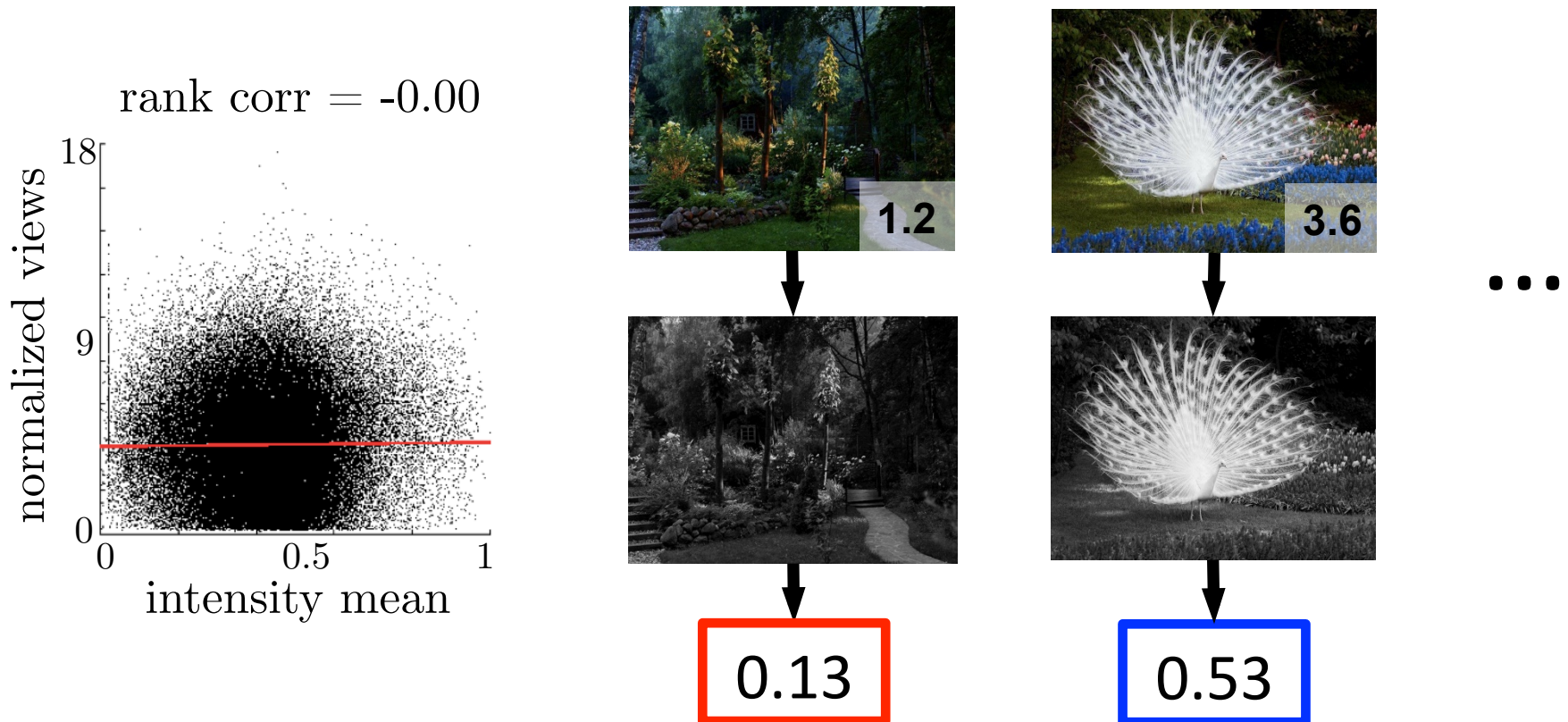
Predicting popularity

- Simple image feature: image intensity



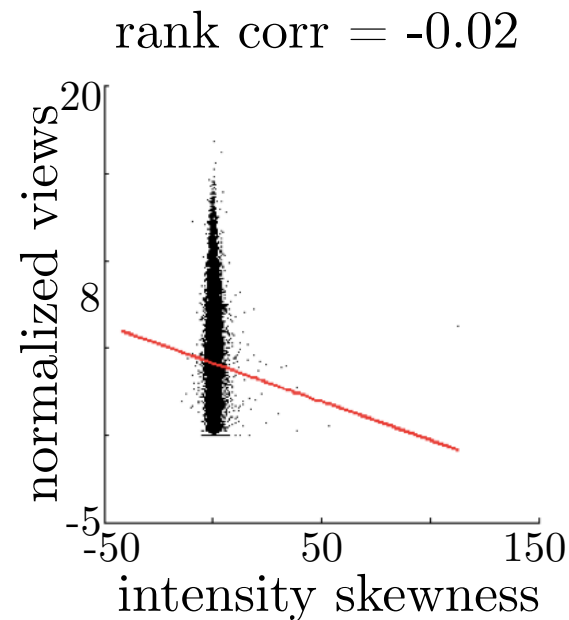
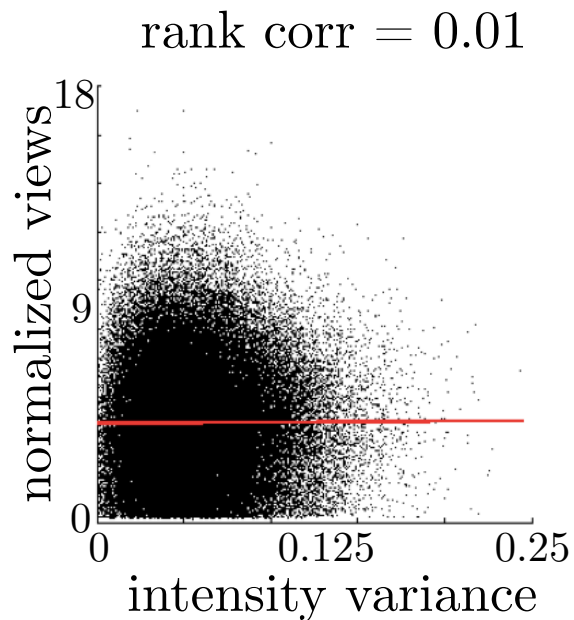
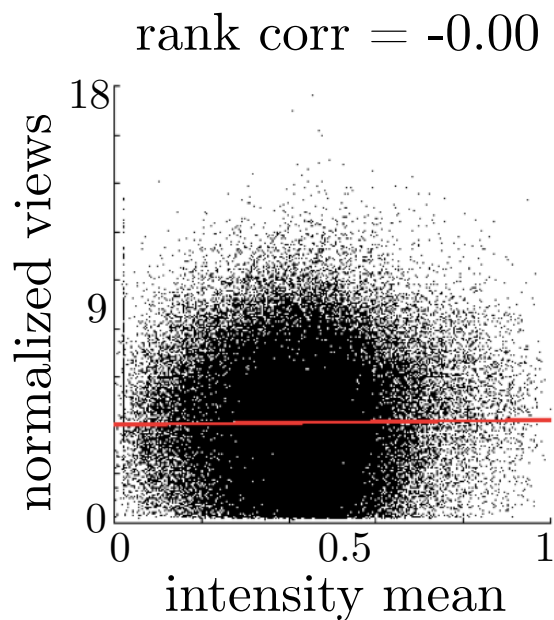
Predicting popularity

- Simple image feature: image intensity



Predicting popularity

- Simple image feature: image intensity



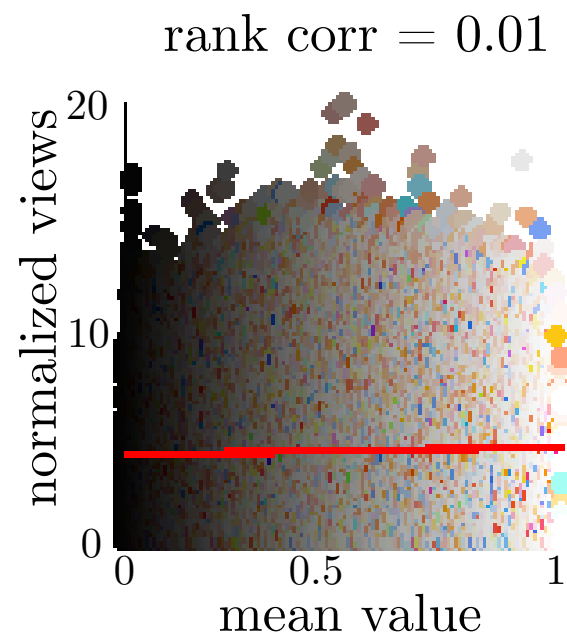
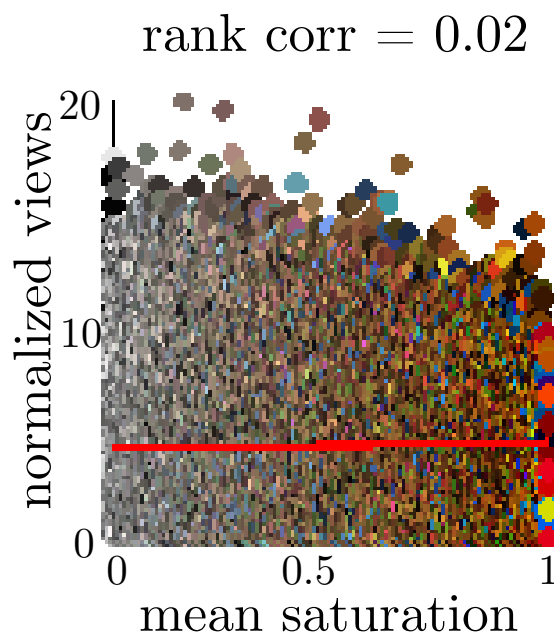
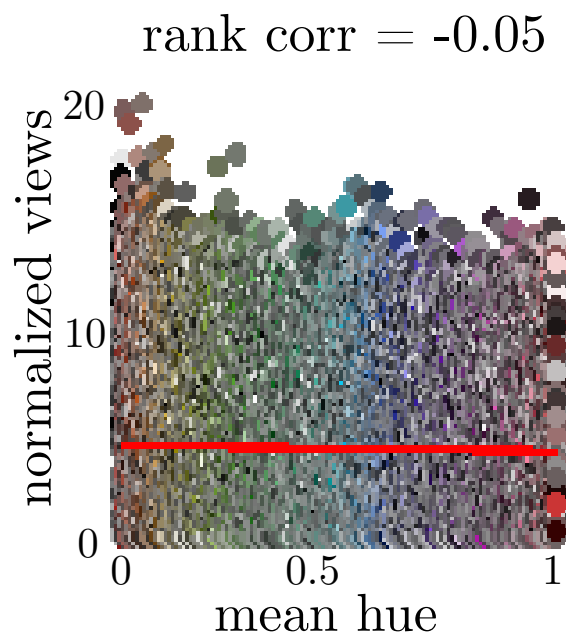
Predicting popularity

