

# Geotag Propagation in Social Networks Based on User Trust Model

Ivan Ivanov, Peter Vajda, Jong-Seok Lee,  
Lutz Goldmann, Touradj Ebrahimi

Multimedia Signal Processing Group  
Ecole Polytechnique Federale de Lausanne, Switzerland



- We introduce users in our system for **geotagging** in order to simulate a real social network
- **GPS coordinates** to derive geographical annotation, which are not available for the majority of web images and photos
- A GPS sensor in a camera provides only **the location of the photographer** instead of that of the captured landmark
- Sometimes **GPS and Wi-Fi geotagging** determine wrong location due to noise





- Consider **user trust information** derived from users' tagging behavior for the tag propagation
- Build up an **automatic tag propagation system** in order to:
  - *Decrease the annotation time, and*
  - *Increase the accuracy of the system*



<http://www.costadevault.com/blog/2010/03/listening-to-strangers>



## Tags

- summer school
- June
- 2009
- sea

## Geotags

- Hagia Sophia
- Blue Mosque
- Istanbul
- Turkey
- geo:lat = 41.01667
- geo:lon = 28.96667

- **IPTC schema** is considered:
  - *City* – name of the city
  - *Sublocation* – area or name of the landmark
  - *Examples:* Istanbul (Hagia Sophia), San Francisco (Golden Gate Bridge)

# Trust and reputation systems



## Feedback Profile

[See what's new](#)



**auctionshopusa** (private)

Positive Feedback (last 12 months): 98.3% [\[How is Feedback Percentage calculated?\]](#)

Member since: Jun-14-04 in United States

### Recent Feedback Ratings (last 12 months)

	1 month	6 months	12 months
Positive	69	422	879
Neutral	0	0	5
Negative	8	9	12

### Detailed Seller Ratings (last 12 months)

Criteria	Average rating	Number of ratings
Item as described	★★★★★	533
Communication	★★★★★	535
Shipping time	★★★★★	529
Shipping and handling charges	★★★★★	528

### Member Quick Links

- [Contact member](#)
- [View items for sale](#)
- [View more options](#)



## Customer Reviews

### Citizen Men's AT0200-05E Eco-Drive Chronograph Canvas Watch

159 Reviews

5 star:	(77)
4 star:	(56)
3 star:	(13)
2 star:	(10)
1 star:	(3)

Average Customer Review

★★★★☆ (159 customer reviews)

Share your thoughts with other customers

[Create your own review](#)

Search Customer Reviews

Only search this product's reviews

> [See most helpful viewpoints](#)

< Previous | 1 2 ... 16 | Next >

[Most Helpful First](#) | [Newest First](#)

★★★★★ **Nice Addition.**, August 25, 2010

By **DaveH "Deal Hunter"** (LI, NY) - [See all my reviews](#)

**Amazon Verified Purchase** ([What's this?](#))

This review is from: **Citizen Men's AT0200-05E Eco-Drive Chronograph Canvas Watch** (Watch)

Just received my Citizen AT0200-05E today and the watch looks better in person. Read lots of reviews about the stock band being short but it wasn't a concern for me as I ordered my watch with the Modena Panerai black band upgrade. The rubber band really dresses up the watch nicely and adds a diving watch quality to it. I've included some pictures with my review with the "wet" look and I think it's a great upgrade to an already awesome watch!

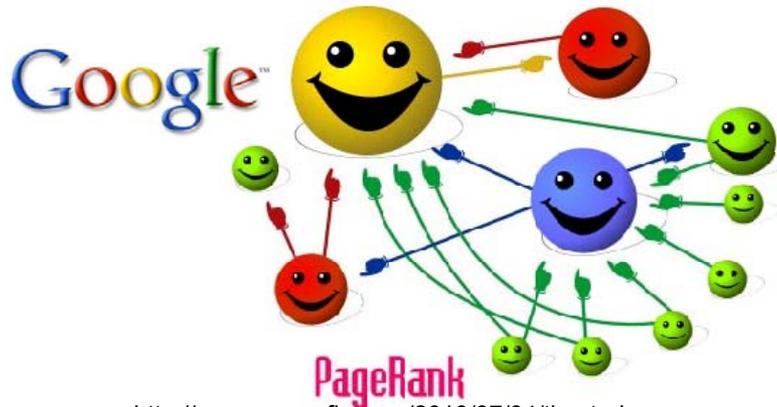
Help other customers find the most helpful reviews

[Report this](#) | [Permalink](#)

Was this review helpful to you?

Yes  No

[Comment](#)

