Tag Suggestr: Automatic Photo Tag Expansion using Visual Information for Photo Sharing Websites

Onur Kucuktunc, Sare G. Sevil, A. Burak Tosun, Hilal Zitouni, Pinar Duygulu, and Fazli Can

Bilkent University,

Department of Computer Engineering.

Ankara, Turkey

Motivation

Organization and retrieval problems

Motivation

Name	Registered Users
Photobucket	50,000,000
Snapfish	50,000,000
Webshots	32,000,000
Flickr	26,000,000
imeem	26,000,000
Kodak Easy Share Gallery	20,000,000
Fotolog	15,000,000
Fotki	1,250,000

Motivation

Beautiful morning at Fraser's Hill

Tags

- awe2020
- canon40d
- fraser'shill
- pahang
- malaysia
- tropical
- forest
- travel
- HDR
- sun
- sky
- nature
- morning
- lights
- landscape
- clouds
- canonefs1022mmf3545usm
- 1022mm
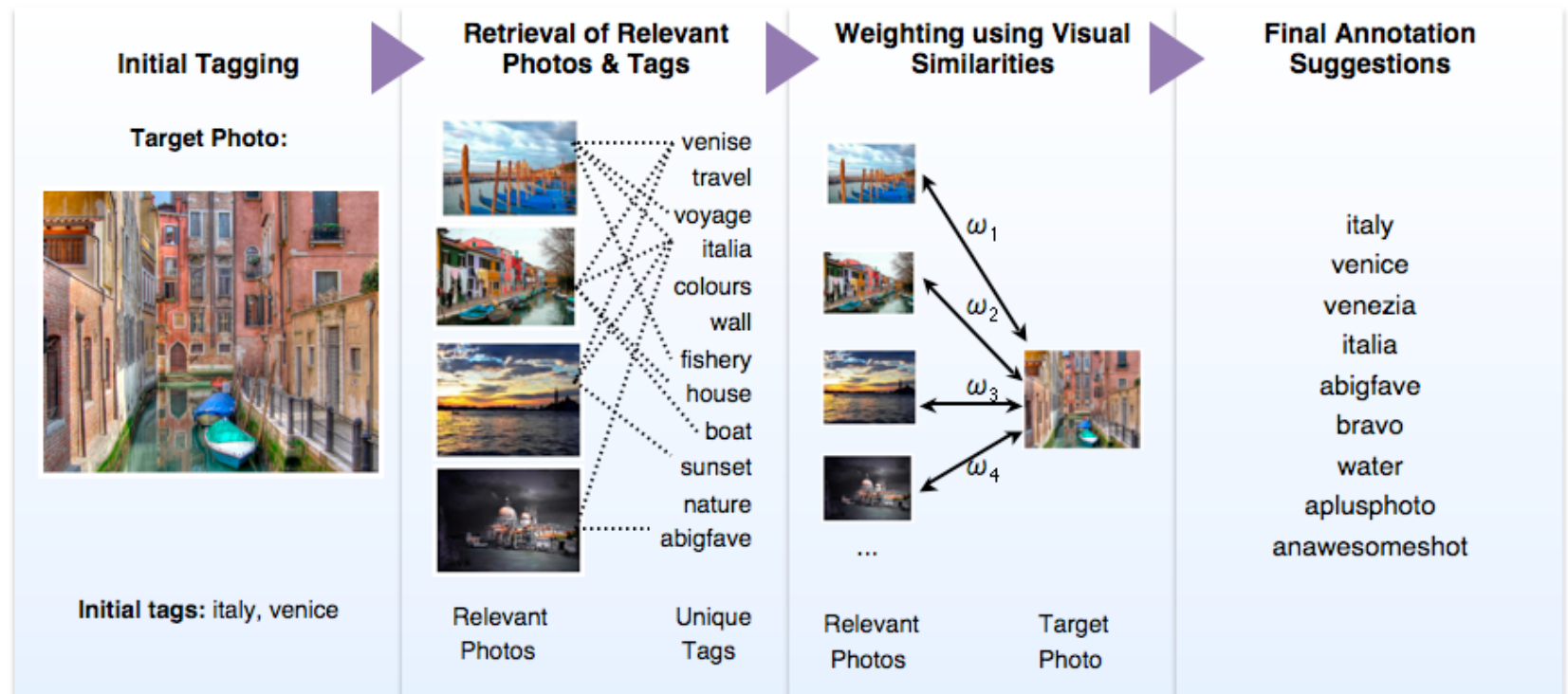- tropicalforest
- tone
- sunrise
- mapping
- canon

4

Purpose

- Assist users in order to
  - Ease the process
  - Reduce noise in tags
  - Provide more descriptive/meaningful tags.

