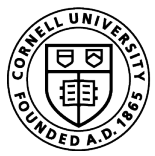
# Beyond Classification: **Latent User Interests Profiling** from Visual Contents Analysis

*Longqi Yang*, Cheng-Kang (Andy) Hsieh, Deborah Estrin

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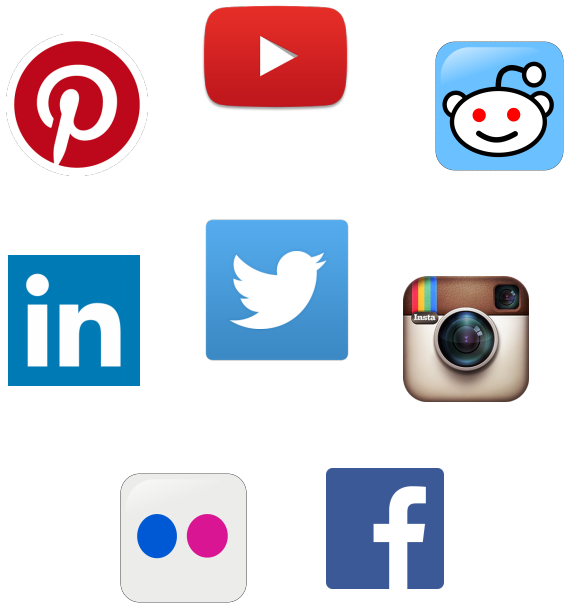
## Social Network