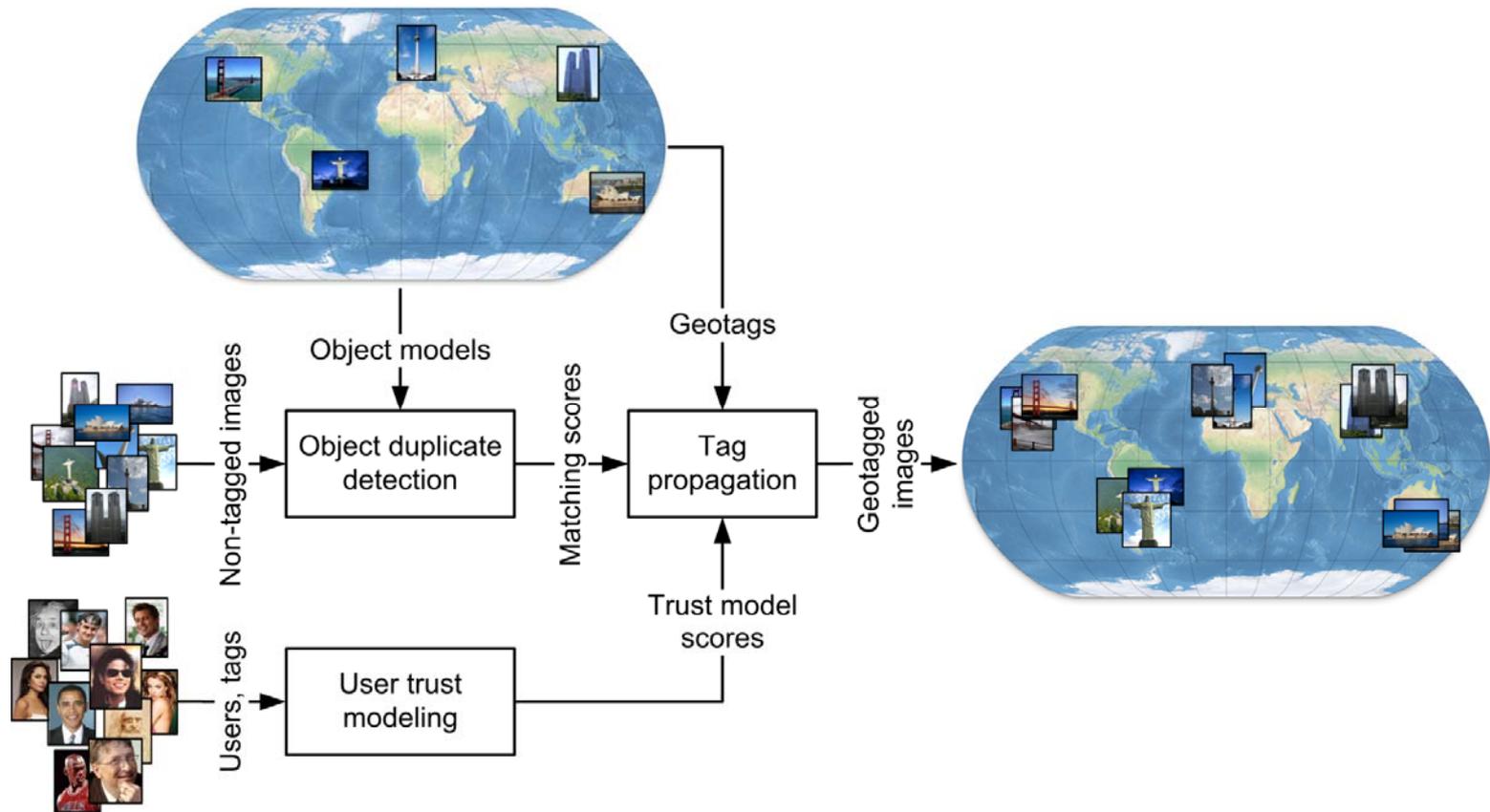


PageRank

<http://www.wpconfig.com/2010/07/04/tips-to-increase-your-pagerank>

Email spam filtering



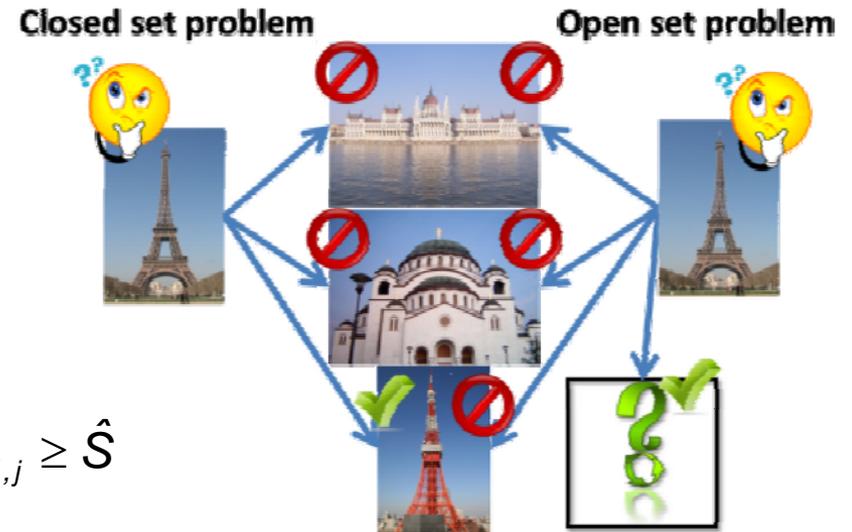


- Object duplicate detection module provides a matching score matrix  $S_{i,j}$ ,  $i \in [1, M]$ ,  $j \in [1, N]$
- Two application scenarios:
  - **Closed set problem:**

$$C_{i,j} = \begin{cases} 1, & \text{if } S_{i,j} = \max_{i \in [1, M]} \{S_{i,j}\} \\ 0, & \text{otherwise} \end{cases}$$

- **Open set problem:**

$$O_{i,j} = \begin{cases} 1, & \text{if } S_{i,j} = \max_{i \in [1, M]} \{S_{i,j}\} \wedge S_{i,j} \geq \hat{S} \\ 0, & \text{otherwise} \end{cases}$$



- Three steps:
  - **User evaluation** – comparing the predicted tags to manually defined ground truth (for a real photo sharing system, such as Panoramio, it is not necessary to collect ground truth data since user feedback can replace them):

$$U_{i,j} = \begin{cases} 1, & \text{if user } j \text{ tags image } i \text{ correctly} \\ 0, & \text{otherwise} \end{cases}$$

- **Trust model creation** – the percentage of the correctly tagged images by particular user out of the overall number of tagged images  $M$ :

$$T_j = \frac{\sum_{i=1}^M U_{i,j}}{M}$$

- **Tag propagation** – only tags from users who are trusted ( $T_j > \hat{T}$ ) are propagated to other photos in the dataset

# User trust modeling in Panoramio

10

**Panoramio** Forum | Blog | Sign in | Help  
Sign up | Upload | Places | Tags Search place

World Map > Switzerland > Vaud > Lausanne

## Suisse, le Montreux "Bateau à Aube" au Port de Lausanne sur le lac Léman

See in Google Earth Share on:



by Roger-11

This photo is selected for Google Earth [?] - ID: 23286122

More photos by Roger-11



1000 ft  
200 m @20.0 Google - Imagery ©2010, Map data ©2010 - Terms of Use  
in Lausanne, Switzerland  
46° 20' 20.60" N, 6° 27' 33.75" E  
Misplaced? Suggest new location **Tagged incorrectly?**  
©2010 Google - Terms of Use

<http://www.panoramio.com/photo/23286122>

- Idea:



*true flag (correct tag)*



*false flag (wrong tag + suggest a correct tag)*

- The more misplacements a user has, the more untrusted he/she is
- User trust ratio:

$$T_j = \left( \frac{\# \text{ true flags}}{\# \text{ all associated flags}} \right)_{\text{all images tagged by user } j}$$

- Users can collaboratively eliminate a spammer:



Bob



Eve



Alice

$$T\left(\text{Bob}\right) = 0.9$$

Bob

$$T\left(\text{Alice}\right) = 0.7$$

Alice

$$T\left(\text{Eve}\right) = 0.5$$

Eve

- Users can collaboratively eliminate a spammer:



Bob



Eve



Alice

$$T(\text{Bob}) = 0.3 \quad \downarrow$$

Bob

$$T(\text{Alice}) = 0.7$$

Alice

$$T(\text{Eve}) = 0.9 \quad \uparrow$$

Eve

- Users can collaboratively eliminate a spammer:



Bob



Eve



Alice



$$T(\text{Bob}) = 0.7 \uparrow$$

Bob

$$T(\text{Alice}) = 0.8 \uparrow$$

Alice

$$T(\text{Eve}) = 0.4 \downarrow$$

Eve

# Tag propagation based on user trust model

15

$$T(\text{Bob}) = 0.7$$

Bob

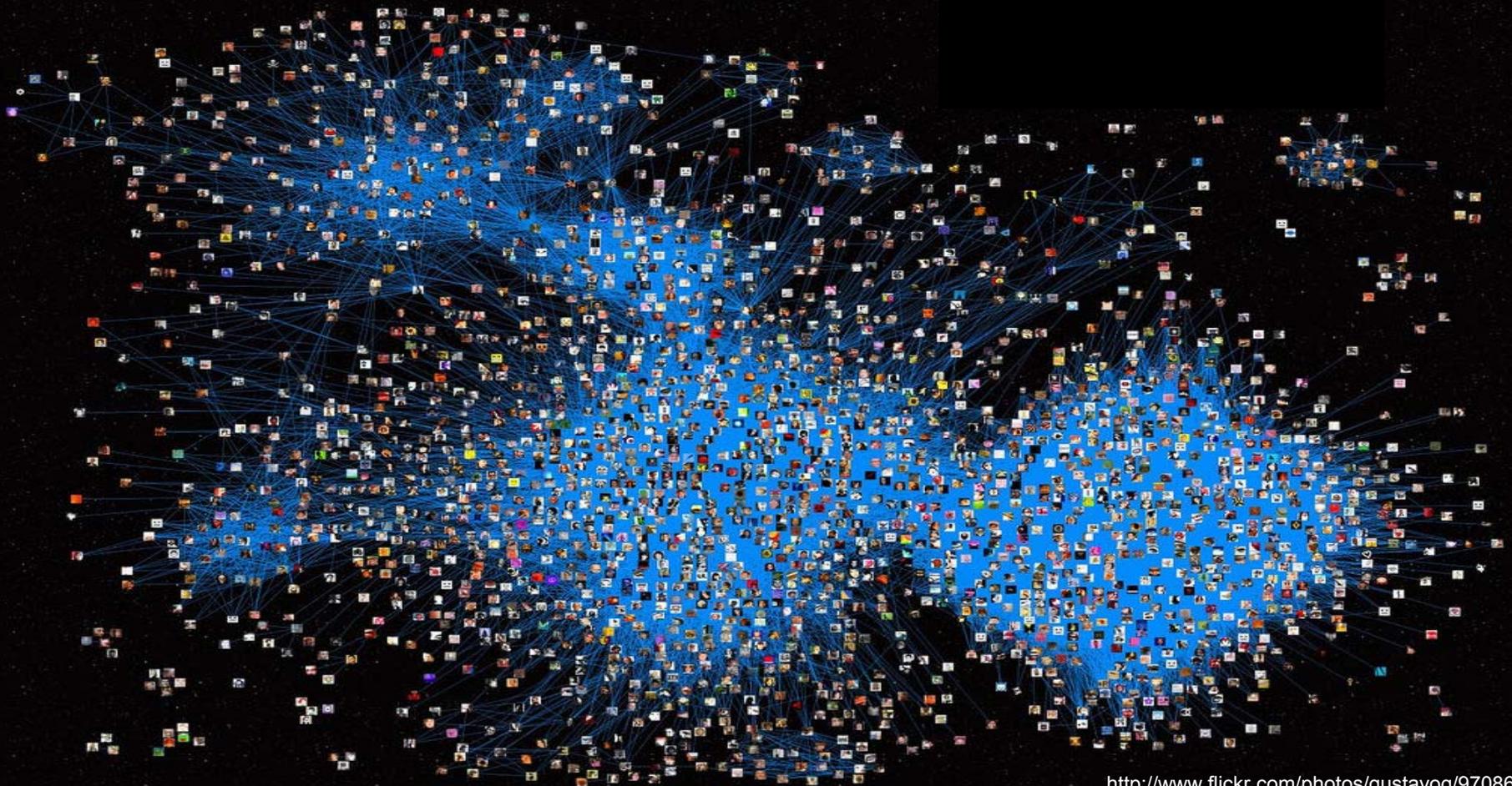
$$T(\text{Alice}) = 0.8$$

Alice

$$T(\text{Eve}) = 0.4$$

Eve

$$\hat{T} = 0.6$$



# Tag propagation based on user trust model

16

$$T(\text{Bob}) = 0.7$$

Bob

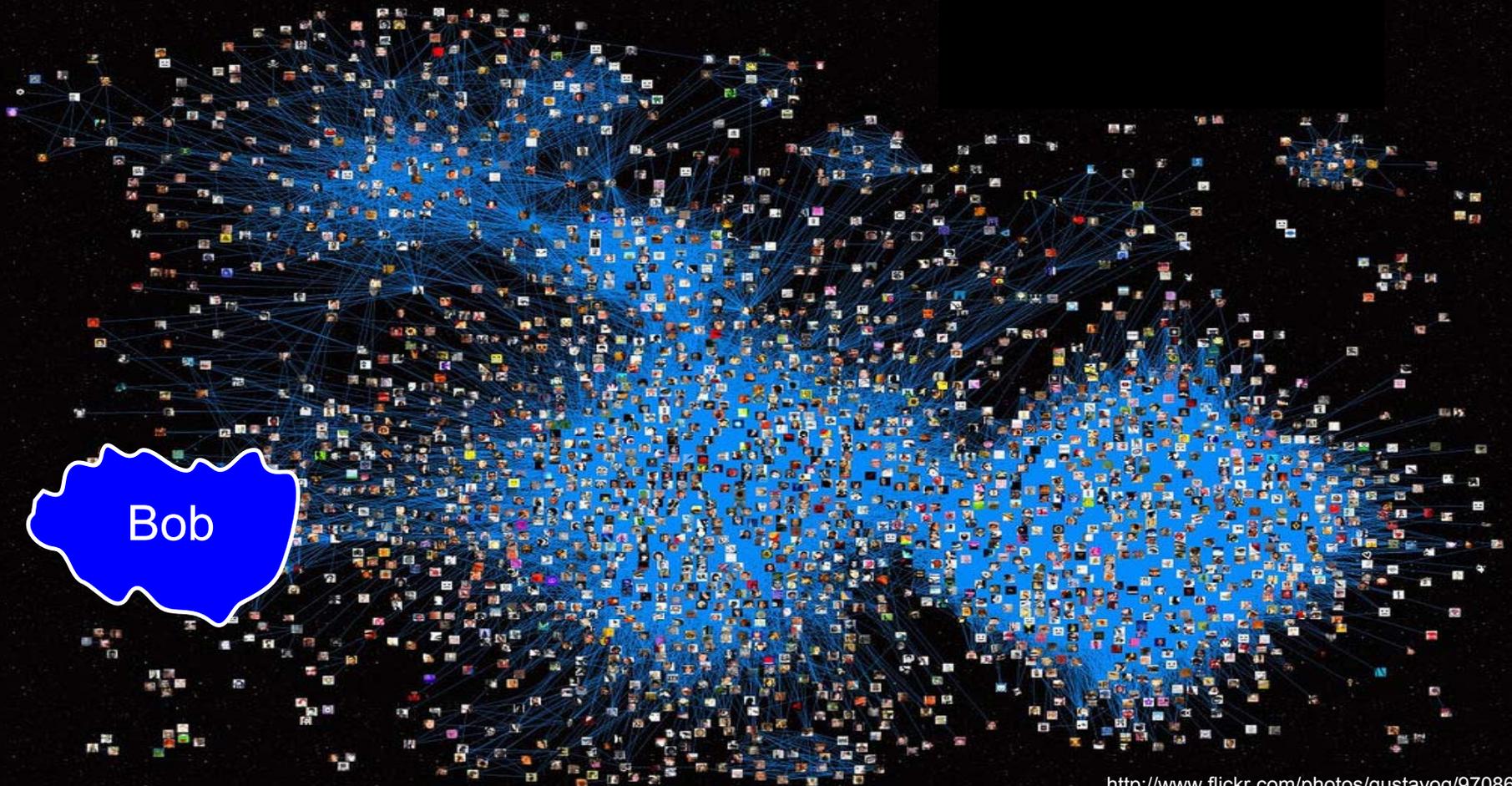
$$T(\text{Alice}) = 0.8$$