- Simple image features: HSV color space

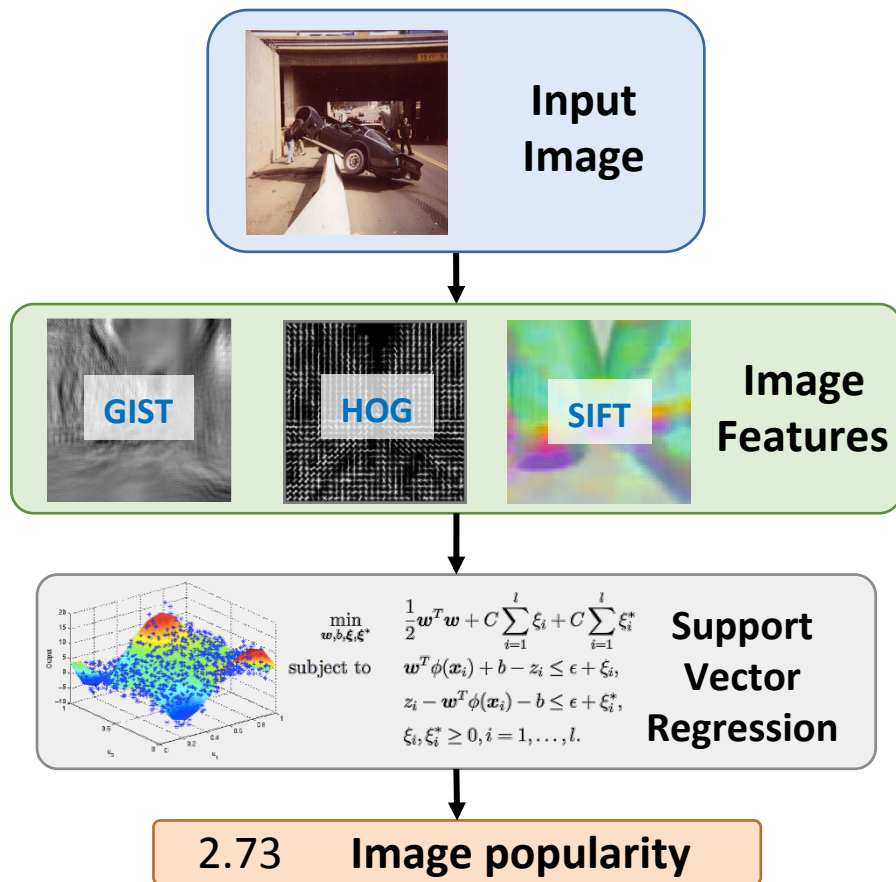


Predicting popularity

- Simple image features: HSV color space



Predicting popularity

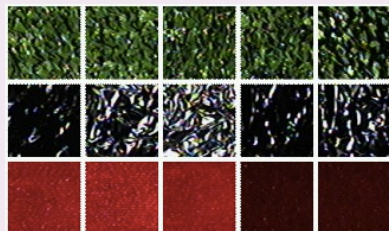


Predicting popularity



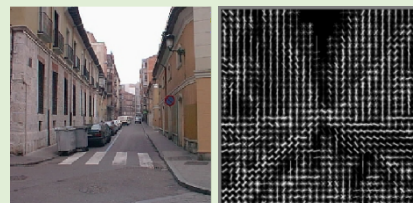
Gist

e.g. GIST [Oliva 2001]



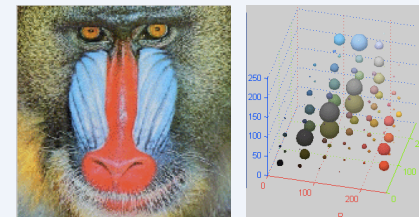
Texture

e.g. LBP [Ojala 2002]



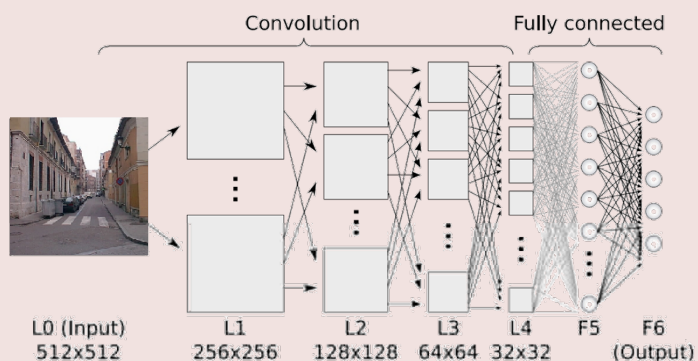
Gradient

e.g. HOG [Dalal 2005]



Color BoW

e.g. [van de Weijer 2009]



Deep learning

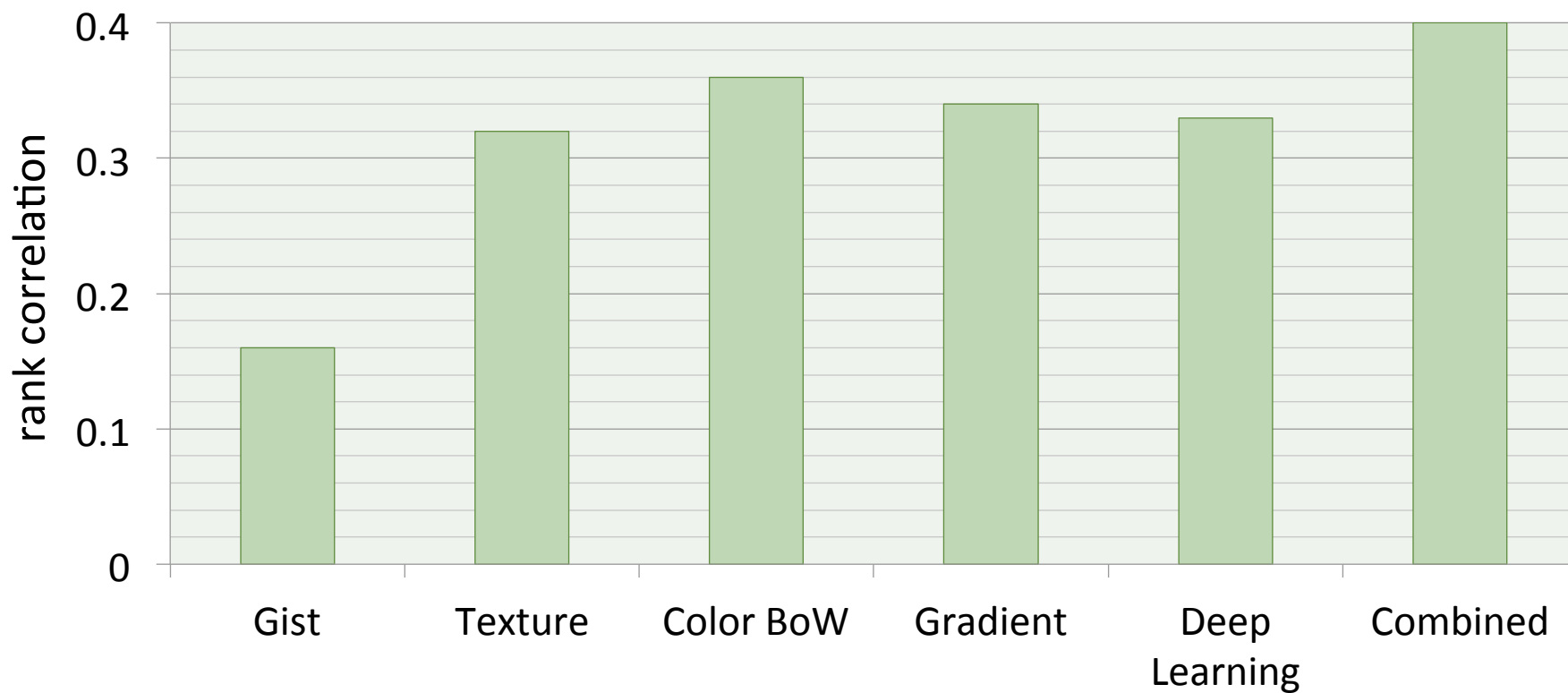
e.g. [Krizhevsky 2012]

airplane	remote	...
bicycle	car	person
bird	stove	sheep
boat	table	train
bottle	apple	television
orange	cart	dog
bench	ray	fox