## Online Purchases

Alibaba.com

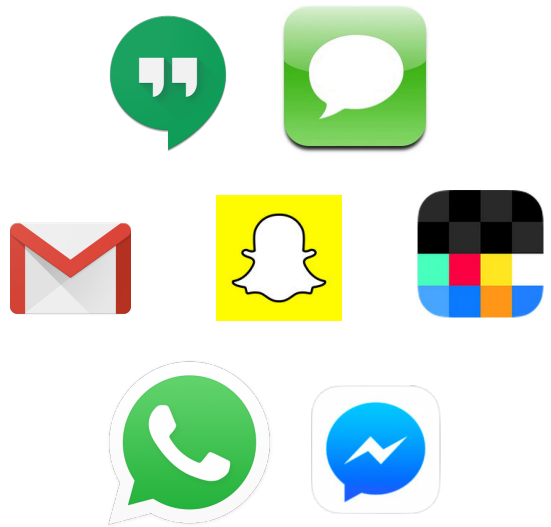
ebay

Instacart

freshdirect

Peapod
peapod.com

## Communications



# Our interests are manifested online …

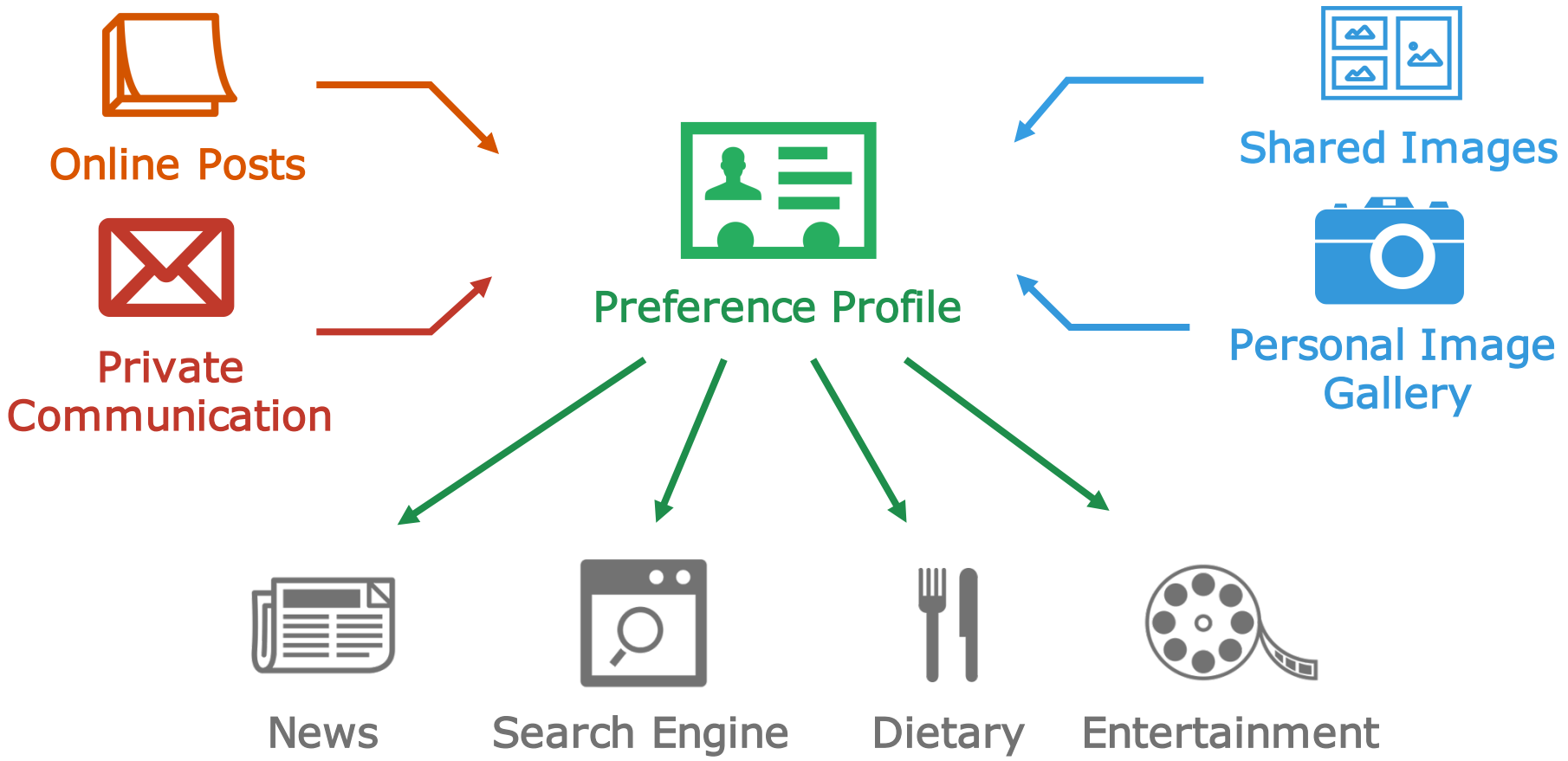


Posted/Shared Contents

People Connected/Followed

Items Purchased

# Preferences learning using small data



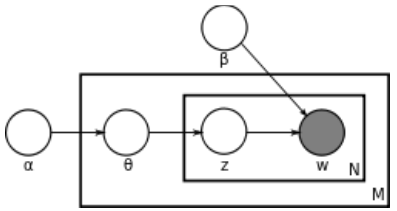
# Text/label-centric approach is widely studied

River

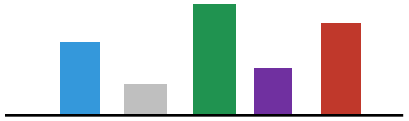
restaurant

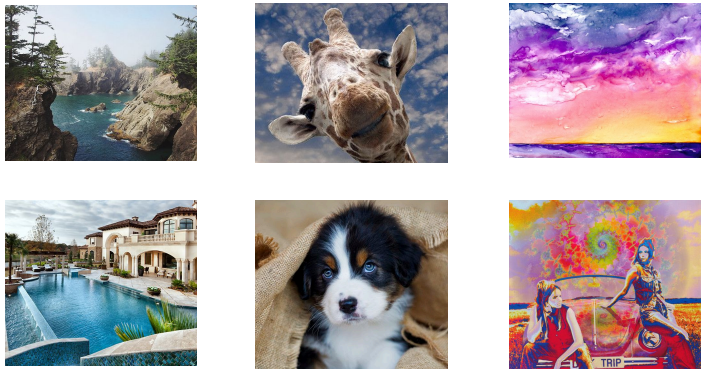
tourism

landscape




Topic Modeling
Structure Prediction





Classification/Labeling/Image-to-text

Travel Animal Art

# But preferences are sometimes not just about text...

User A



Travel Images




User B

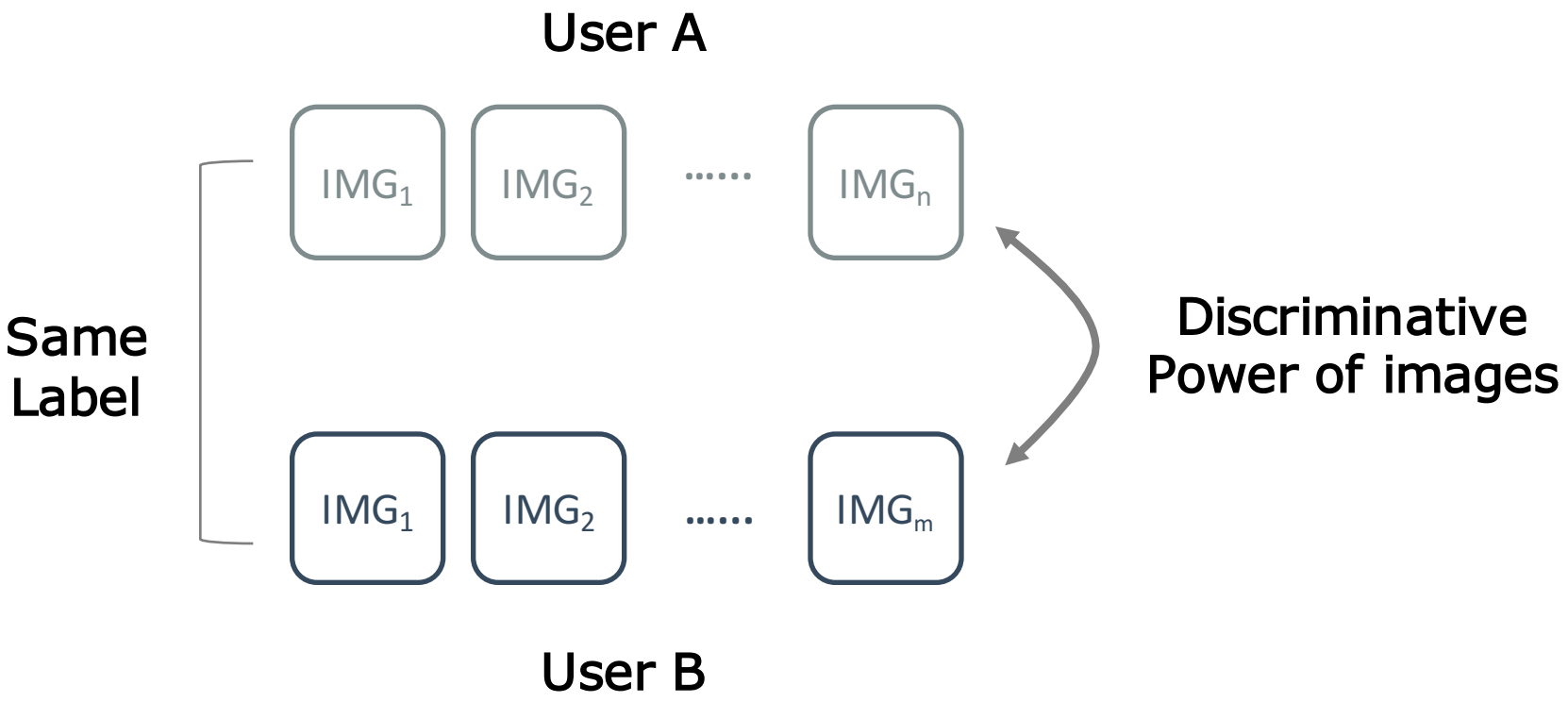
Intra-categorical variance: Hard to capture with text/label!