- *TagSuggestr: suggesting tags at upload time*

5

Approach

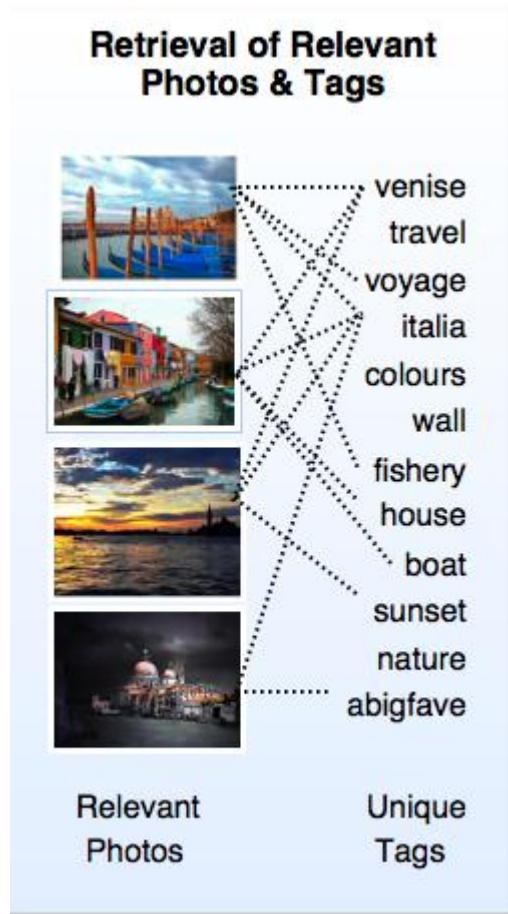# Approach – Initial Tagging

Initial Tagging

Target Photo:

Initial tags: italy, venice

- Require initial set of tags

- Initial tags:
 ➡ used for retrieving relevant images.

Approach – Relevant Photos

Retrieval of Relevant Photos & Tags

venise
travel
voyage
italia
colours
wall
fishery
house
boat
sunset
nature
abigfave

Relevant Photos   Unique Tags

- Photos including all initial tags..

- Retrieve corresponding tags.

- Form set of distinct tags.

8

Approach – Computing Weights

Weighting using Visual Similarities

ω_1

ω_2

ω_3

ω_4

...

Relevant Photos   Target Photo
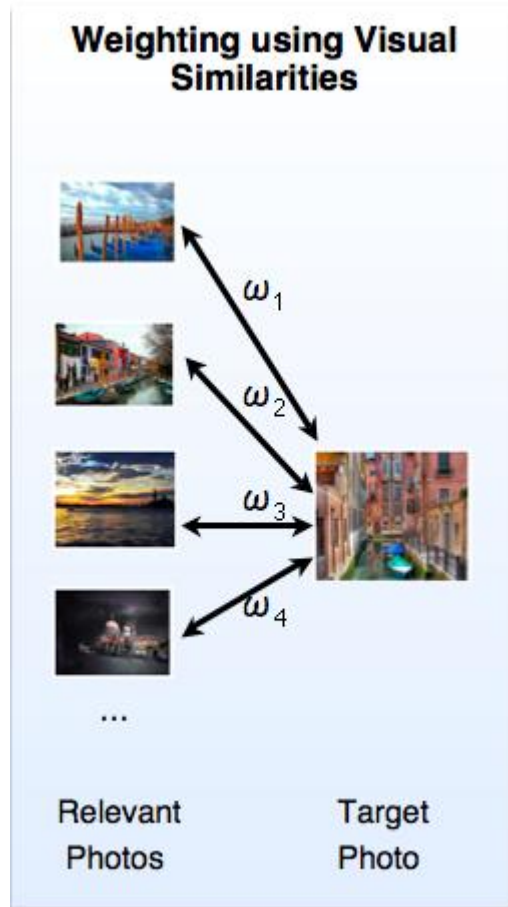
- ○ We need to assign weights to tags.