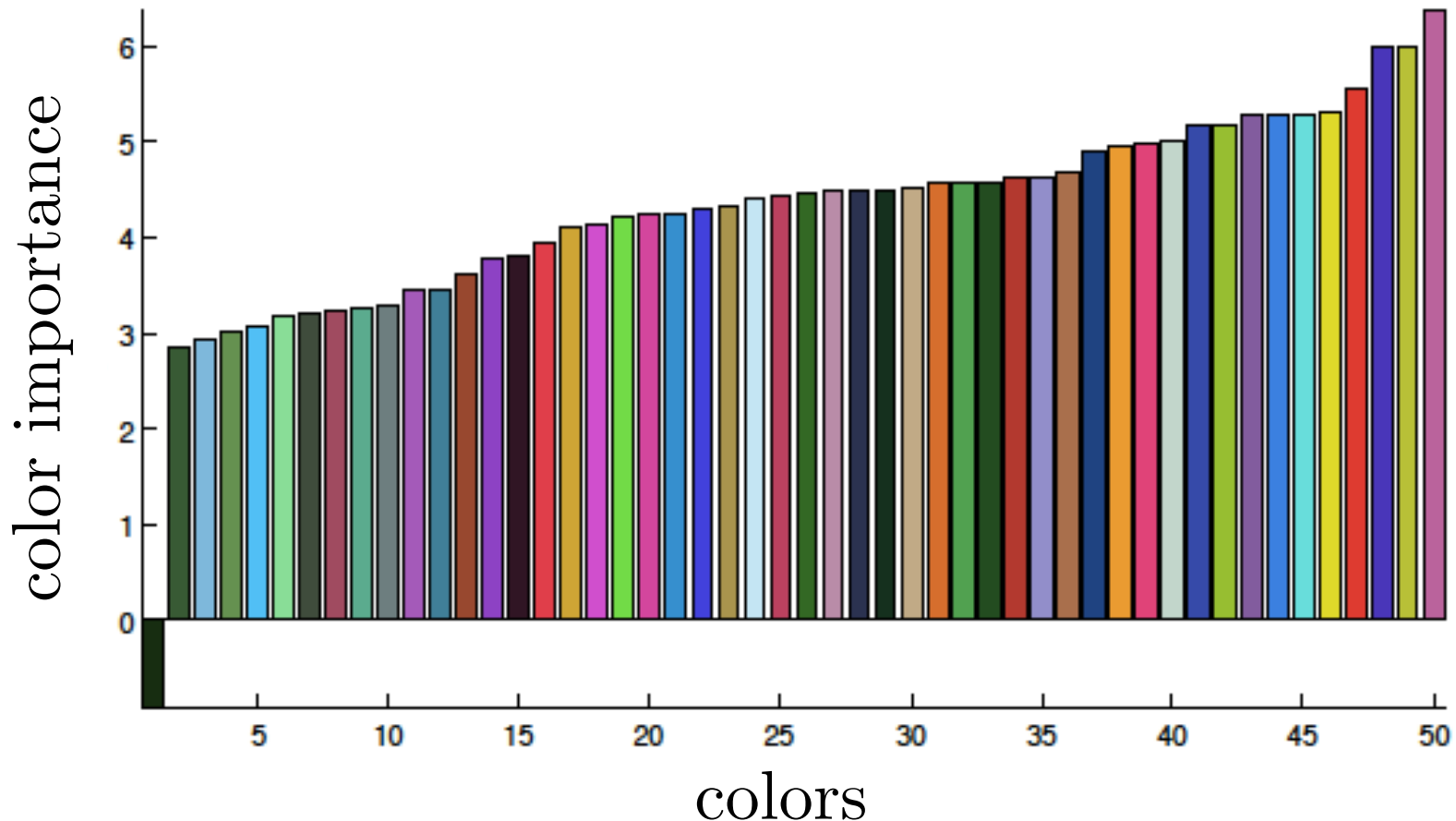
1000 Objects

e.g. [Krizhevsky 2012]

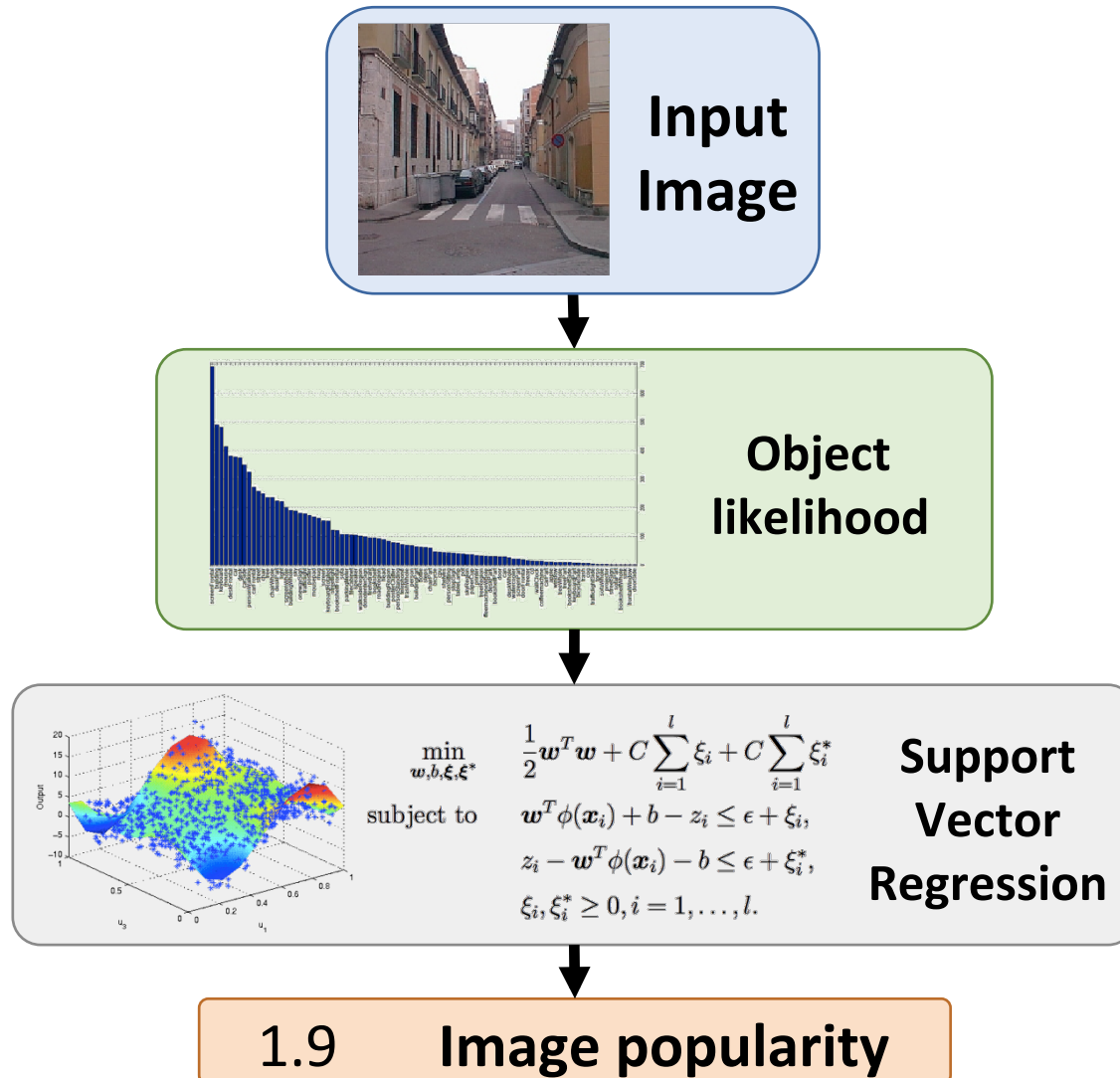
Predicting popularity



What makes an image popular?



What makes an image popular?



What makes an image popular?

Medium positive impact



giant panda



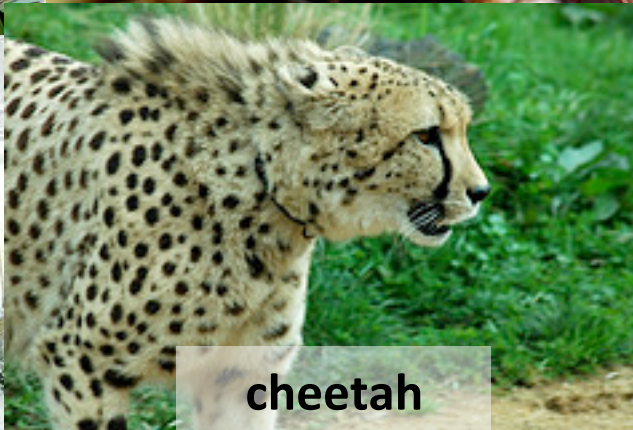
ladybug



basketball



plow



cheetah



llama

What makes an image popular?

Strong positive impact



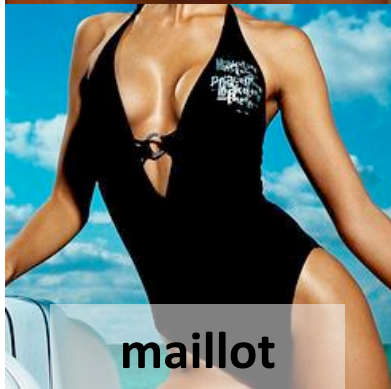
brassiere



revolver



miniskirt



maillot



bikini



cup

What makes an image popular?