## Research question

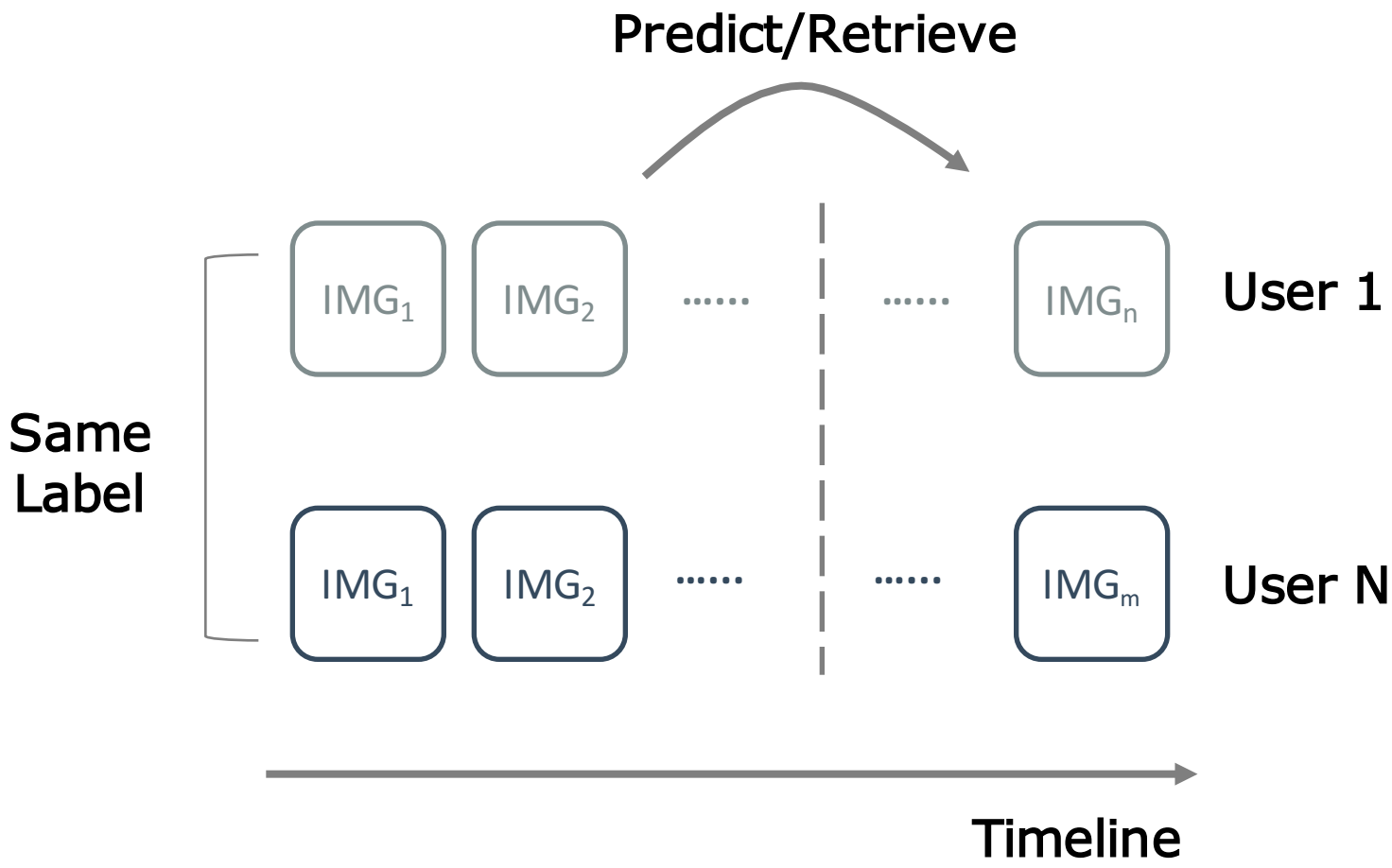
**Images' predictive power** for users' preferences **beyond labels**