- ○ Visual similarity between a given image and target image is important.

9

Approach – Computing Weights

Weighting using Visual Similarities

Relevant Photos   Target Photo
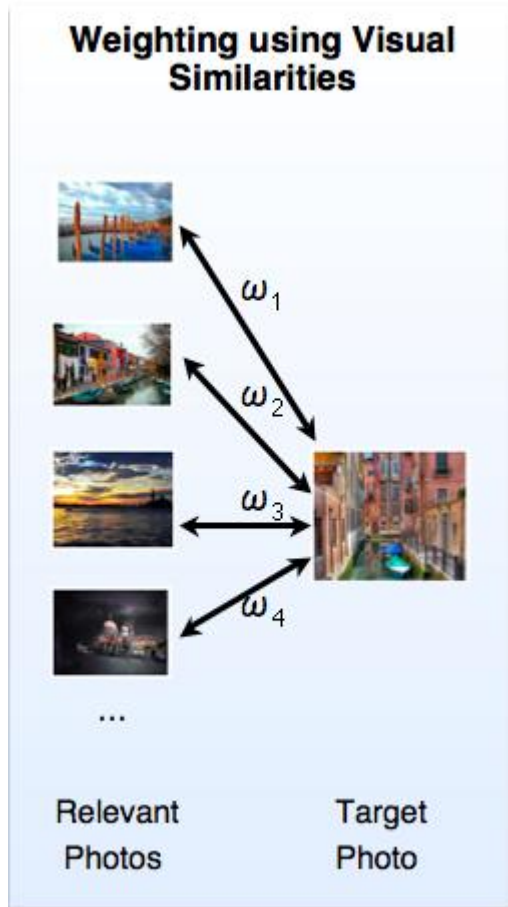
- Visual similarity computed as:

$$\omega_i = \frac{1}{dist(f_{I_t}, f_{I_i})}, \ i \in \{1, ..., m\}$$

- Two different feature extraction methods were evaluated:
  - Color Histograms
  - Interest Points

10

Approach – Computing Weights

○ W_i : weight of tag i.

$$W = \begin{array}{c} \\ I_1 \\ I_2 \\ \\ \\ I_m \end{array} \begin{array}{|ccccc|} t_1 & t_2 & t_3 & & t_n \\ \hline 1 & 0 & 1 & \cdots & 0 \\ 1 & 1 & 0 & \cdots & 0 \\ & & & & \\ & & & & \\ 0 & 0 & 0 & \cdots & 1 \\ \hline \end{array} \begin{array}{c} \times \ \omega_1 \\ \times \ \omega_2 \\ \\ \\ \times \ \omega_m \end{array} \Bigg\} \ \sum = \begin{array}{|ccccc|} t_1 & t_2 & t_3 & & t_n \\ \hline & & & & \\ \hline \end{array}$$

11

Approach

Final Annotation Suggestions

italy
venice
venezia
italia
abigfave
bravo
water
aplusphoto
anawesomeshot

- ○ Sort tags according to weights.

- ○ Tags with higher weights are suggested.

12

Experimental Work

- Applied to Flickr: Java API FlickrJ.

- 100 photos selected
  ➡ 66 target photos

- For each target photo
  ➡ 100 relevant photos

  ~ 7000 images

13

Experimental Work

Analysis: Number of required initial tags

Number of initial tags	Number of relevant photos
1	514044
2	4050
3	95
4	14
5	4

2-3 tags

Evaluation Methods

How do we decide a suggested tag is valid?

1. Use an existing Flickr photo
2. Manually pick initial tags from its tag list.
3. Performance: how many of the original tags could we suggest?