Negative impact



http://popularity.csail.mit.edu

Popularity Demo

How likely is your image to become popular? Upload it to find out!

Upload: No file chosen

or

URL:

or

Click One:



Popularity API

Usage: http://popularity.csail.mit.edu/cgi-bin/image.py?url=IMG_URL

Example:

<http://popularity.csail.mit.edu/cgi-bin/image.py?url=http://popularity.csail.mit.edu/demo/1.jpg>

Notice: Please do not overload our server by querying repeatedly in a short period of time. This is a free service for academic research and education purposes only. It has no guarantee of any kind. For any questions or comments regarding this API or potential commercial applications, please contact [Aditya Khosla](#).

Media coverage



THE
HUFFINGTON
POST

TE TechCrunch

TIME

Entrepreneur

YAHOO!
NEWS

THE TIMES OF INDIA The Washington Post

http://popularity.csail.mit.edu

Popularity Demo

How likely is your image to become popular? Upload it to

Popularity API

Usage: <http://popularity.csail.mit.edu/cgi->

To: khosla@csail.mit.edu
popularity

Dear Aditya Khosla,

This popularity calculator is a nice initiative, but i think these girls deserve much better scores than 5.

Best regards,


THE VERGE

 HUFFINGTON
POST

 TechCrunch

 TIME

 Entrepreneur

 YAHOO!
NEWS

 THE TIMES OF INDIA The Washington Post

Overview

Predicting popularity



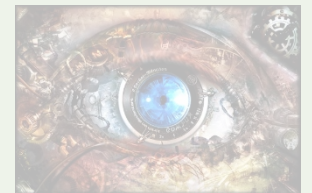
Predicting memorability



Modifying memorability



Perspective



What is memorability?

Memorability = The likelihood of remembering a particular image.

Welcome to the

Visual Memory Game

A stream of images will be presented on the screen for 1 second each.

Your task:
**Clap anytime you see an image you saw
before in this experiment.**

Ready?



(Seriously, get ready to clap. The images go by fast...)