Task 1: Pairwise Comparison
Task 2: Prediction

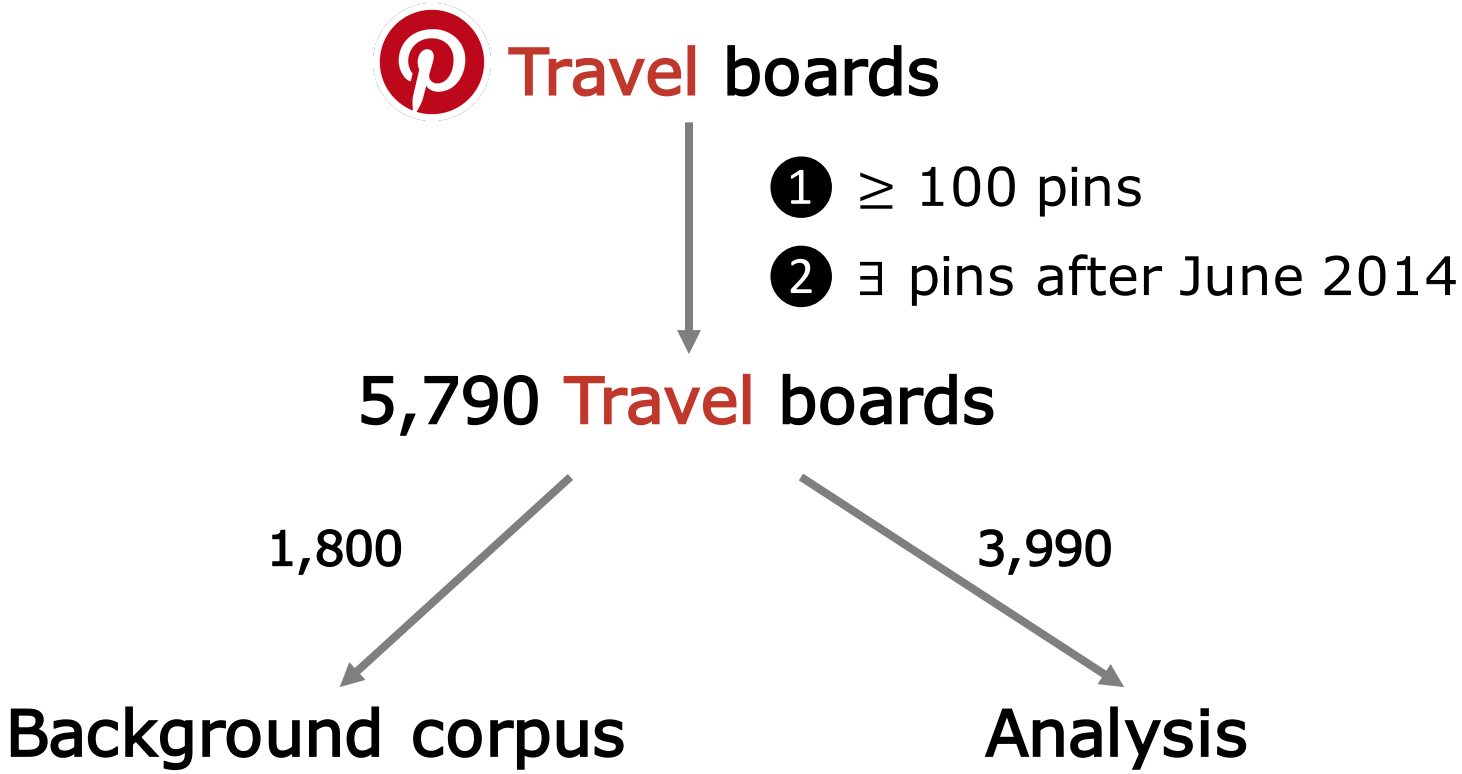
# Pairwise Comparison



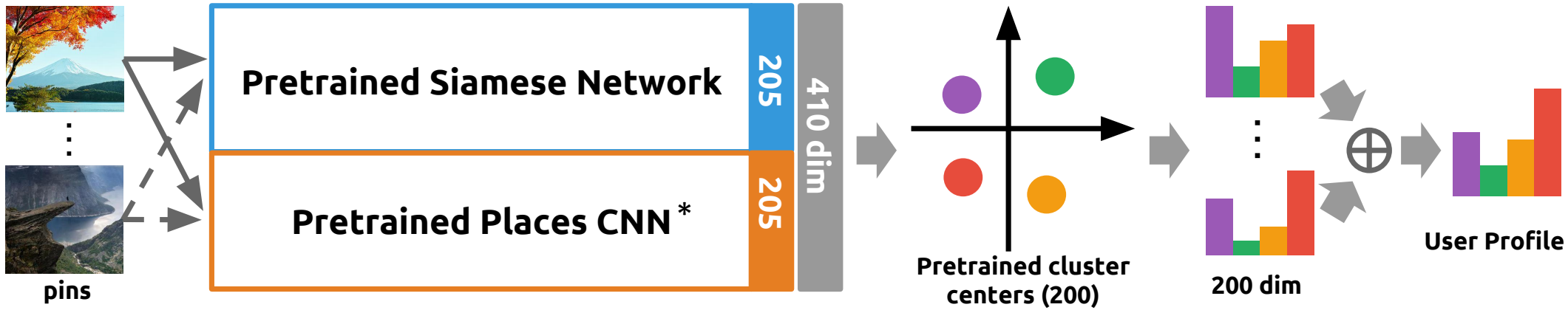
# Prediction: Consistency of Preferences