15

Evaluation Methods

○ Computed precision/recall values and *accuracy.*

$$A(I_i) = \frac{|\, T_i \cap ST(I_i)\,|}{|\, ST(I_i)\,|} \qquad A_{Avg} = \frac{\sum_{i=1}^{n} A(I_i)}{n}$$

○ 3 approaches evaluated:

1. Tag Frequency
2. Color Similarity
3. SIFT Similarity

● *Frequency approach is the baseline.*

16

Evaluation Methods

- Two experiments performed:
  1. Suggest-All-Tags
  2. Suggest-Top-5

17

Evaluation Methods

Suggest-All-Tags

- Suggest as many tags as were present in the original list.

Evaluation Methods

duomo, italy (a)   colosseo, roma (b)   taiwan, protest (c)

Gray: Color Histogram, Black: SIFT, Dashed: Frequency

SAMT 2008 – Tag Suggestr

Evaluation Methods

tokyo, city (d) | dog, winter (e) | beyoglu, istanbul (f)
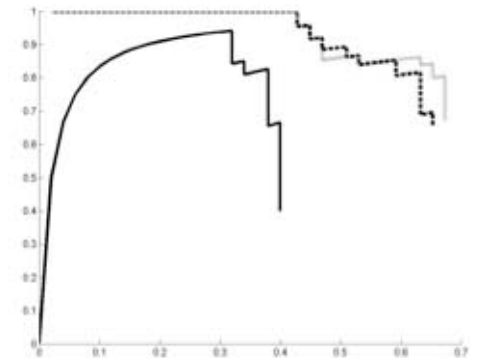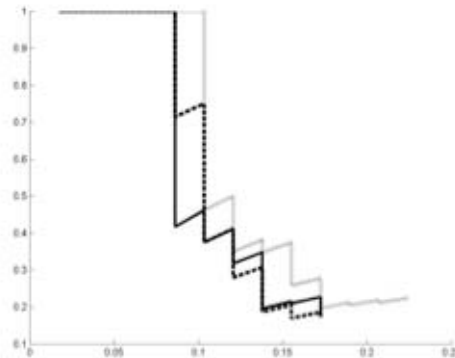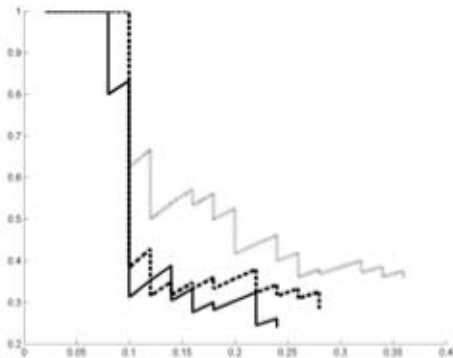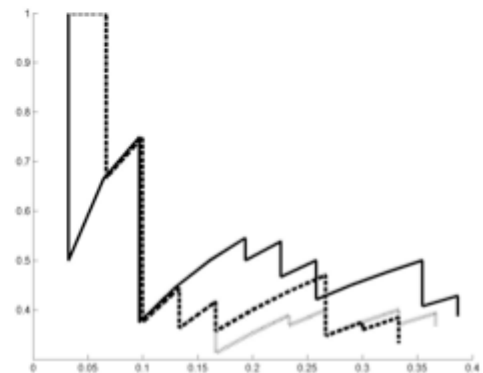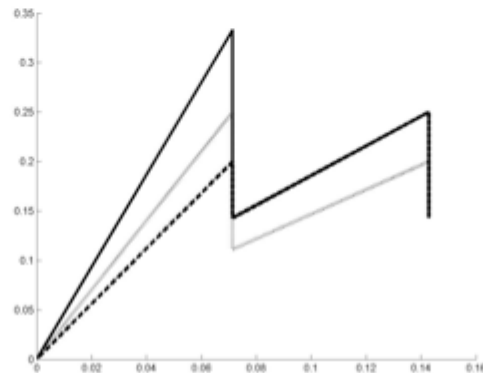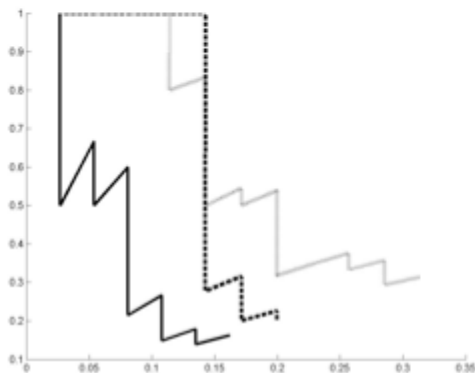
Gray: Color Histogram, Black: SIFT, Dashed: Frequency