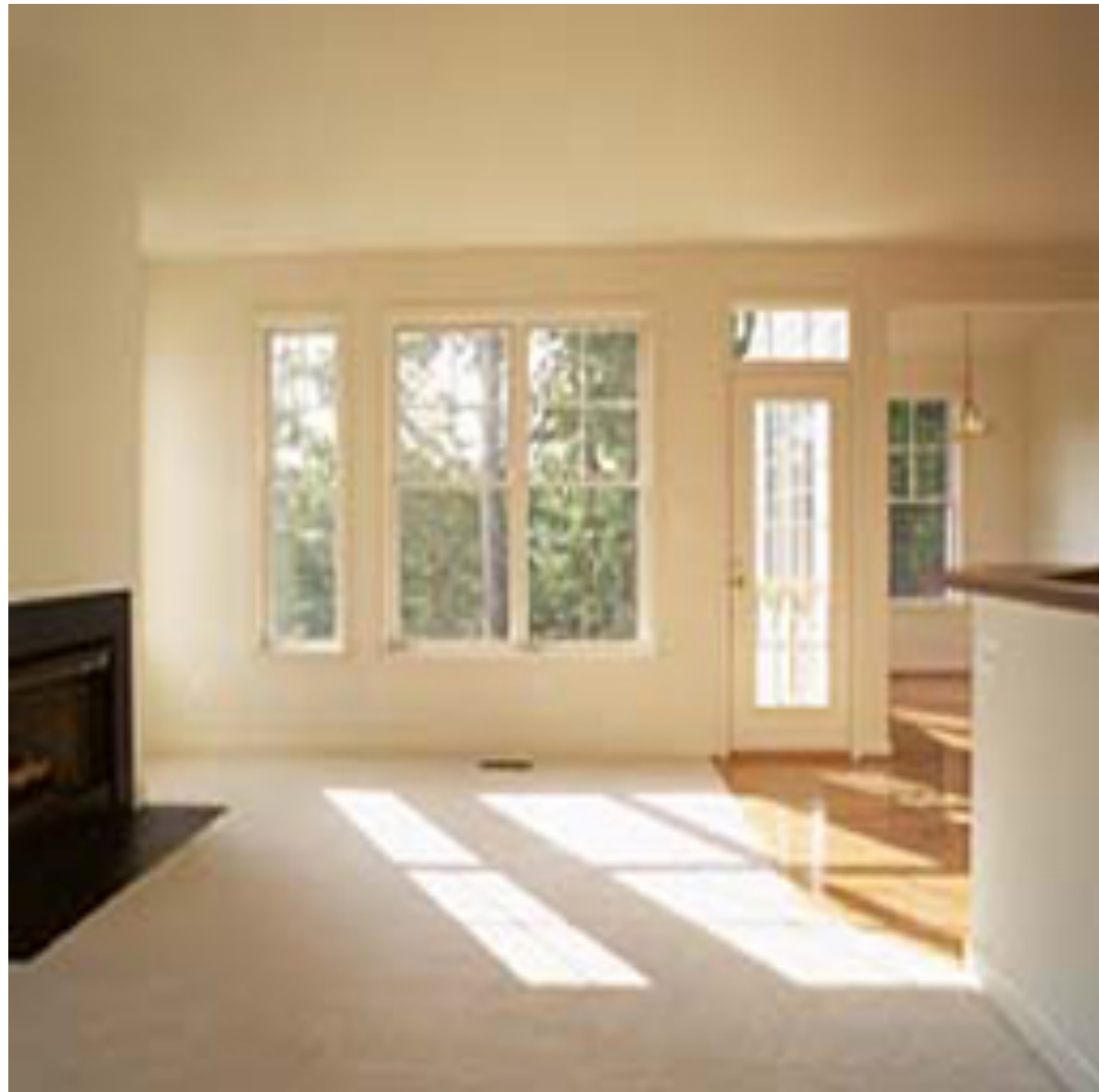
<clap!>







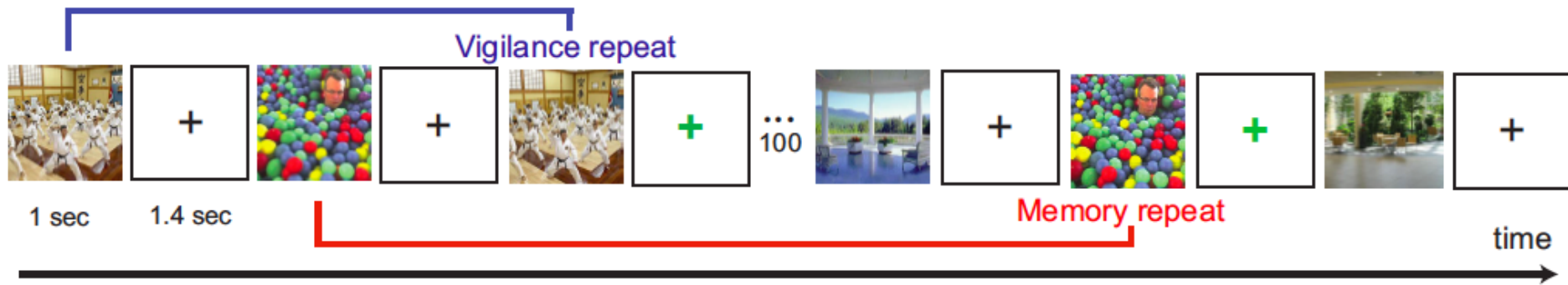






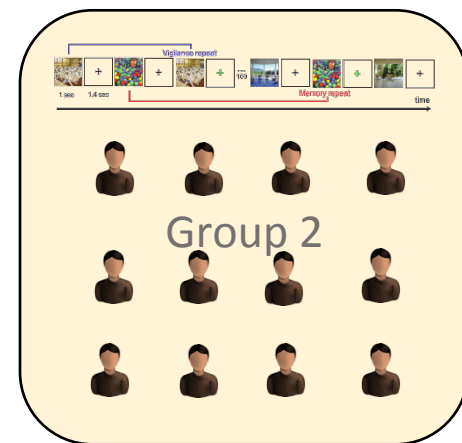
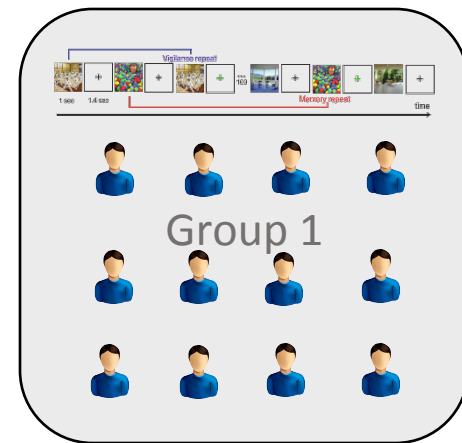
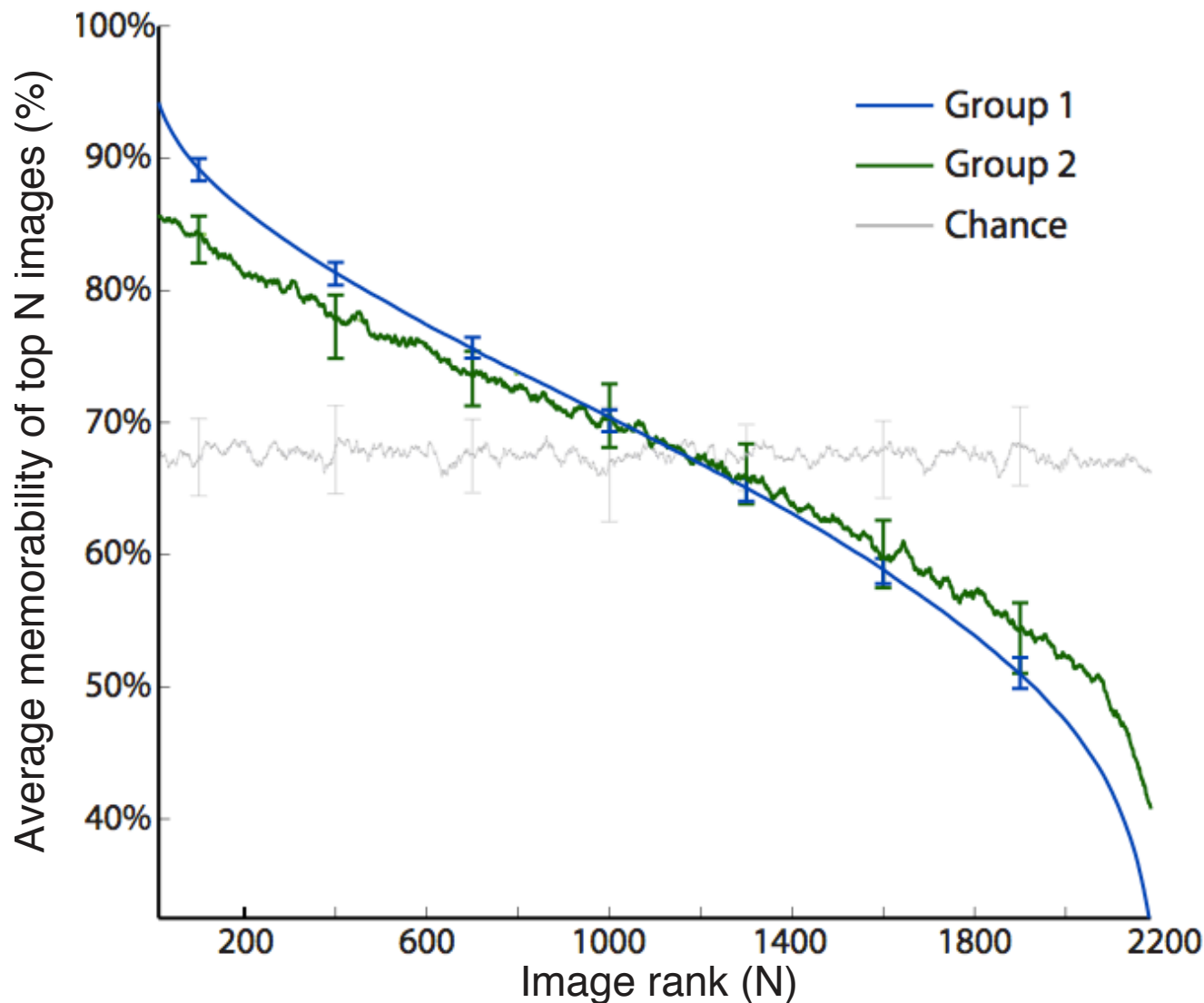
<clap!>

Measuring Memorability



Memorability = Probability of correctly detecting a repeat after a single view of an image in a long sequence.

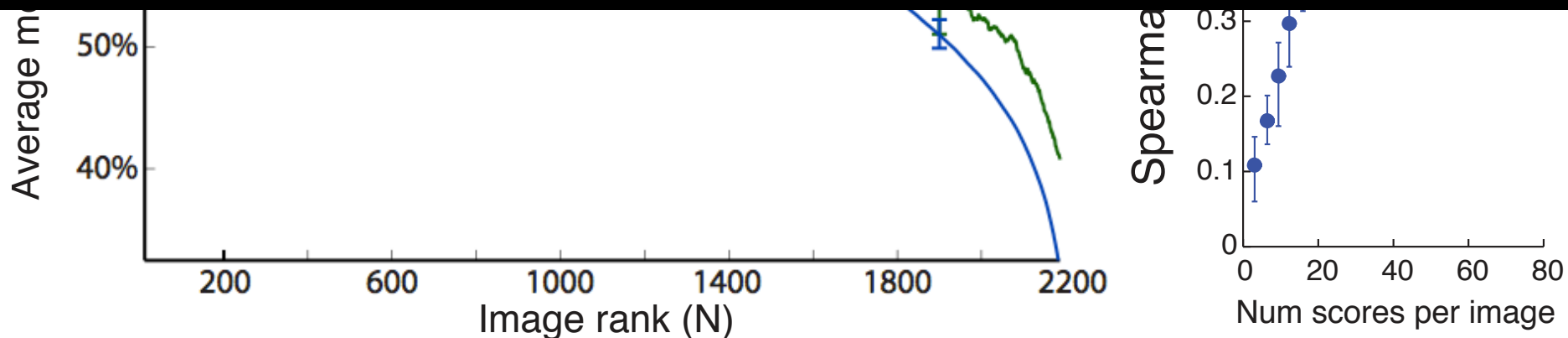
Measuring Memorability



Measuring Memorability



Memorability is an intrinsic and measurable property!



0) Human estimation? Predicting memorability

asking people how memorable an image is

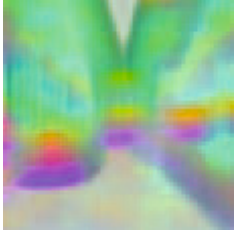
$$\rho = -0.02$$



1) Simple scalar stats?

color, brightness, number of objects, mean hue

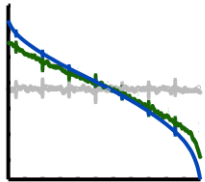
$$\rho < 0.16$$



2) Computer vision features?

SIFT, HOG, GIST and SSIM

$$\rho = 0.50$$



3) Human consistency?

consistency across human subjects in memory game

$$\rho = 0.75$$

Overview

Predicting popularity



Predicting memorability



Modifying memorability



Summary

Modifying face memorability



Goal

- Modify faces to be more/less memorable while keeping identity, and other attributes intact

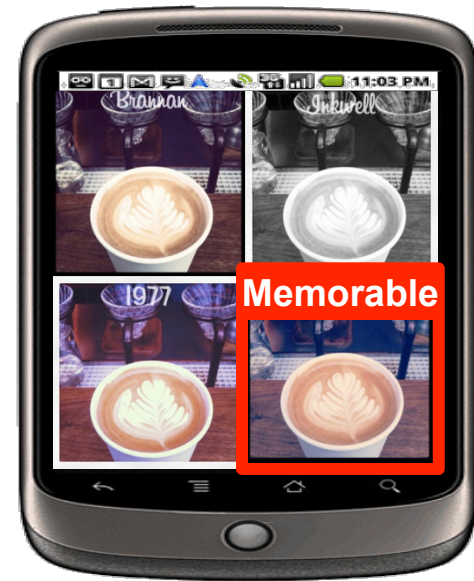
Problem

- Features such as HOG/SIFT significantly outperform AAM based features for memorability prediction