# Dataset

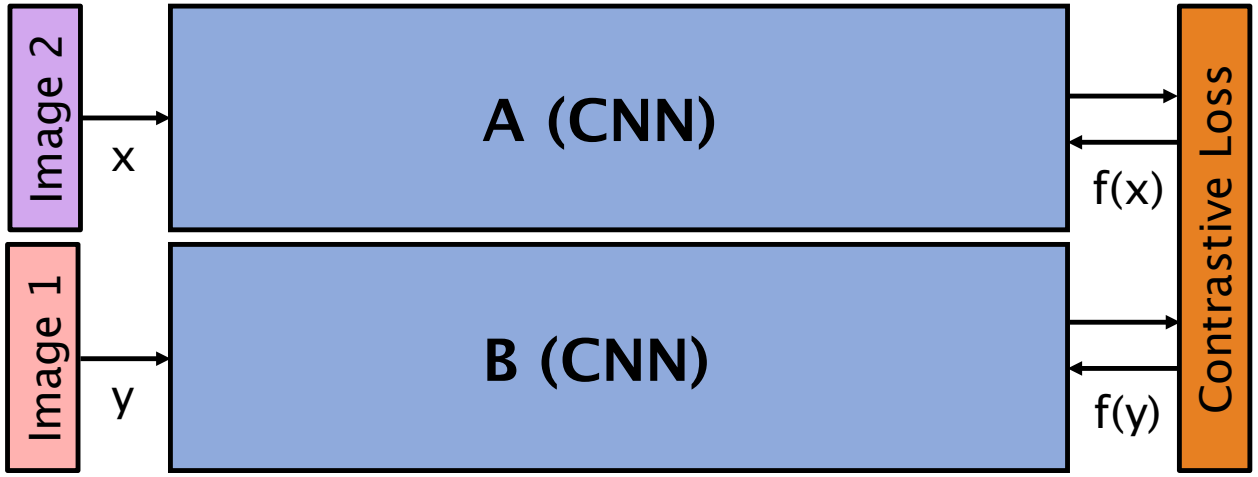

Travel boards
1 ≥ 100 pins
2 ∃ pins after June 2014
5,790 Travel boards
1,800
3,990
Background corpus
Analysis

# User Modeling and Image Representation




* B. Zhou, A. Lapedriza, J. Xiao, A. Torralba, and A. Oliva. "Learning Deep Features for Scene Recognition using Places Database." Advances in Neural Information Processing Systems 27 (NIPS), 2014

