High-level attributes of images: How memorable is an image?

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Motivations

How to measure memorability?

What content makes an image memorable?

Understanding memorability

Database

Prediction algorithms

Applications

aquarium · fish · person · floor

Pixels · GIST

Memory Game

Database: 2222 photographs from SUN database (*Xiao et al. 2010*).

665 participants on Amazon's Mechanical Turk.

Memorability = probability of correctly detecting a repeat after a single view of an image in a long stream.

1-7 back — Vigilance repeat

*** 100

91-109 back — Memory repeat

time

Memorable

Average

Forgettable

$\rho = 0.75$

Group 1 · Group 2 · Chance

Average % memorability, according to Group 1, of 25 images centered about rank N

Image rank N, according to specified group

Wide range of memorabilities and high inter-subject consistency

Predicting image memorability

Prediction algorithm: SVM Regression with non-linear kernels on following features:

"Aquarium, indoors"
1) **Scene** annotations — $\rho = 0.42$
scene categories of entire image

aquarium · person
2) **Object** annotations — $\rho = 0.49$
number, size, and rough position of each object class

"Funny, peaceful, eye contact"
3) **Attribute** annotations — $\rho = 0.53$
Understandable attributes describing layout, aesthetics, emotions, actions, and appearance of people

Pixels · GIST · SIFT · HOG · SSIM
4) **Global image features** — $\rho = 0.47$
pixel histograms, GIST, spatial pyramids of SIFT, HOG, SSIM

5) **All features** — $\rho = 0.59$
All annotations and global image features

Automatic predictions from global image features

Predicted memorable

Predicted average

Predicted forgettable

What content makes an image memorable?

Object score = (prediction when object included in image's feature vector) - (prediction when object removed)

Objects shaded according to object score (computed per image)

− 0.15 · 0 · + 0.09

Objects ranked according to object score (averaged across images)

mountain · tree · sky · building · ... · seats · floor · person sitting · person

Scenes ranked according to their average memorability

broadleaf forest (52%) · botanical garden (52%) · natural lake (52%) · campus (53%) · ... · bedroom (76%) · bakery shop (81%) · art studio (81%) · bathroom (84%)

Understanding memorability

Aesthetics versus memorability
corr: −0.28
M / A
↑A ↓M · ↑A ↑M · ↓A ↓M · ↓A ↑M

Unusualness versus memorability
corr: −0.11
M / U
↑U ↓M · ↑U ↑M · ↓U ↓M · ↓U ↑M

0.36 → Enclosed space
Person: face visible
Person: eye contact
Sky
Number of people in image

Attributes · Scenes · Objects

Magnitude of correlation with memorability

Features — 922

Information theoretic feature selection

$$A^* = \arg\max \; \mathrm{I}(A; M)$$
$$\text{s.t.} \quad C(A) \leq B$$

Rank corr
0.48 · 0.46 · 0.44 · 0.42 · 0.4 · 0.38 · 0.36

Testing · Training

Features — 2 4 6 8

enclosed_space < 0.47

face_visible < 0.21 · · · face_visible < 0.49

peaceful < 0.75 · recognize < 0.55 — 0.78 · peaceful < 0.75 · single_focus < 0.20

0.64 · recognize < 0.45 · recognize < 0.45 — 0.65 · 0.61 · 0.83

0.56 · 0.62 · 0.69 · 0.73

Applications and future directions

Retrieve better images from search

Design mnemonic aids
"heavy" / "lourds"

Diagnose memory problems

Summarize photo album or video

Make an image more memorable

Understand human memory