webcamaze – Amazing Webcams

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Webcams – Eyes of the Internet

> 25,000 webcams on-line
The Most Common Image Worldwide
Example Sequence
Images are Overwritten – What a pity!

- GOAL: Spot some “cool” images – automatically
“In the right time at the right spot”
Challenges

1. Enormous amount of data

2. What do we (humans) find interesting?
Challenges

1 Enormous amount of data

2 What do we (humans) find interesting?
What is “Interesting”

- (highly) subjective
  - prior knowledge
  - context
  - personal favor
  - semantics
  - etc.
What is “Interesting”
What is “Interesting”
What is “Interesting”
What is “Interesting”

- Interestingness in image sequences
  - Sequence specifies the context

Outline

- Human consensus baseline of visual interestingness
- Computational approach
Human Consensus Baseline
Dataset – 20 Sequences
Dataset – High Scores

1.00

0.93

0.87

29.03.2014

Helmut Grabner
Dataset – High Scores
Dataset – Medium Scores

0.58

0.42
Dataset – Statistics

Human Consensus Baseline

Non interesting: 0.0
Interesting: 1.0

avg/seq: 154
97%

avg/seq: 5
3%
Dataset – Consistency

Standardized Cronbach’s Alpha

0.7 0.8 0.9 1.0

questionable  acceptable  good  excellent

average 0.83

Available on-line!

The human consensus baseline gives a solid ground and can be used to:
- build computational models and
- evaluate them.
Human Study on Single Images

- Memorability dataset...

...with additional annotations
- Human annotates (Mechanical Turk)
- > 900 features (e.g., indoor, enclosed space, aesthetic, famous place, etc.)


Correlation with Memorability

Abstract

Artists, advertisers, and photographers are routinely presented with the task of creating an image that a viewer will remember. While it may seem like image not. Contrary to popular belief, unusual or aesthetically pleasing scenes do not tend to be highly memorable. This work represents one of the first attempts at ...

Correlation with “Interestingness”

corr: 0.59

corr: 0.63

Correlation with Interestingness

A new Concept: Interestingnessness

Psychological View

- **Daniel Berlyne** (1924-1976)
- Mid-50s: Interest relevant for human learning

- 4 collative variables:
  - **Novelty**
  - **Uncertainty**
  - **Conflict**
  - **Complexity**

Computational Approach: Overview

Image Sequence

Interestingness Cues
- emotion
- complexity
- novelty
- learned

Ranking
- high
- low

Combination and Context Regularizations
Cues for Interestingness: Emotion

Image ↔ Arousal ↔ Emotions


High scoring samples
Cues for Interestingness: Complexity

Image ↔ # Bytes ↔ Complexity

Compression

High scoring samples
Cues for Interestingness: Novelty

Image ↔ outlier ↔ Novelty

dense regions (normality)

High scoring samples


[M. Breunig, H. Kriegel, R. Ng, and J. Sander. LOF: Identifying density-based local outliers. In Proc. ACM SIGMOD Int. Conf. on Management of Data, 2000]
Cues for Interestingness: Learned

Features & Machine Learning

Image ↔ Interestingness


High scoring samples
Combination & Context Regularization

- **Linear Model**
  \[ s = w^T [x^{(emotion)}, x^{(novelty)}, x^{(learned)}, x^{(complexity)}]^T \]

- **Context Regularization**
  - Temporal neighboring images \(\Rightarrow\) similar interestingess Score
  - Visually similar images \(\Rightarrow\) similar interestingess Score

[\cite{V. Jain and E. Learned-Miller. Online domain adaption of a pre-trained cascade of classifiers. In Proc. CVPR, 2011.}]
Results

- Evaluation: Top$_3$ Score

Human Consensus Ranking:
- Top 3
  - Human Consensus Scores:
    - 10 9 8
  - Computer Ranking:
    - 8 6 9

\[
\text{Top}_3 = \frac{8 + 6 + 9}{10 + 9 + 8} = 0.6
\]
Results: Box-plot of Top_3 for the 20 Sequences

- Chance: 17%
- Fusion:
  - Combined
  - + regularization
- Interestingness Cues:
  - Emotion
  - Complexity
  - Learned
  - Novelty
Low Ranked Images
Failures

False Positives

Misses
Computational Approach – Conclusion

- We have demonstrated – while still remaining far from a semantic interpretation – a number of basic cues and their straightforward combination already let us mimicking human interest responses.
www.webcamaze.com
Automatically Detected Interesting Images
Automatically Detected Interesting Images
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Automatically Detected Interesting Images
Automatically Detected Interesting Images
Automatically Detected Interesting Images
Automatically Detected Interesting Images
On-line almost 3 years

2011-06-06

2014-03-21
> 10,000 webcams
an image every 15 minutes
~1,000,000 images per day
webcamaze – Honest Insights

~1,000,000 Images/Day
~100 m

~1,000 Images/Day
~10 cm

(5 min.)

~1 Images/Day
0.1 mm
Other Applications…

- Make a long and boring video short and interesting

Original (40 s)
Other Applications…

- Make a long and boring video short and interesting
Other Applications…

- Make a long and boring video short and interesting
Other Applications…

- Make a long and boring video short and interesting

15 s (66% reduced)
Other Applications...

- Make a long and boring video short and interesting
Make a long and boring talk short and interesting
Summary

What cases human interest?

Approach it computationally

User Study, Analysis

Application(s)
Thanks!

Fabian Nater

Michael Gygli

Michel Druey

Michael Herzog
Thank you!

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