# User Modeling and Image Representation

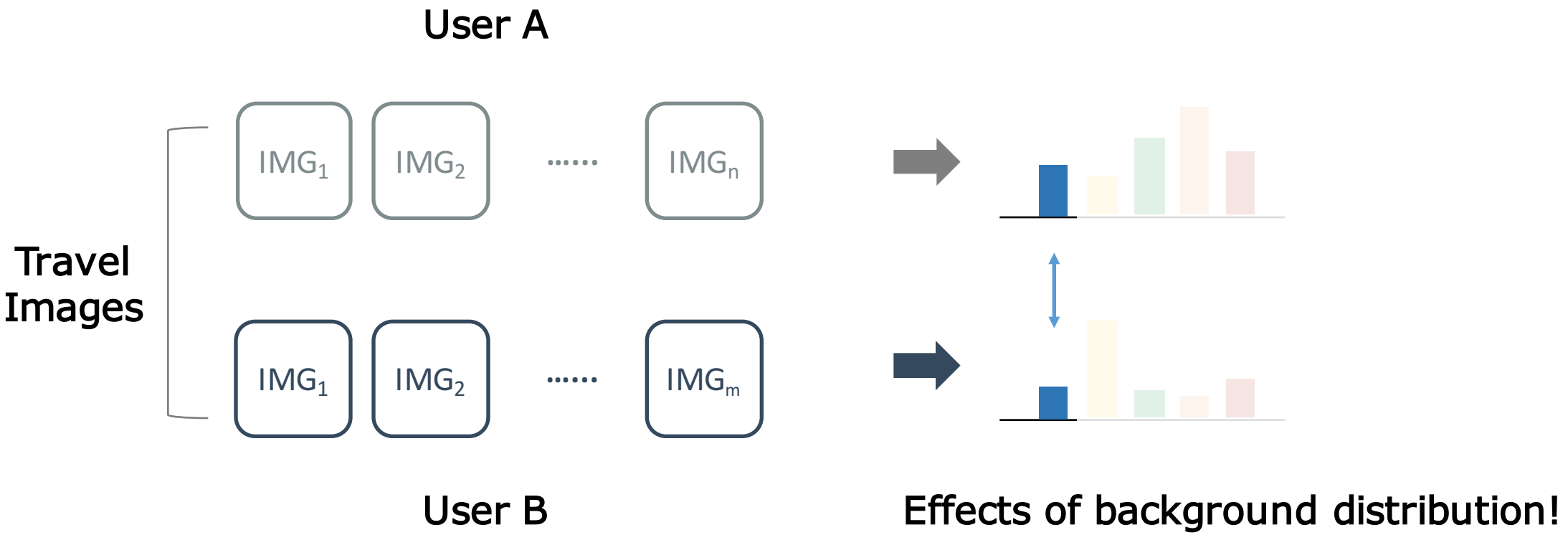



$$\{ \; , \; \} \xrightarrow{l = 1} \| \; - \; \| \approx 0$$

$$\mathcal{L} = \frac{1}{2} l D^2 + \frac{1}{2}(1 - l)\max(0, m - D)^2$$

$$\{ \; , \; \} \xrightarrow[l = 0]{} \| \; - \; \| > m$$

# Pairwise Comparison



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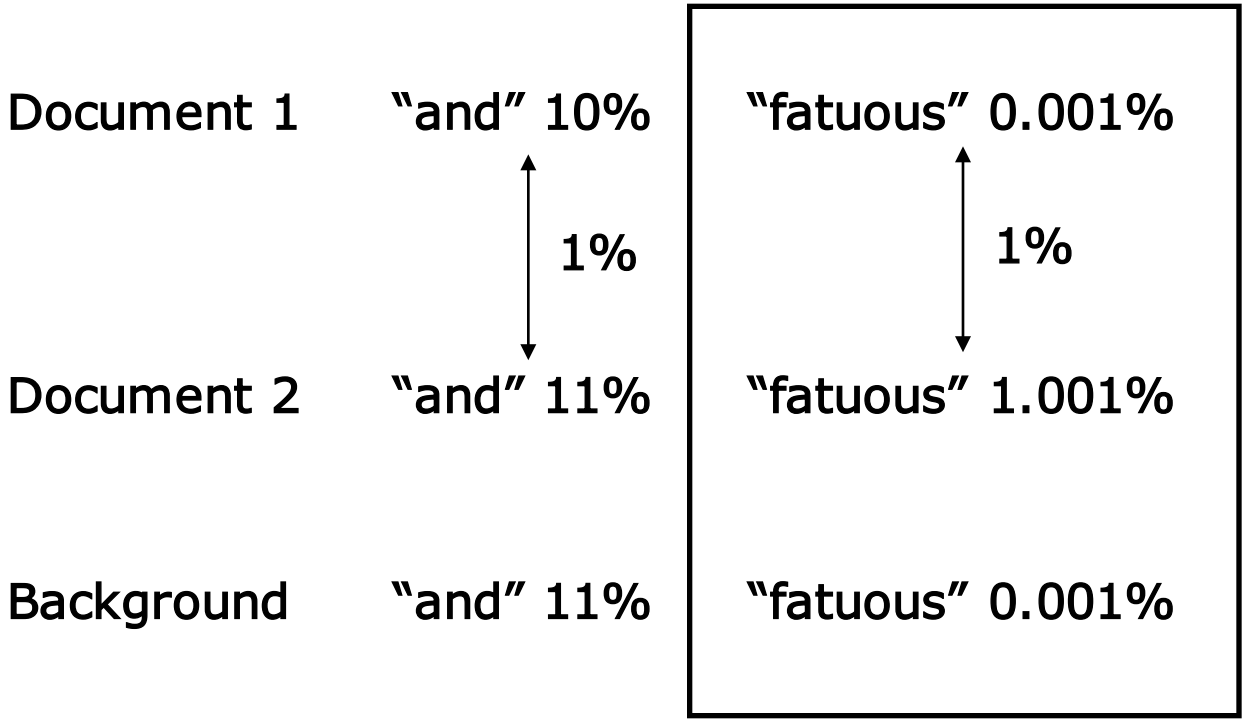