Evaluation Methods

screen, notebook (g) | office, desk (h)

Gray: Color Histogram, Black: SIFT, Dashed: Frequency

SAMT 2008 – Tag Suggestr

Evaluation Methods

Evaluation Methods

23
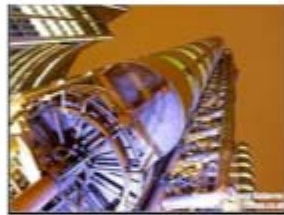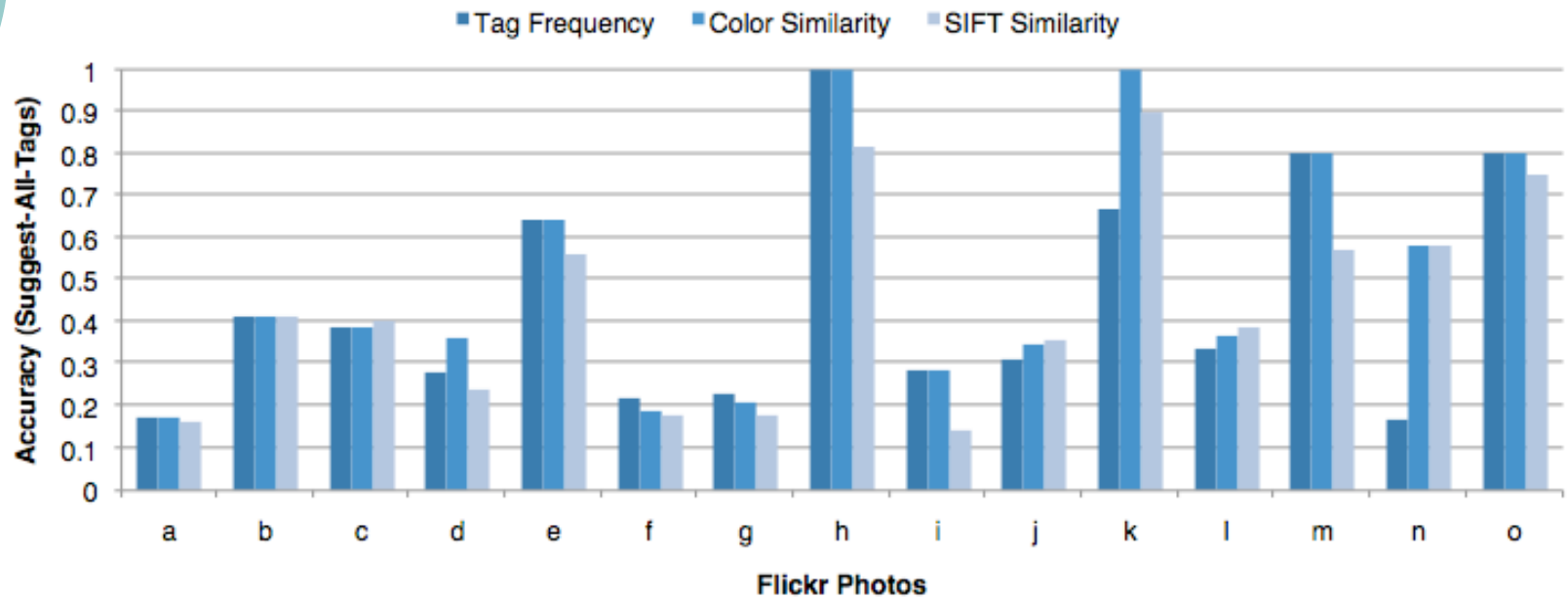
Evaluation Methods

Suggest-Top-5

○ Suggest only the top 5 tags.

