What makes an image popular?
Can we predict what will become popular?
Why does it matter?

content distribution
Why does it matter?

‘selfie selection’
Why does it matter?

advertising
Why does it matter?

content distribution

‘selfie selection’

advertising

video summarization

modifying popularity

understanding user behavior
Related work

• Social networks
  – Gladwell, 2002
  – Rogers, 2003
  – Romero et al, 2011

• Video popularity
  – Pinto et al, 2013
  – Shamma et al, 2011
  – Nwana et al, 2013

• High-level attributes
  – Dhar et al, 2011
  – Isola et al, 2011
  – Patterson et al, 2012
  – Khosla et al, 2013

• Text popularity
  – Petrovic et al, 2011
  – Hong et al, 2011
Overview

• What is image popularity?

• Predict popularity using image content?

• How does this compare to social factors?

• What makes an image popular?

• Conclusions and future work
Overview

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What is image popularity?
What is image popularity?
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
What is image popularity?
What is image popularity?

- Context dependent

Facebook newsfeed

Flickr search results

Flickr user
Popularity dataset

Dataset: 2.3 million Flickr images
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 ($\rho$)

Szabo and Huberman, 2010
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Predicting popularity using image content
Predicting popularity using image content

- Simple image feature: image intensity
Predicting popularity using image content

- Simple image feature: image intensity
Predicting popularity using image content

- Simple image feature: image intensity

![Graph showing normalized views vs. intensity mean with rank corr = -0.00.](image)

- 1.2
- 3.6
- 0.13
- 0.53

...
Predicting popularity using image content

- Simple image feature: image intensity

rank corr $= -0.00$

rank corr $= 0.01$

rank corr $= -0.02$
Predicting popularity using image content

- Simple image features: HSV color space
Predicting popularity using image content

- Simple image features: HSV color space

- Rank corr = -0.05
- Rank corr = 0.02
- Rank corr = 0.01
Predicting popularity using image content

Input Image

Computer vision features

GIST  HOG  SIFT

Support Vector Regression

\[
\begin{align*}
\min_{w, b, \xi} & \quad \frac{1}{2} w^T w + C \sum_{i=1}^{l} \xi_i + C \sum_{i=1}^{l} \xi_i^* \\
\text{subject to} & \quad w^T \phi(x_i) + b - z_i \leq \epsilon + \xi_i, \\
& \quad z_i - w^T \phi(x_i) - b \leq \epsilon + \xi_i^*, \\
& \quad \xi_i, \xi_i^* \geq 0, i = 1, \ldots, l.
\end{align*}
\]

1.9  Image popularity
Predicting popularity using image content

**Gist**
e.g. GIST [Oliva 2001]

**Texture**
e.g. LBP [Ojala 2002]

**Gradient**
e.g. HOG [Dalal 2005]

**Color**
e.g. [van de Weijer 2009]

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**Deep learning**
e.g. [Krizhevsky 2012]

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1000 Objects

e.g. [Krizhevsky 2012]

- airplane
- bicycle
- bird
- boat
- bottle
- orange
- bench

- remote
- car
- stove
- table
- apple
- cart
- ray

- ... 
- person
- sheep
- train
- television
- dog
- fox
Predicting popularity using image content

![Bar chart showing rank correlation for different features.](chart.png)
Predicting popularity using image content

![Bar chart showing rank correlation for different image features and user types. The features are Gist, Texture, Color, Gradient, Deep learning, Objects, and Combined. The user types are One-per-user, User-mix, and User-specific. The y-axis represents rank correlation ranging from 0.0 to 0.4. The chart shows varying degrees of correlation across different features and user types.]
Predicting popularity using image content
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Predicting popularity using social cues

- **User information**
  - Mean views
  - Photo count
  - Contacts
  - Groups
  - Group members
  - Member duration
  - Is pro

- **Image information**
  - Tags
  - Title length
  - Description length
Predicting popularity using social cues

![Graph showing rank correlation for different features: Mean views, Photo count, Contacts, Groups, Is pro, Tags, Title length, Desc. Length. The graph compares one-per-user, user-mix, and user-specific rankings.](image-url)
Predicting popularity using image + social cues

![Bar chart showing rank correlation for different scenarios: Content only, Social only, and Combined.]