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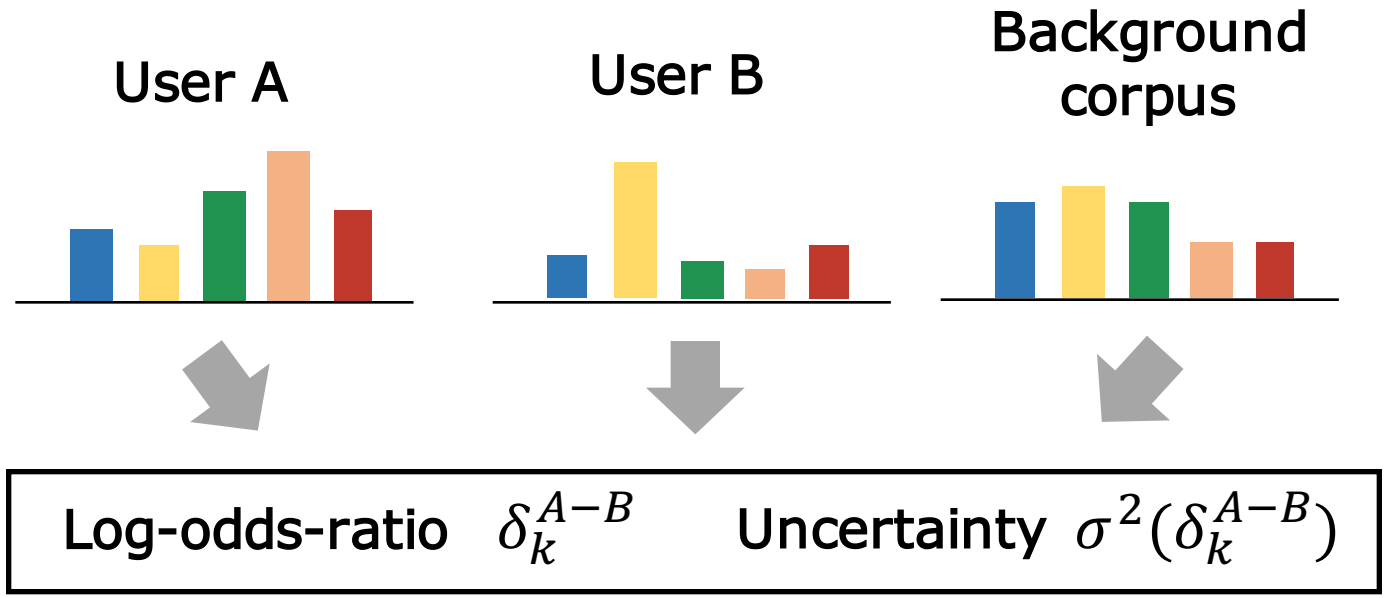
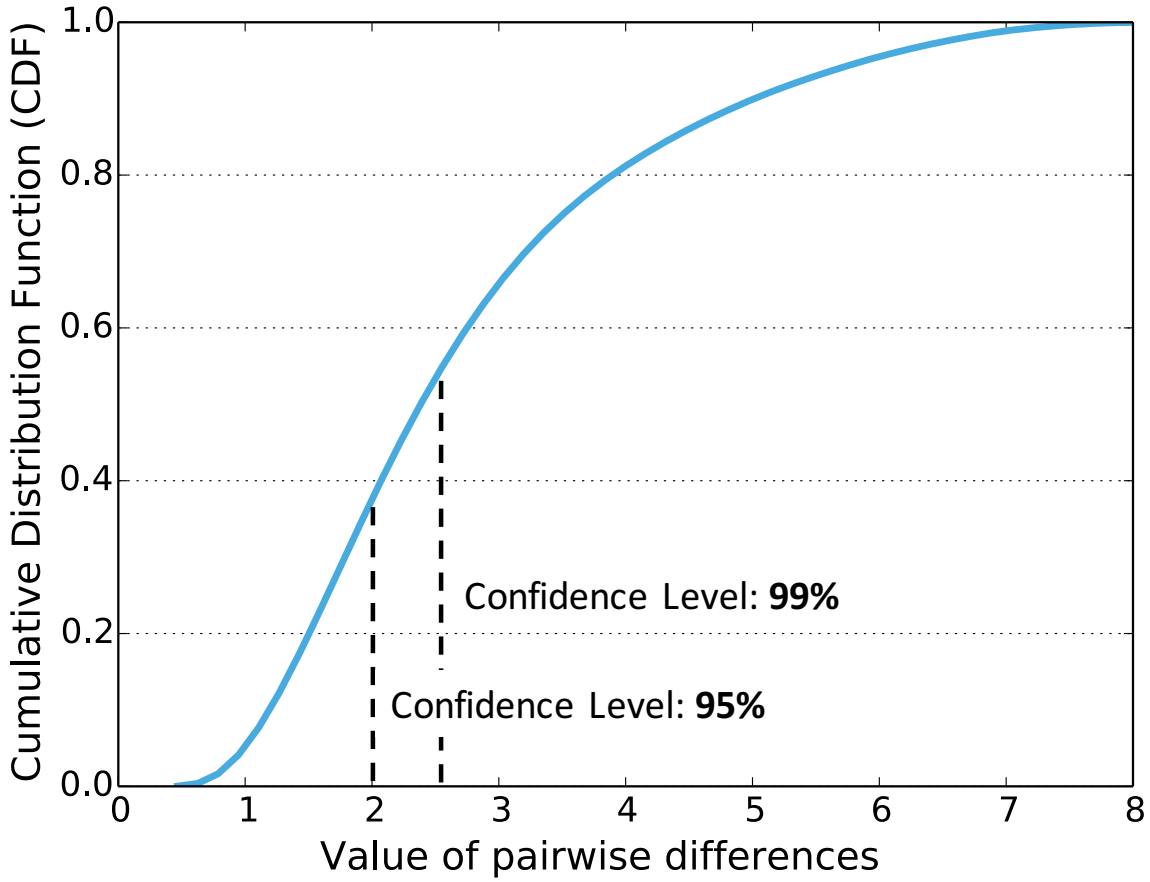