Alice

$$T(\text{Eve}) = 0.4$$

Eve

$$\hat{T} = 0.6$$



# Tag propagation based on user trust model

17

$$T(\text{Bob}) = 0.7$$

Bob

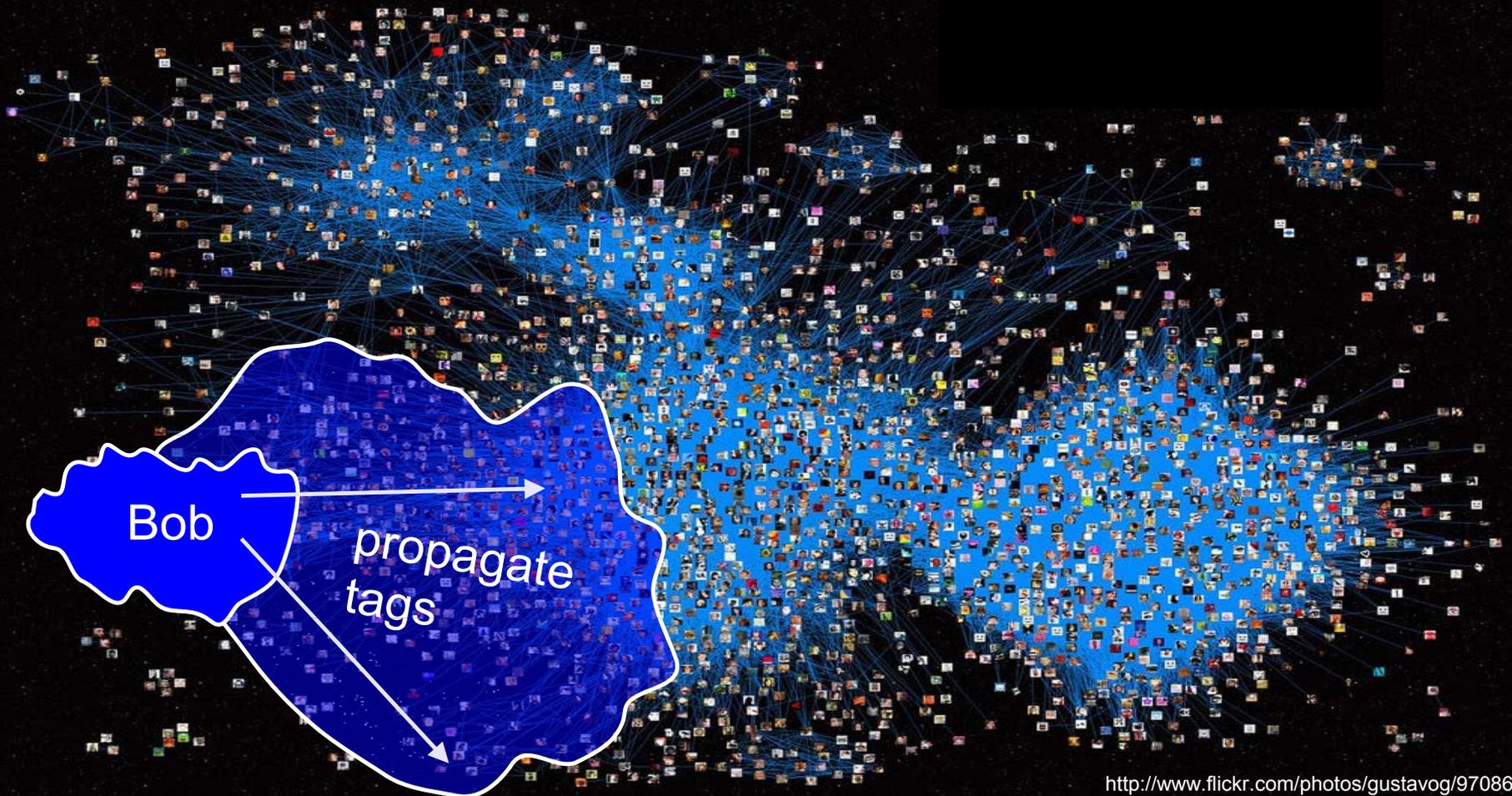
$$T(\text{Alice}) = 0.8$$

Alice

$$T(\text{Eve}) = 0.4$$

Eve

$$\hat{T} = 0.6$$



# Tag propagation based on user trust model

18

$$T(\text{Bob}) = 0.7$$

Bob

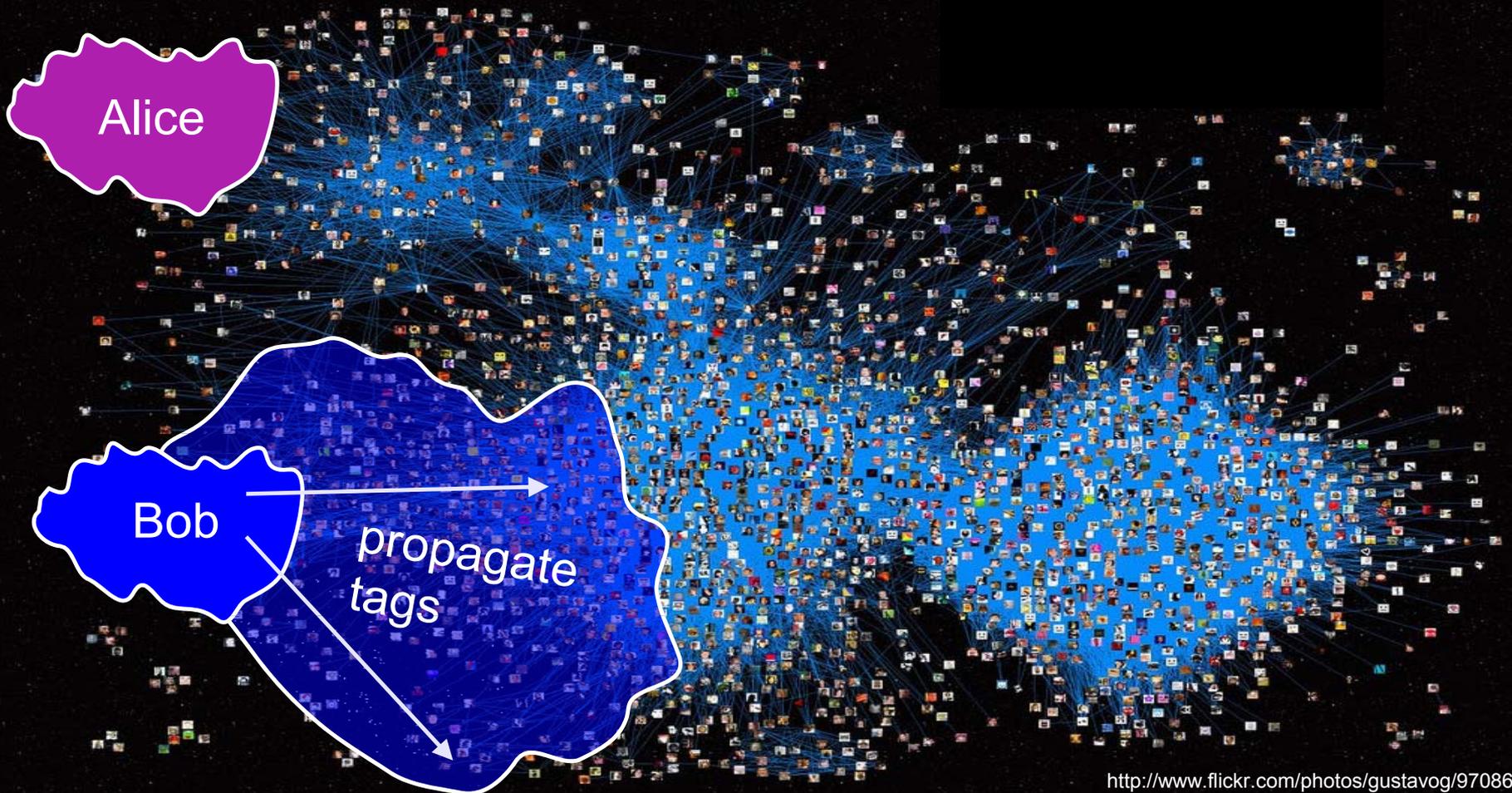
$$T(\text{Alice}) = 0.8$$

Alice

$$T(\text{Eve}) = 0.4$$

Eve

$$\hat{T} = 0.6$$