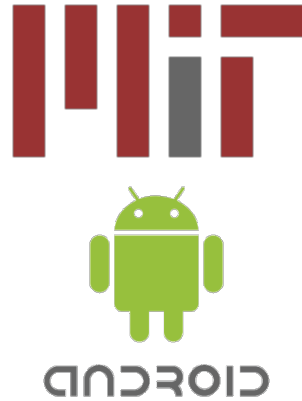
Advertising



Mobile Applications



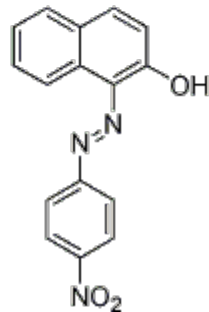
Logos



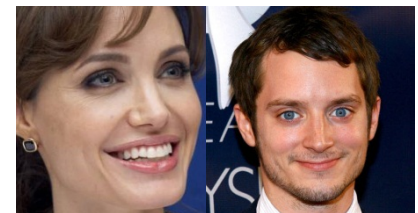
Social Networking



Education



Face Memorability



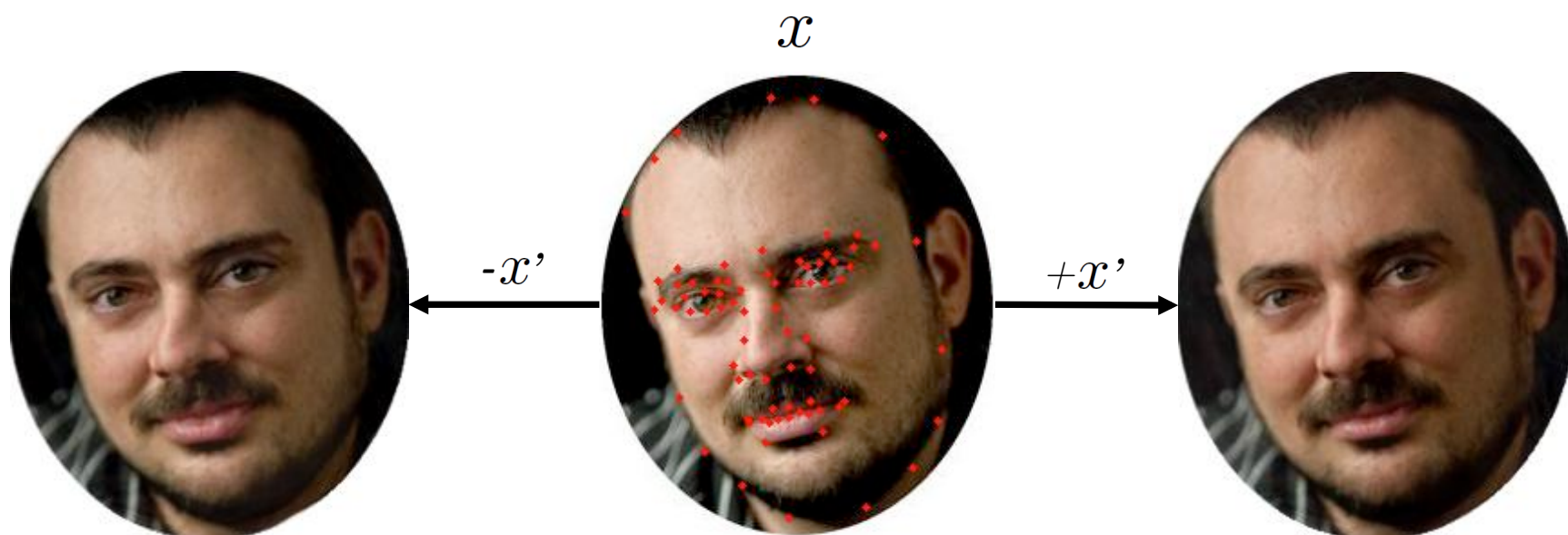
Modifying face memorability



Goal

- Modify faces to be more/less memorable while keeping identity, and other attributes intact

Modifying face memorability



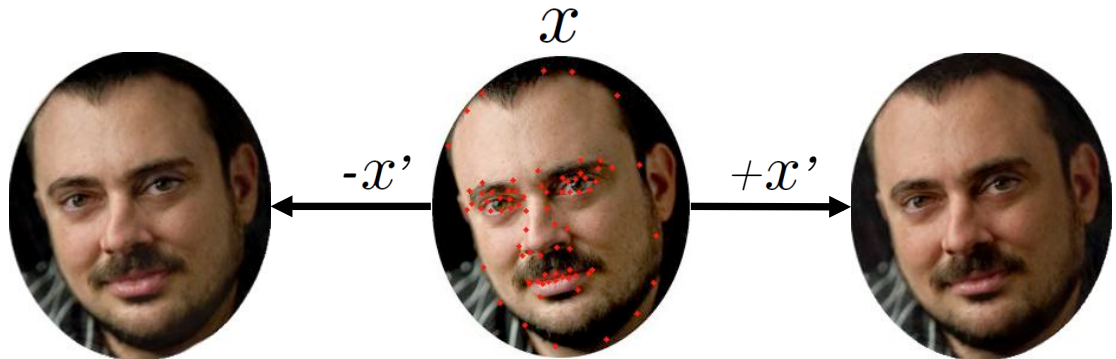
x : shape and appearance

Modifying face memorability

$$\min_x$$

cost of
modifying:

\mathcal{X} : *shape and
appearance*



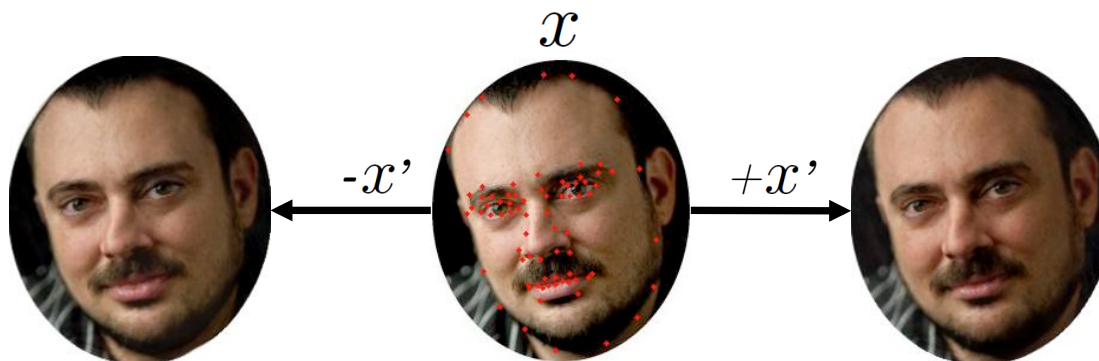
Modifying face memorability

$$\min_x \quad \underline{C_{id}(x)}$$

cost of
modifying:

identity

\mathcal{X} : *shape and
appearance*



Modifying face memorability

$$\min_x \quad \underbrace{C_{id}(x)}_{\text{identity}} + \lambda \underbrace{C_{attr}(x)}_{\text{attributes}}$$

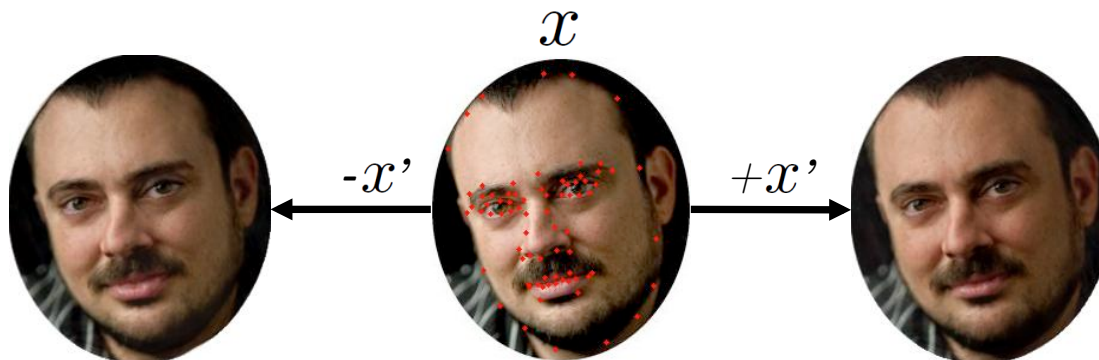
cost of
modifying:

identity

attributes

e.g. age, gender, emotion

\mathcal{X} : shape and
appearance

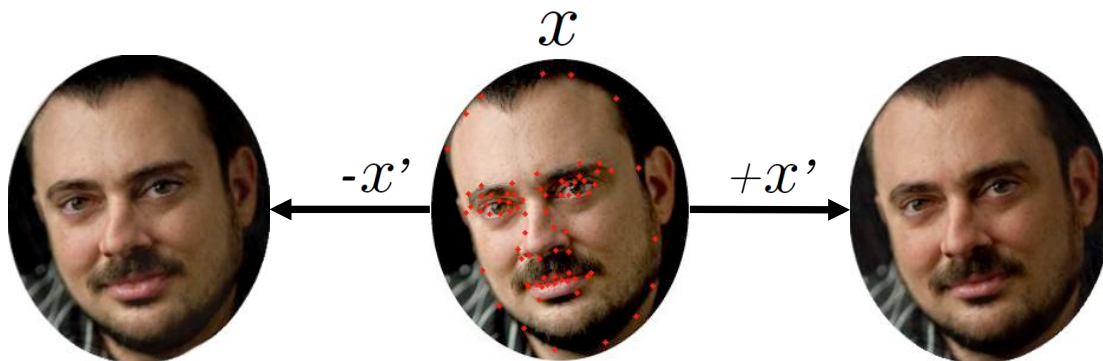


Modifying face memorability

$$\min_x \quad \underbrace{C_{id}(x)}_{\text{identity}} + \lambda \underbrace{C_{attr}(x)}_{\substack{\text{attributes} \\ \text{e.g. age, gender, emotion}}} + \gamma \underbrace{C_{mem}(x)}_{\text{memorability}}$$

cost of modifying:

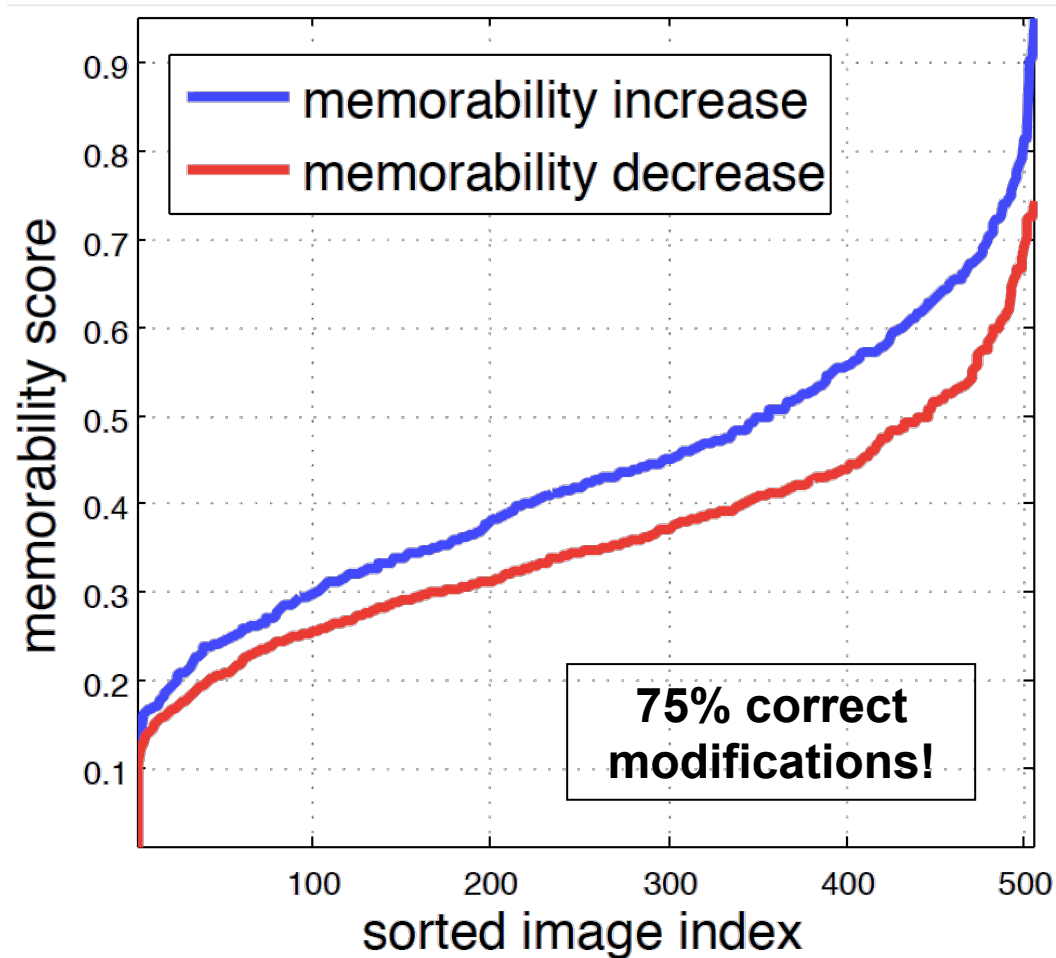
\mathcal{X} : shape and appearance



Modifying face memorability



Modifying face memorability

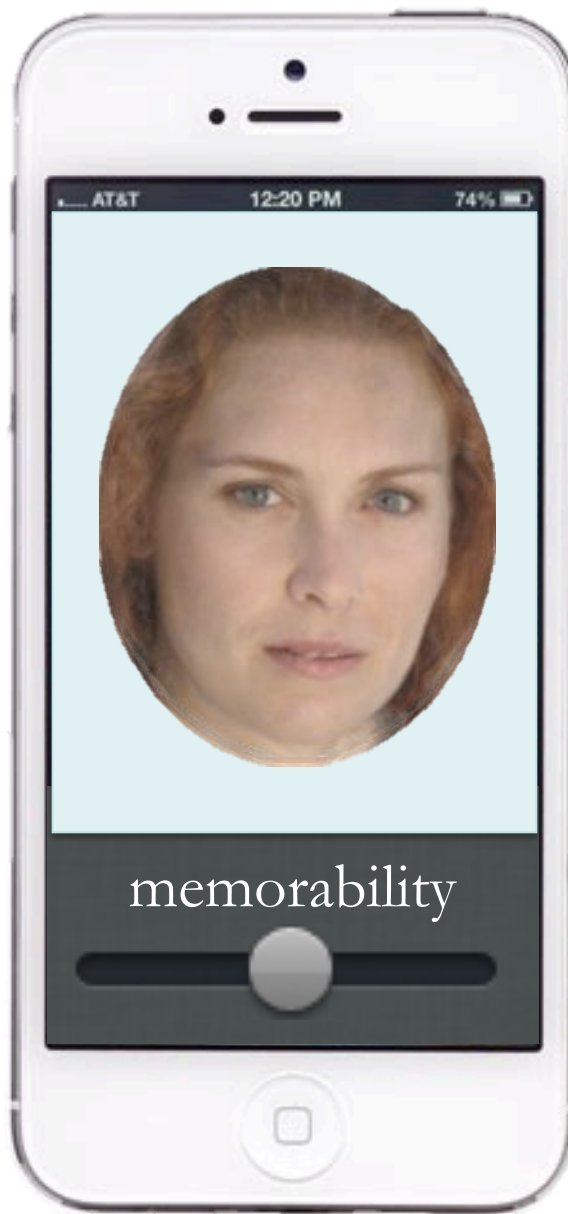


Modifying face memorability

GIZMODO

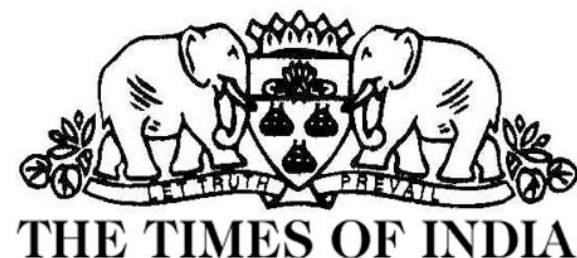
WIRED

n p r



The New York Times

gizmag



Overview

Predicting popularity



Predicting memorability

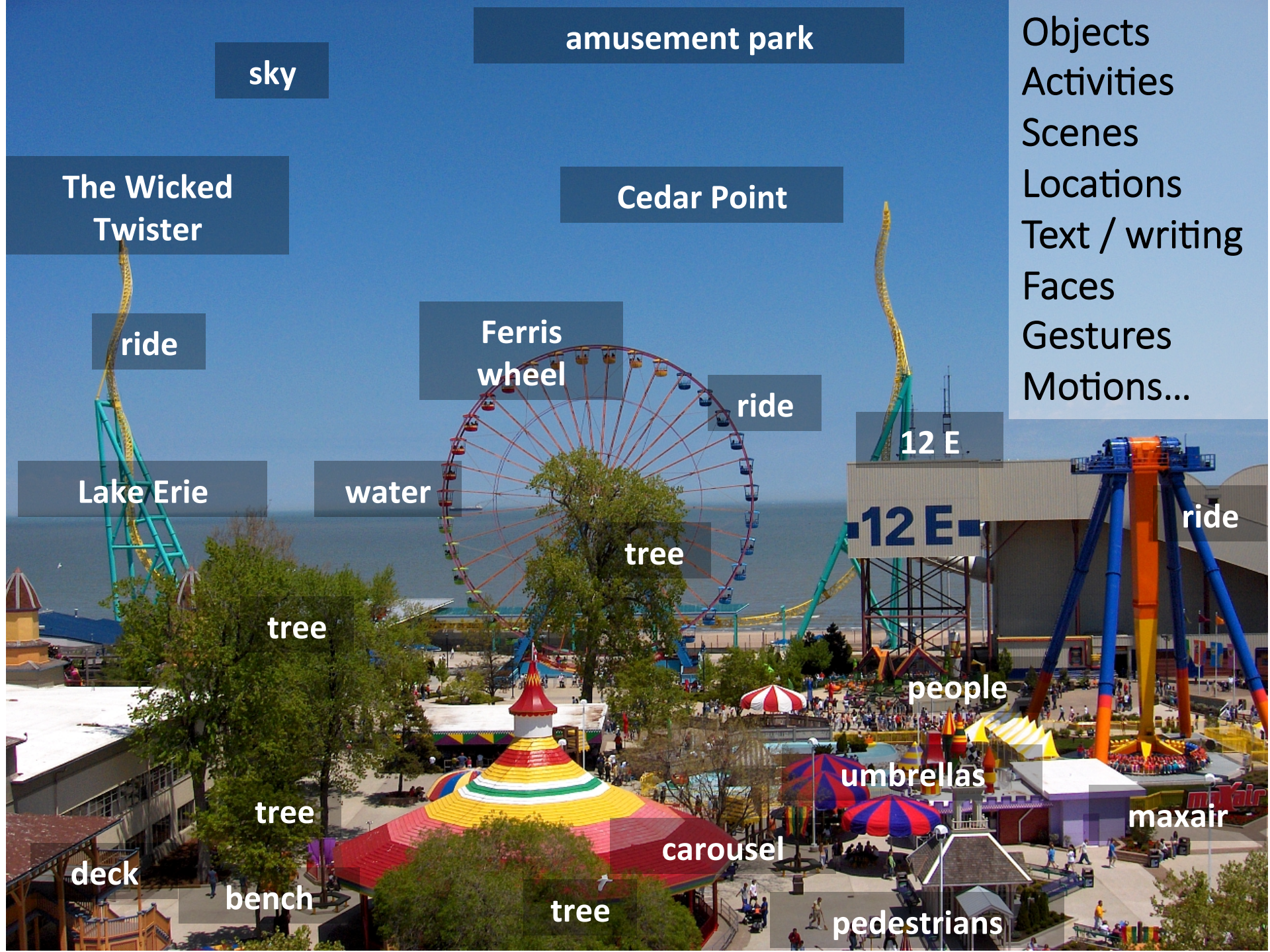


Modifying memorability



Perspective





amusement park

sky

The Wicked
Twister

Cedar Point

ride

Ferris
wheel

ride

12 E

Lake Erie

water

tree

tree

people

ride

umbrellas

maxair

carousel

deck

bench

tree

pedestrians

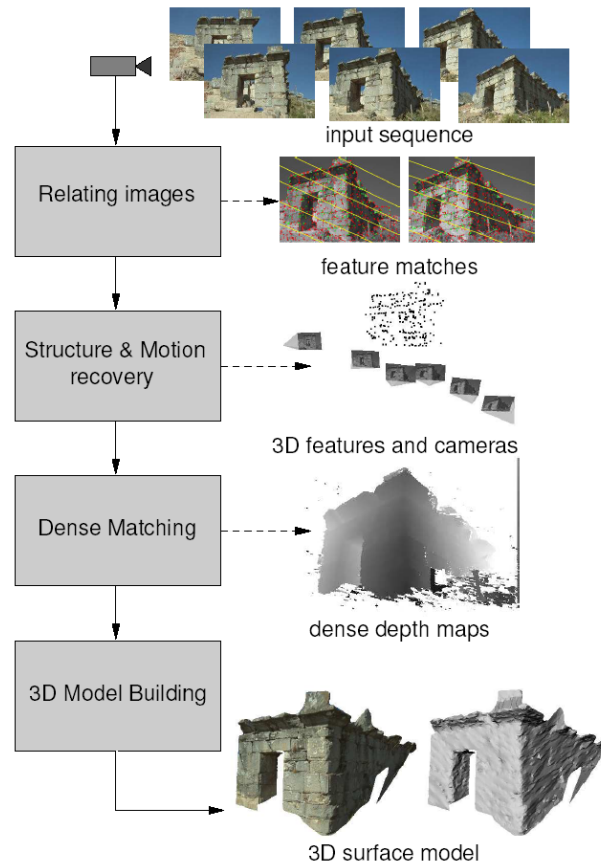
Objects
Activities
Scenes
Locations
Text / writing
Faces
Gestures
Motions...