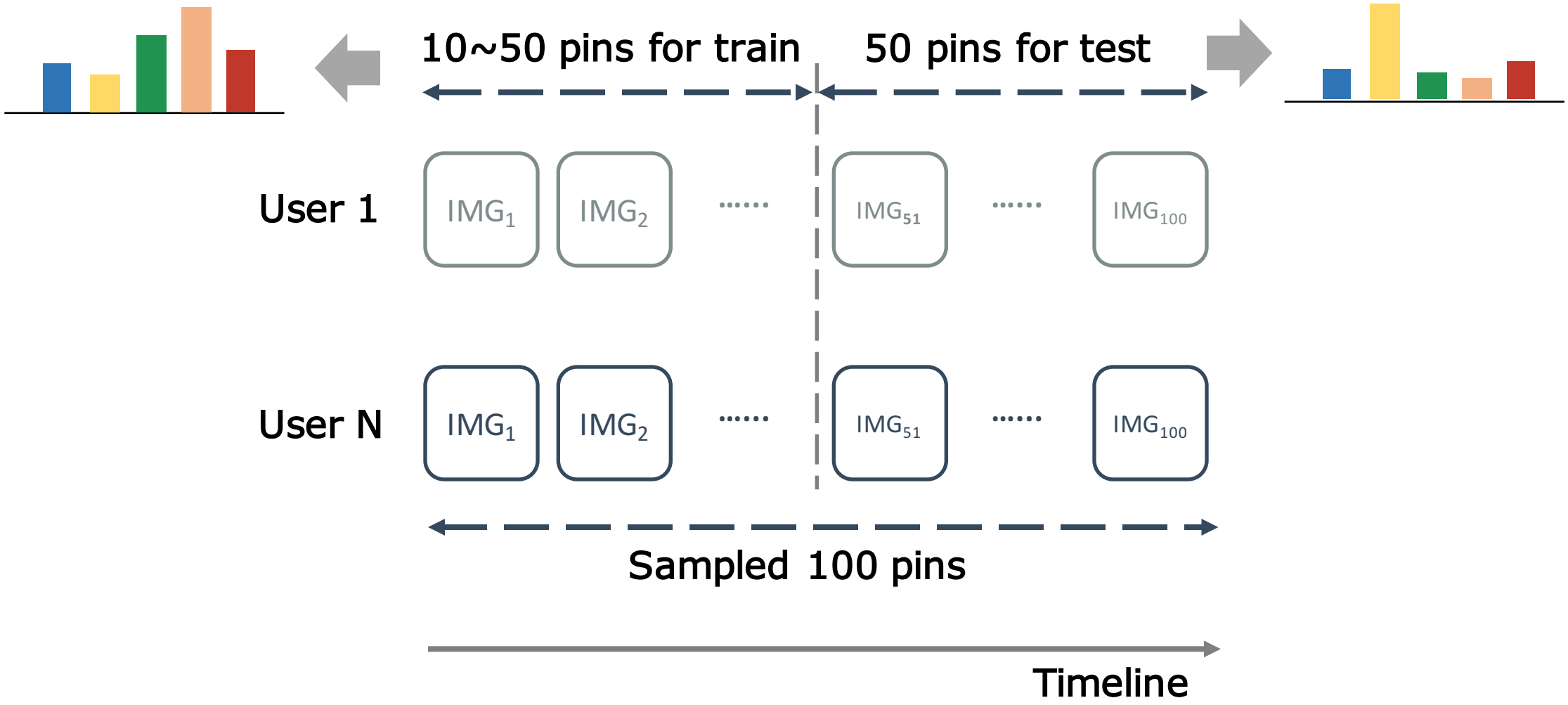

$$z_k^{A-B} = \frac{\delta_k^{A-B}}{\sqrt{\sigma^2(\delta_k^{A-B})}}$$

# Pairwise Comparison

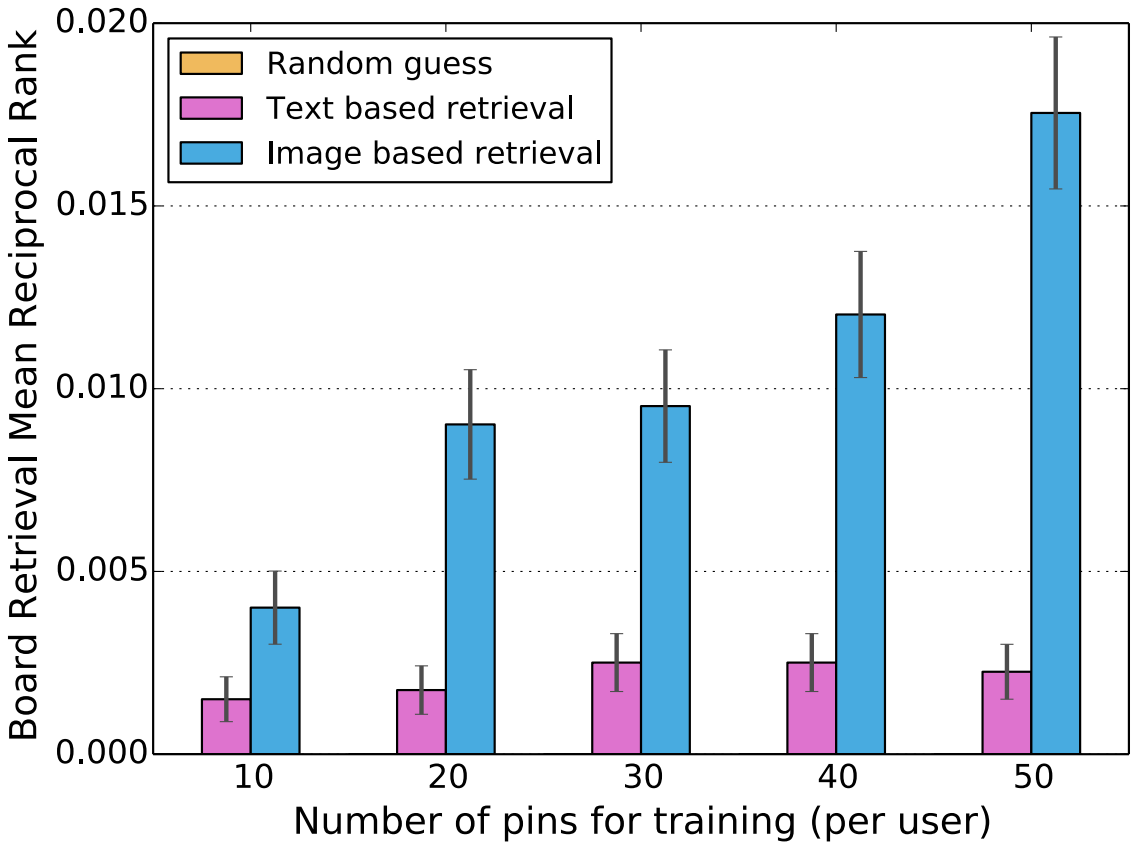



$\max\left|z_k^{A-B}\right|$ For all user pairs among 3,990 boards

# Prediction


10~50 pins for train
50 pins for test
User 1
IMG1
IMG2
IMG51
IMG100
User N
IMG1
IMG2
IMG51
IMG100
Sampled 100 pins
Timeline

# Prediction




$$MRR = \frac{1}{N}\sum_{i=1}^{N}\frac{1}{rank_i}$$

# Conclusion


**Small data fueled preferences learning – what can we do next?**

- Utilities of images beyond text/labels.
- Multi-modal data fusion
- End-to-end learning

# For more information

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http://smalldata.io/

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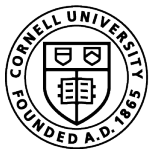
 @ylongqi

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