# Tag propagation based on user trust model

19

$$T(\text{Bob}) = 0.7$$

Bob

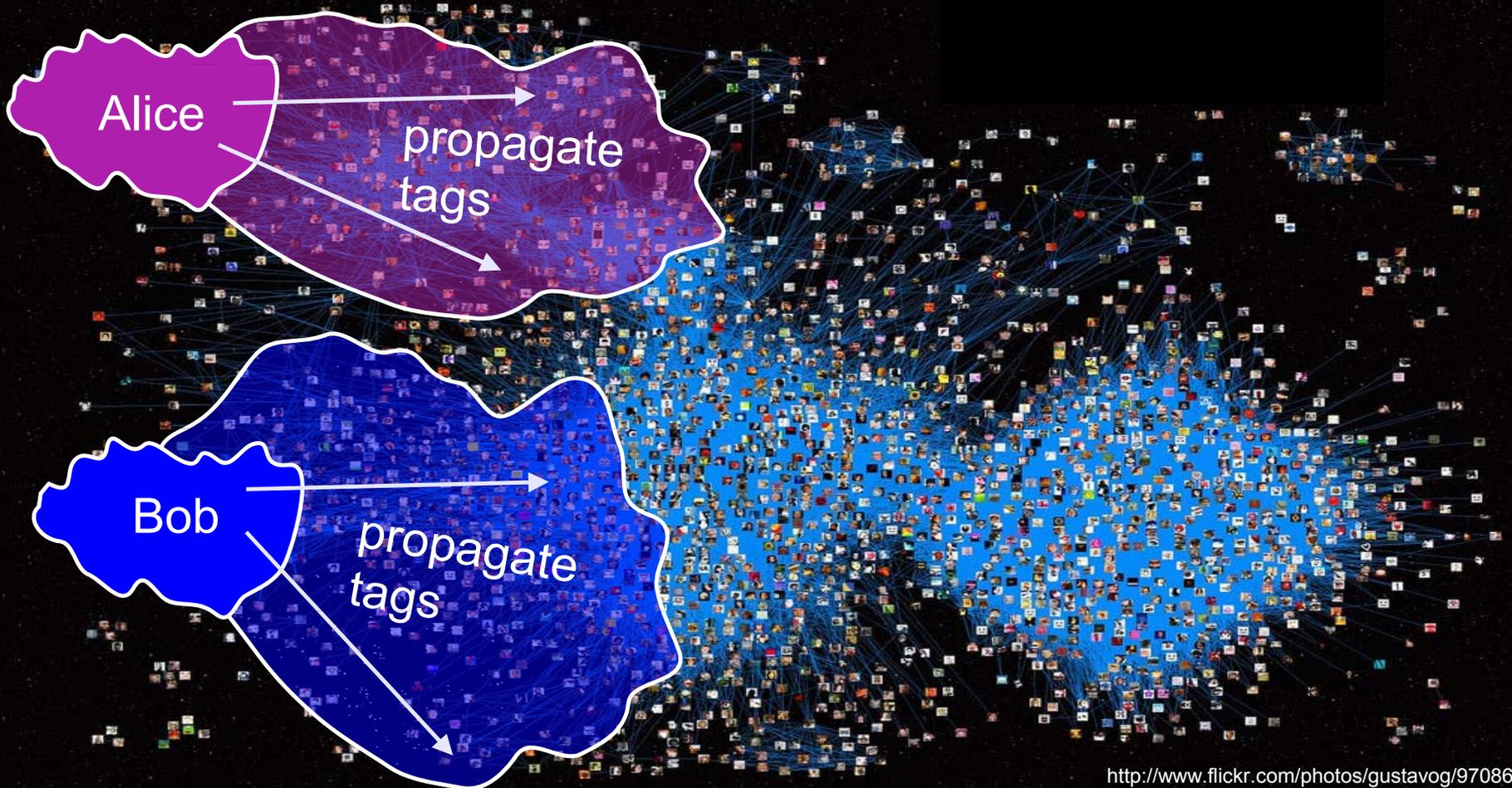
$$T(\text{Alice}) = 0.8$$

Alice

$$T(\text{Eve}) = 0.4$$

Eve

$$\hat{T} = 0.6$$



# Tag propagation based on user trust model

20

$$T(\text{Bob}) = 0.7$$

Bob

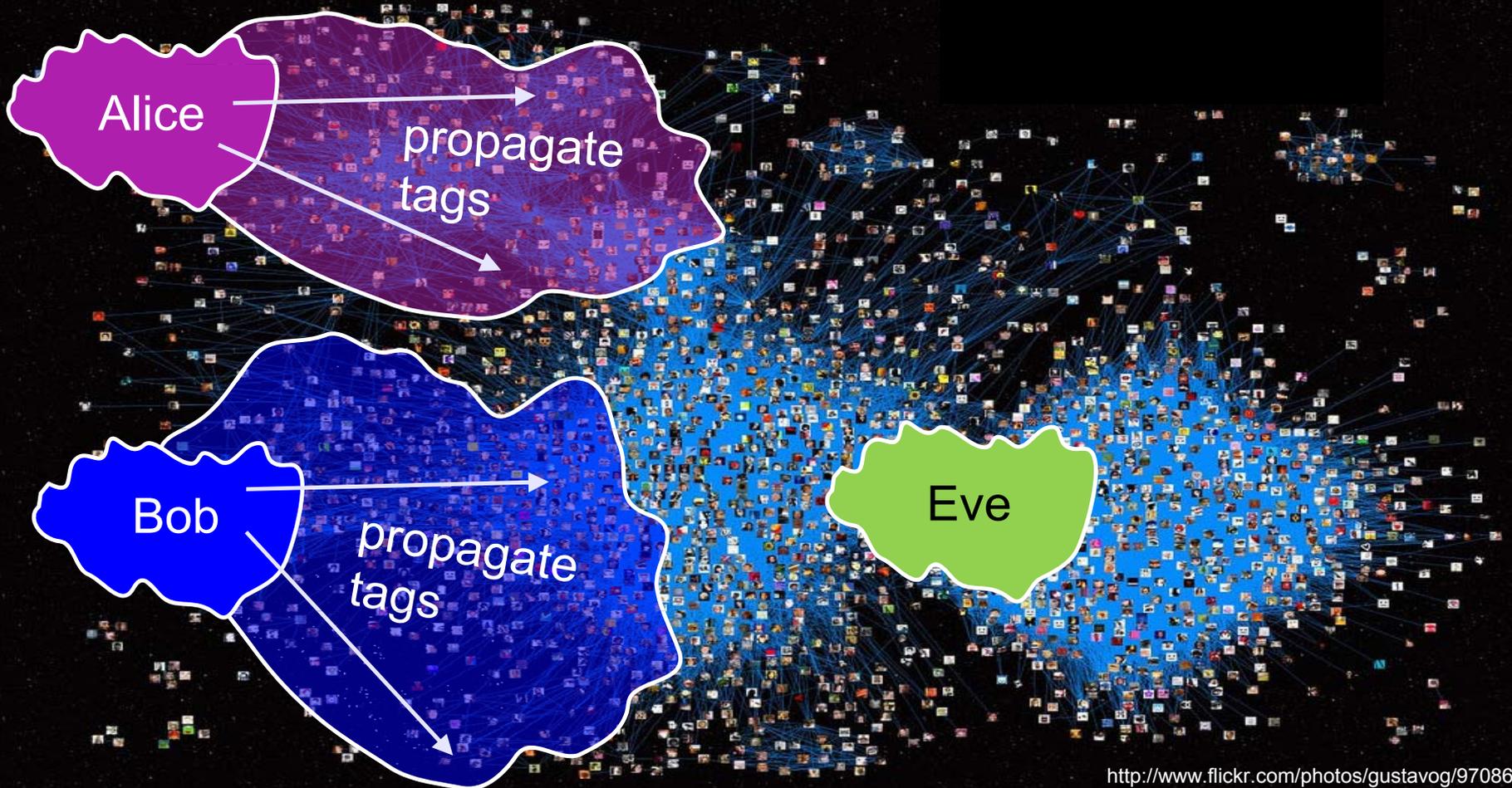
$$T(\text{Alice}) = 0.8$$

Alice

$$T(\text{Eve}) = 0.4$$

Eve

$$\hat{T} = 0.6$$



# Tag propagation based on user trust model

21

$$T(\text{Bob}) = 0.7$$

Bob