- **Content only** shows a rank correlation of around 0.4.
- **Social only** has a lower rank correlation, around 0.2.
- **Combined** scenario shows the highest rank correlation, close to 0.6.

Legend:
- Blue: One-per-user
- Orange: User-mix
- Gray: User-specific
Predicting popularity using image + social cues

![Bar chart showing rank correlation for different methods: Content only, Social only, Combined. One-per-user and User-mix methods are also shown.](image)
Predicting popularity using image + social cues

![Graph showing rank correlation for different strategies: Content only, Social only, and Combined.](image-url)
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What makes an image popular?

van de Weijer et al, CVPR 2007
What makes an image popular?

![Input Image]

Color histogram

![Diagram of support vector regression]

1.9 Image popularity
What makes an image popular?

![Color Importances Graph]

- The graph illustrates the relationship between color importance and the number of colors in an image.
- As the number of colors increases, so does the perceived importance of colors.
- The data suggests that images with more colors tend to be perceived as more important.

This visual representation helps in understanding how color diversity affects the way images are perceived.
What makes an image popular?

• Predicting object categories

Krizhevsky et al, NIPS 2012
What makes an image popular?

- tench, Tinca tinca
- goldfish, Carassius auratus
- great white shark
- tiger shark, Galeocerdo cuvieri
- hammerhead, hammerhead shark
- electric ray, crampfish, numbfish, torpedo
- stingray
- cock
- hen
- ostrich, Struthio camelus
- brambling, Fringilla montifringilla
- goldfinch, Carduelis carduelis
- house finch, linnet, Carpodacus mexicanus
- junco, snowbird
- indigo bunting
- robin, American robin
- bulbul
- jay
- magpie
- chickadee
- water ouzel, dipper
- kite
- bald eagle, American eagle, Haliaeetus leucocephalus
- vulture
- great grey owl, great gray owl, Strix nebulosa
- European fire salamander, Salamandra salamandra
- common newt, Triturus vulgaris
- eft
- spotted salamander, Ambystoma maculatum
- axolotl, mud puppy, Ambystoma mexicanum
- bullfrog, Rana catesbeiana
- tree frog, tree-frog
- tailed frog, bell toad, ribbed toad, tailed toad, Ascaphus trui
- loggerhead, loggerhead turtle, Caretta caretta
What makes an image popular?

1.9 Image popularity

\[
\begin{align*}
& \min_{\mathbf{w}, \xi_i, \xi_i^*} \quad \frac{1}{2} \mathbf{w}^T \mathbf{w} + C \sum_{i=1}^{l} \xi_i + C \sum_{i=1}^{l} \xi_i^* \\
& \text{subject to} \quad \mathbf{w}^T \phi(x_i) + b - z_i \leq \varepsilon + \xi_i, \\
& \quad z_i - \mathbf{w}^T \phi(x_i) - b \leq \varepsilon + \xi_i^*, \\
& \quad \xi_i, \xi_i^* \geq 0, \quad i = 1, \ldots, l.
\end{align*}
\]
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
What makes an image popular?

**Strong positive**
- miniskirt
- maillot
- bikini
- cup
- brassiere
- revolver

**Medium positive**
- cheetah
- giant panda
- basketball
- llama
- plow
- ladybug

**Negative**
- spatula
- plunger
- laptop
- golfcart
- space heater
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Conclusion

• Image popularity can be predicted to a reasonable extent using content alone!

• Both image content and social cues are important for popularity prediction

• Content/social cues help to a different degree in different contexts

• We identify some factors that make an image popular
Future work

• Predicting other notions of popularity e.g. shareability, likeability, comments

• Temporal evolution of popularity

• Effect of high-level attributes such as emotions

• Automatically modifying image popularity
Thank you!