24

Evaluation Methods

Evaluation Methods

Tag Frequency **Color Similarity** **SIFT Similarity**
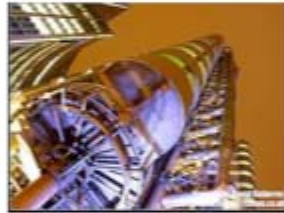
Accuracy (Suggest-Top-5) vs Flickr Photos (a–o)
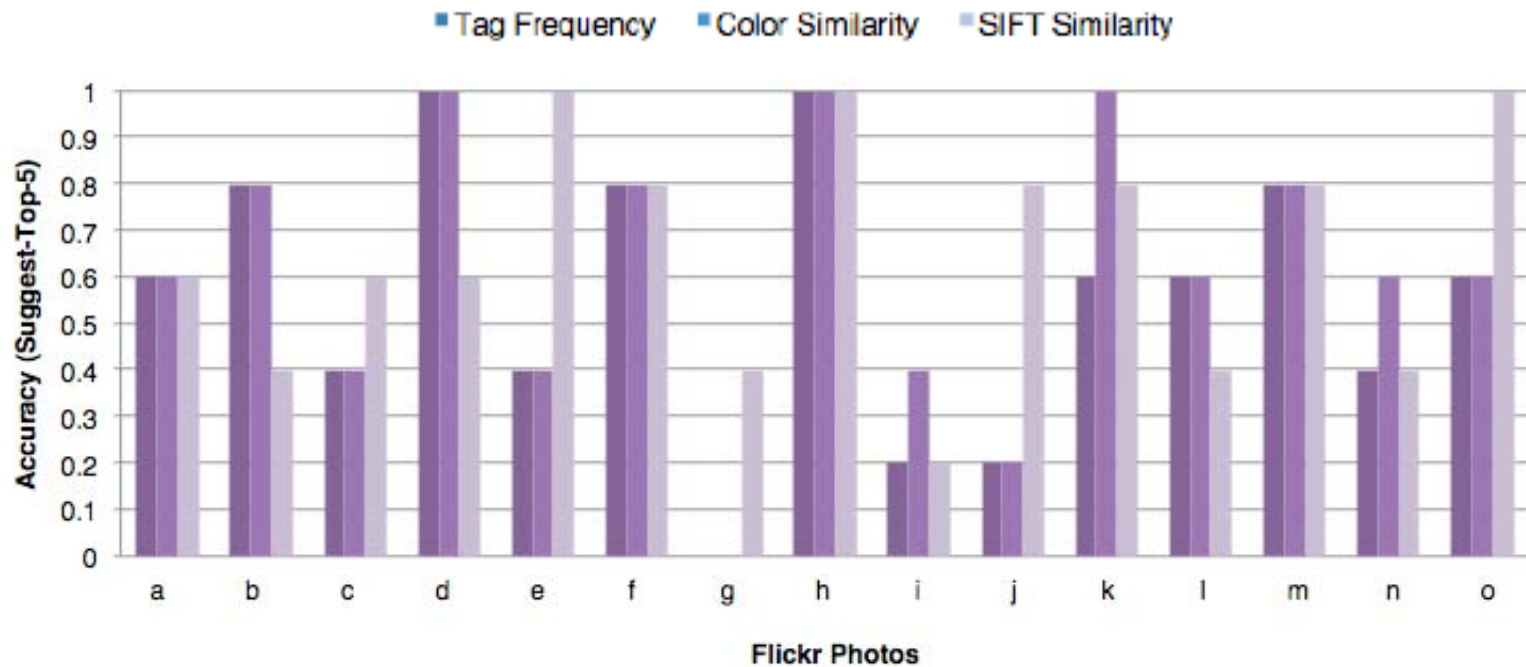
Evaluation Methods

○ Over all accuracy values:

Method	Accuracy for Suggest-all-tags	Accuracy for Suggest-Top-5
Tag Frequency	29%	52%
Color Similarity	31%	53%
SIFT Similarity	27%	46%

Discussion

○ Difficulty of selecting a ground truth
○ Tag lists are
  ● Noisy
  ● incomplete

○ Limited dataset
  ● Results are data dependent

Future Work

- ○ Larger dataset
- ○ Evaluate different visual features and their combinations
- ○ Extensive user-study

29

Demo

SAMT 2008 – Tag Suggestr

32

33

SAMT 2008 – Tag Suggestr

Conclusion

Thank You for Listening.

Questions?

References

- www.wikipedia.org
- www.flickr.com