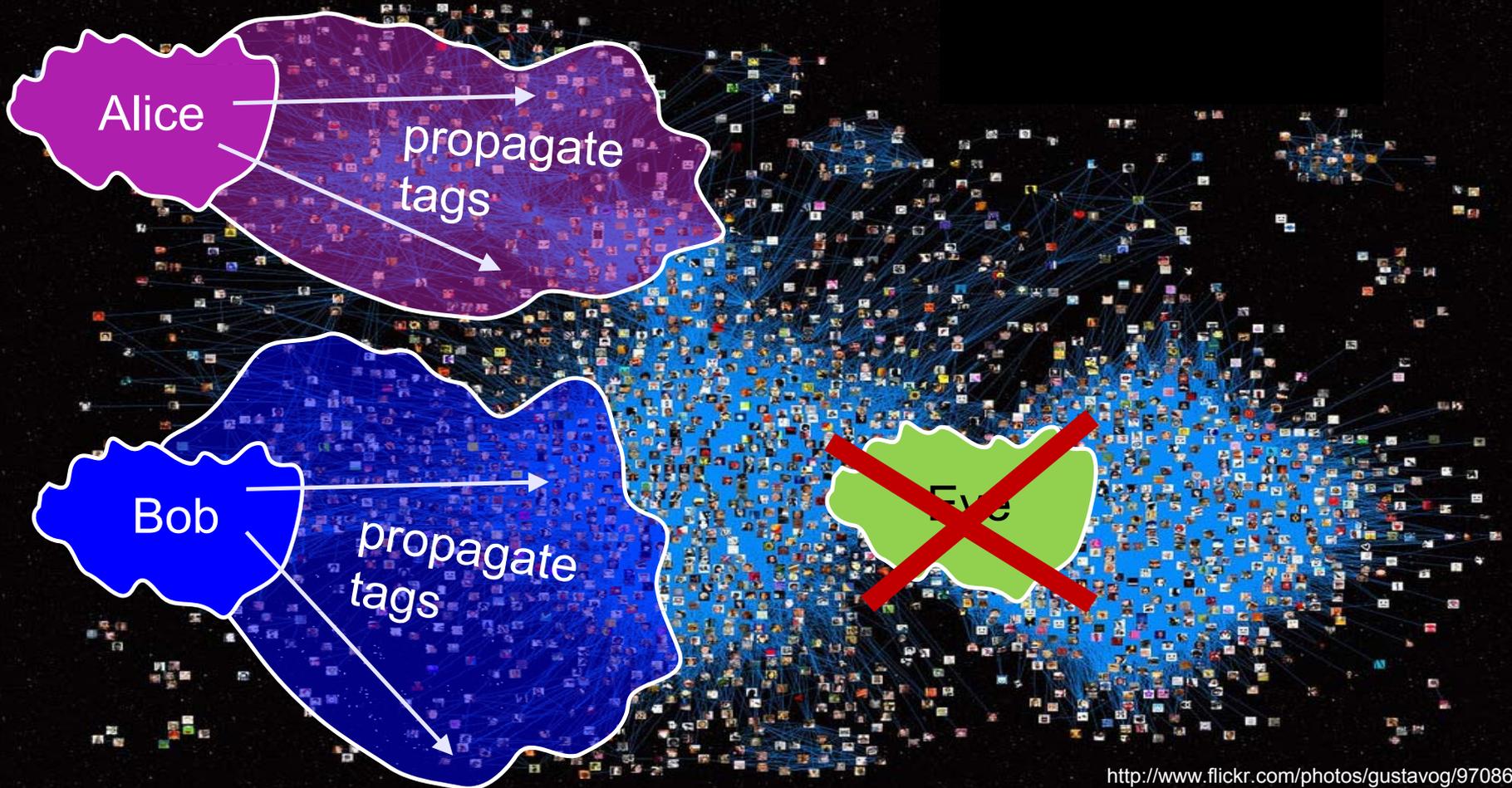
$$T(\text{Alice}) = 0.8$$

Alice

$$T(\text{Eve}) = 0.4$$

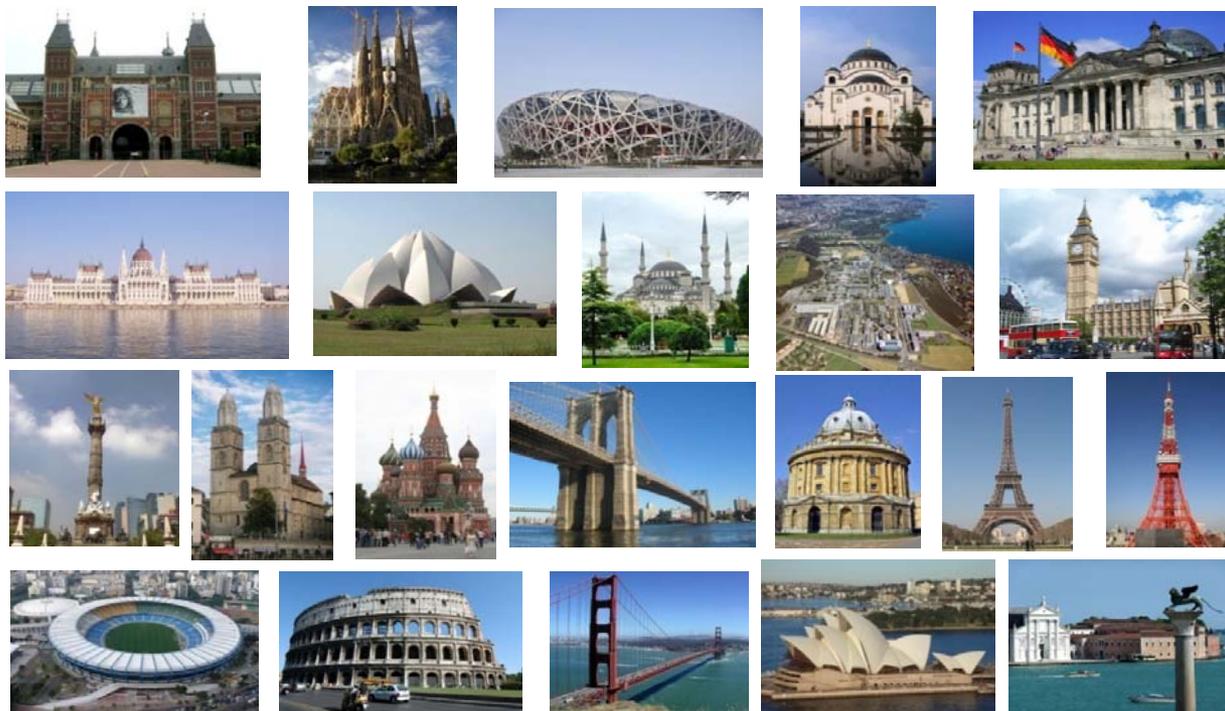
Eve

$$\hat{T} = 0.6$$



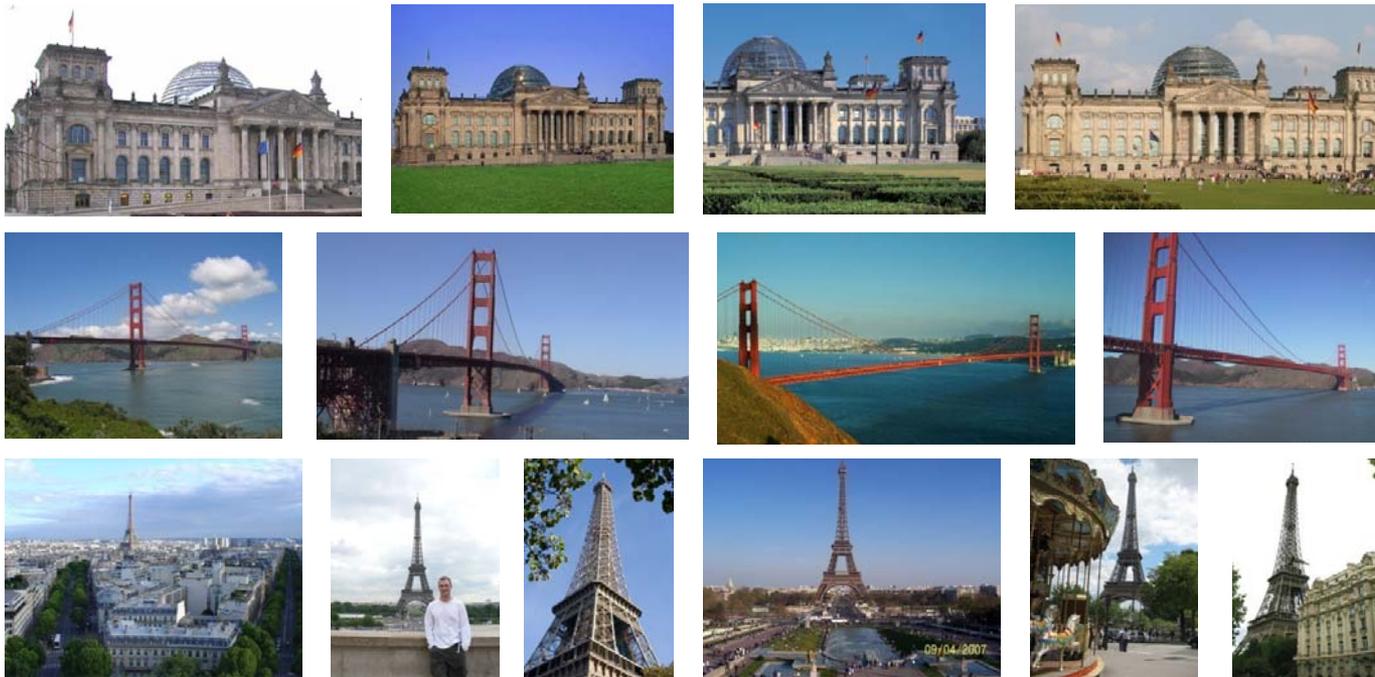
- **Dataset**

- 1320 images – 22 cities, 3 sublocations for each city, 20 sample images for each sublocation



- **Dataset**

- *Large variety of views, distances and partial occlusions*



- **Methodology**

- *Extract a sub network from a large social network, in a way that every user in this subsystem annotates every monument in the subset of the dataset*
- *Upon this sub network, we build up an automatic propagation system in order to decrease the annotation time and increase the accuracy of the system*
- *44 subjects were asked to tag 66 photos, chosen in advance*
- *If either one of geotags (name of the area or name of the monument depicted in the image) is correlated with the object in the image, we assume that the image is correctly tagged*