Real-time stereo

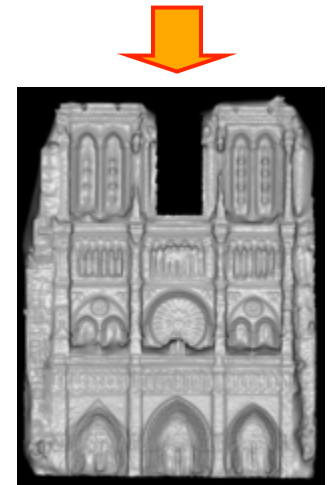


Pollefeys et al.

Structure from motion



Multi-view stereo for community photo collections



Goesele et al.

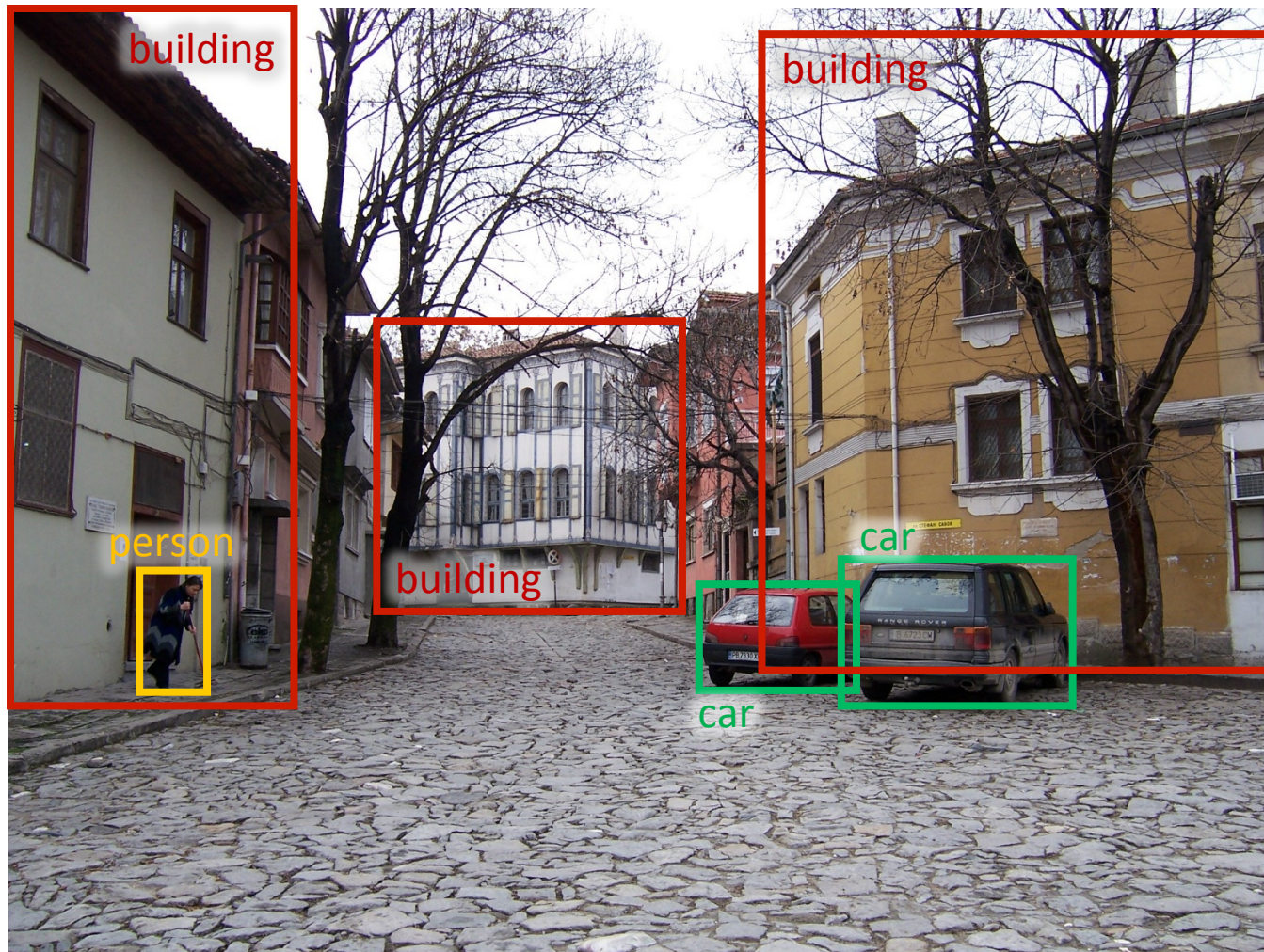
Beyond the Immediate Scene

- An image is more than a simple composition of its visual elements
- What more can we infer from an image?

Different scales of the problem



Different scales of the problem



Different scales of the problem



Different scales of the problem



Different scales of the problem



Different scales of the problem



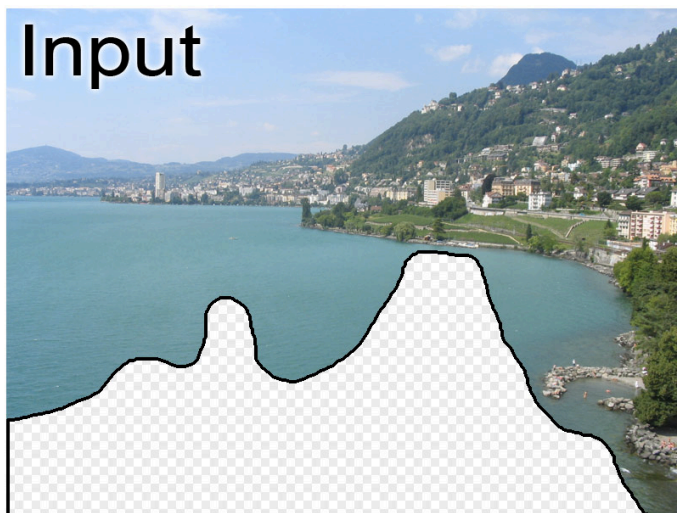
Different scales of the problem



Different scales of the problem



Different scales of the problem



Different scales of the problem



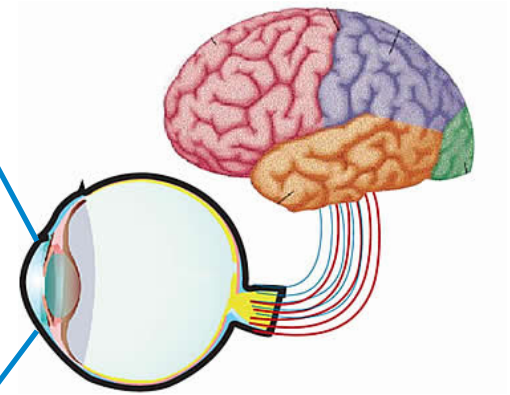
Different scales of the problem



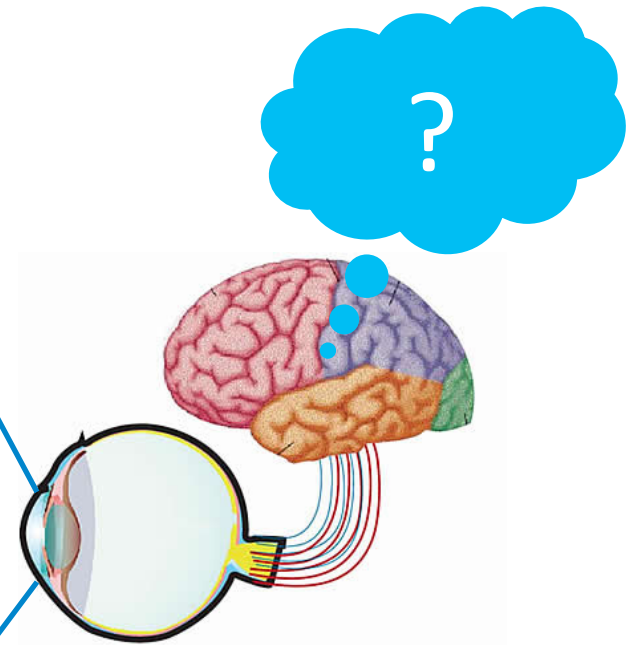
Different scales of the problem



Different scales of the problem



Different scales of the problem



Summary

- Looking beyond the visible scene:
 - Predicting popularity
 - Predicting memorability
 - Finding McDonald's
- We show how to modify the non-visual properties in a predictable way using visual elements
 - Modifying face memorability

Acknowledgements

Thank you!



<http://mit.edu/khosla>