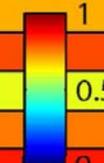
- **Evaluation**

- *Recognition rate (accuracy):*

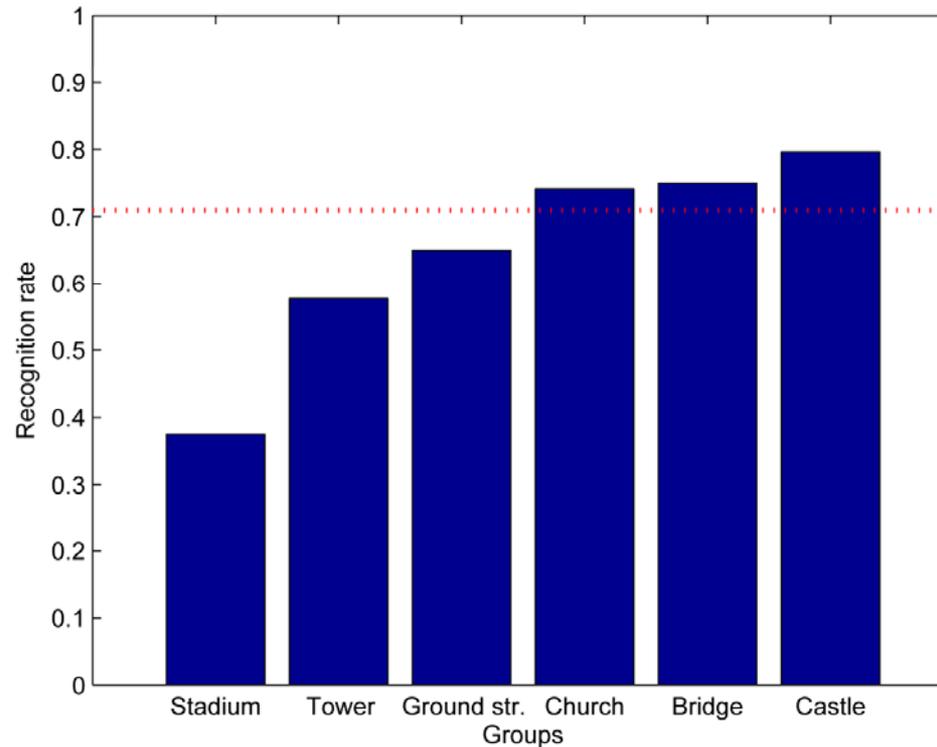
$$RR = \frac{T}{A}$$

- The recognition rate for all landmarks

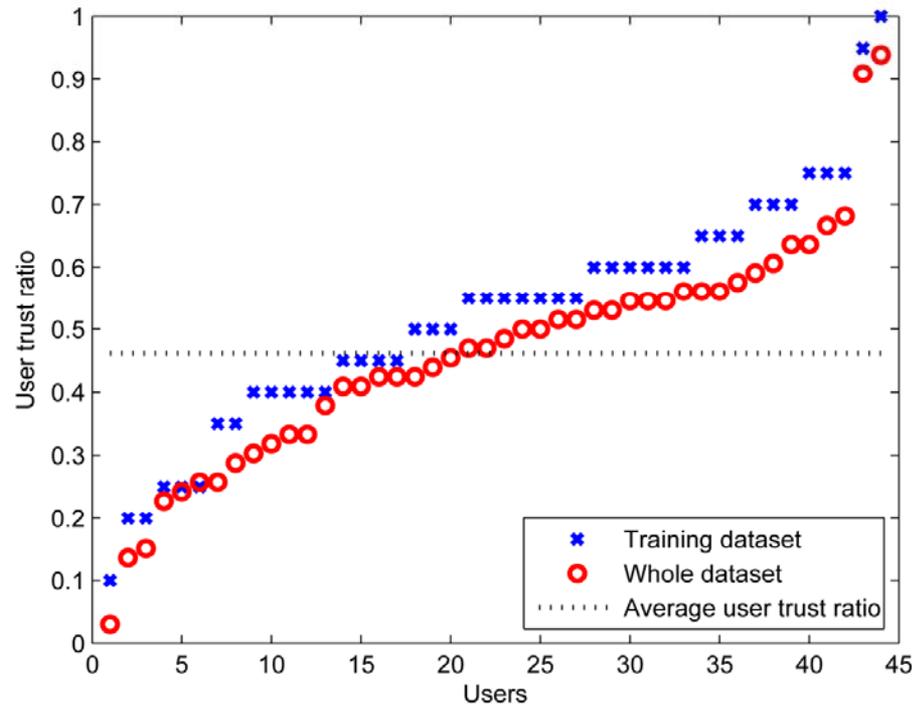
Sydney	Harbour Bridge	Luna Park	Opera House
Oxford	Radcliffe	All Souls College	Ashmolean Museum
Budapest	Parliament	Buda Castle	Hero Square
Paris	Eiffel Tower	Louvre	Arc De Triomphe
Moscow	Christ Savior Cathedral	St. Basil	Kremlin
Delhi	Lotus Temple	Akshardham Temple	Humayun Tomb
Venice	Lion Statue	Campanile Di San Marco	St. Mark Bell Tower
Rome	Pantheon	St. Peter Basilica	Colosseum
London	Big Ben	Buckingham Palace	Tower Bridge
Berlin	TV Tower	Brandenburg Gate	Reichstag
Beijing	Temple Of Heaven	Birds Nest Stadium	Tiananmen
Barcelona	Sagrada Familia	Casa Mila	Olympic Communication Tower
Mexico City	Angel De La Independencia	Torre Latinoamericana	Palace Of Fine Arts
San Francisco	Coit Tower	Golden Gate Bridge	Twin Peaks
Amsterdam	Church Of St. Nicholas	Rijksmuseum	Royal Palace
Rio De Janeiro	Cristo Redentor	Paco Imperial	Maracana
Belgrade	Parliament	Winner Statue	St. Sava Church
Zurich	St. Peter	Fraumunster	Grossmunster
Tokyo	Tower	Metropolitan Government Center	National Museum
Istanbul	Blue Mosque	Hagia Sofia	Galata Tower
Lausanne	EPFL	Riponne	Cathedral
New York	Brooklyn Bridge	Statue Of Liberty	Twin Towers



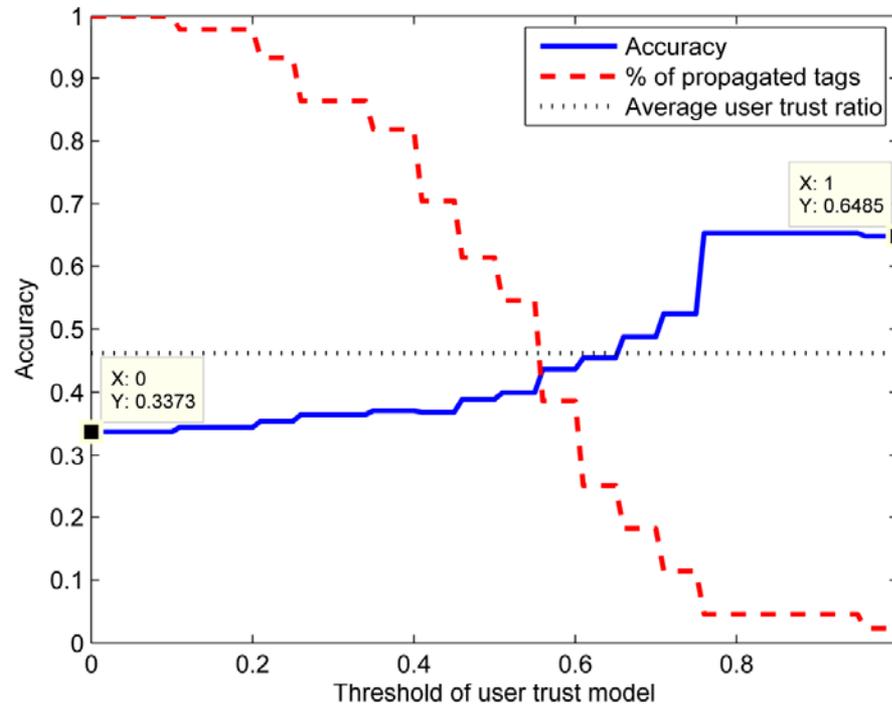
- The recognition rate across the different locations groups (bars) and the recognition rate of all locations (dashed line)



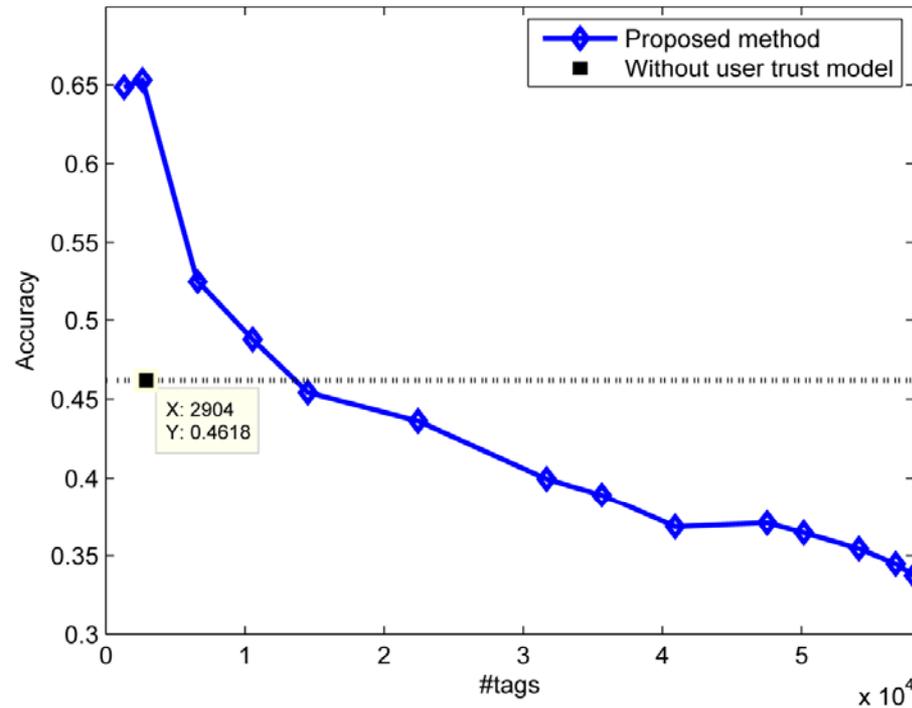
- Trust ratios for the different users for a reduced (first 20 images) and the complete set of training images



- The recognition rate of the geotag propagation system and the percentage of the propagated tags versus the threshold involved in user trust model



- The recognition rate of the geotag propagation system versus the number of tags



- An efficient system for **automatic geotag propagation** by associating locations with distinctive landmarks and using **object duplicate detection** for tag propagation
- **User trust information** derived from users' tagging behavior for the tag propagation
- Only reliable geotags are propagated
- **Increased accuracy** of the tag propagation and a **decrease of tagging efforts**
- The proposed user trust model can be generalized to photo sharing platforms such as Panoramio



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# Thank you for your attention!

Ivan Ivanov, PhD student, EPFL  
ivan.ivanov@epfl.ch

