

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

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# Motivation

<i>Name</i>	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

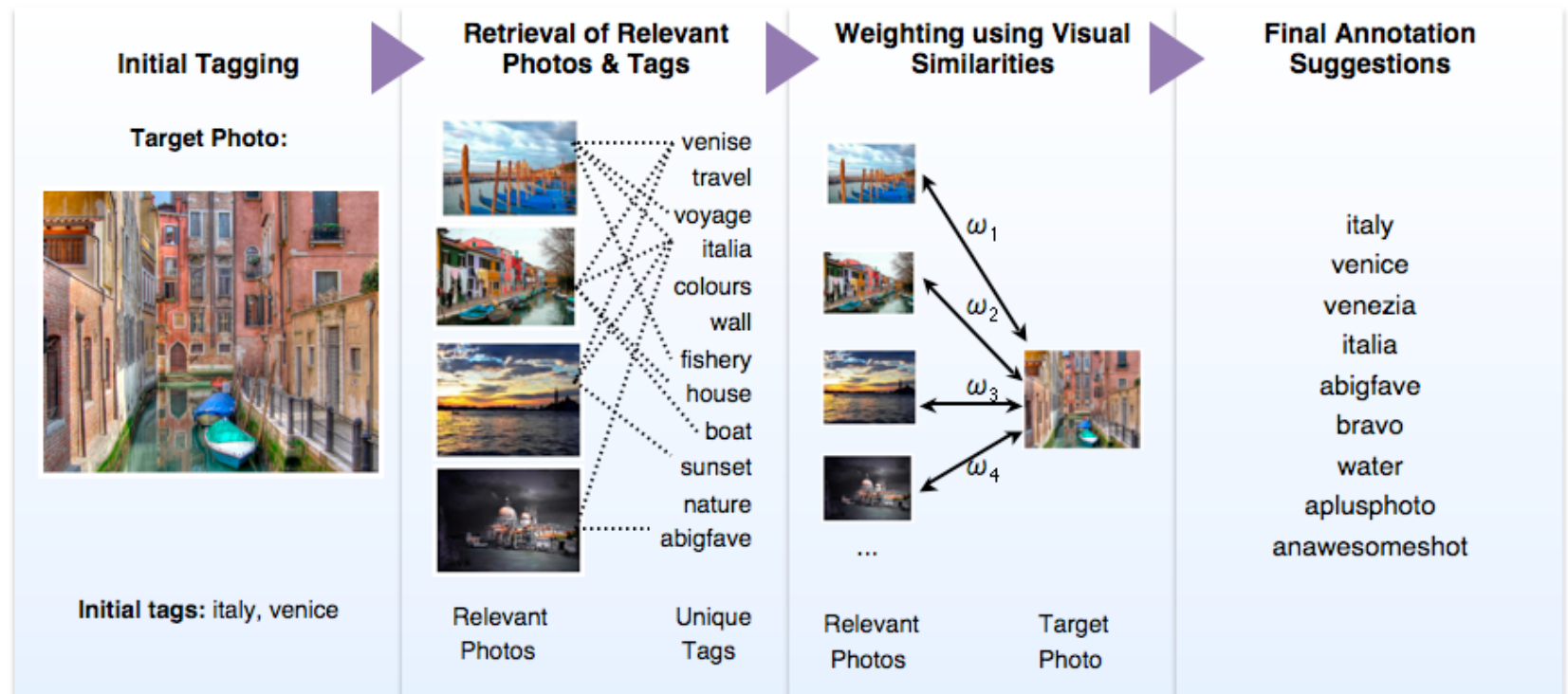
# Purpose

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- Assist users in order to
  - Ease the process
  - Reduce noise in tags
  - Provide more descriptive/meaningful tags.
- *TagSuggestr: suggesting tags at upload time*



# Approach




# Approach – Initial Tagging

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**Initial Tagging**

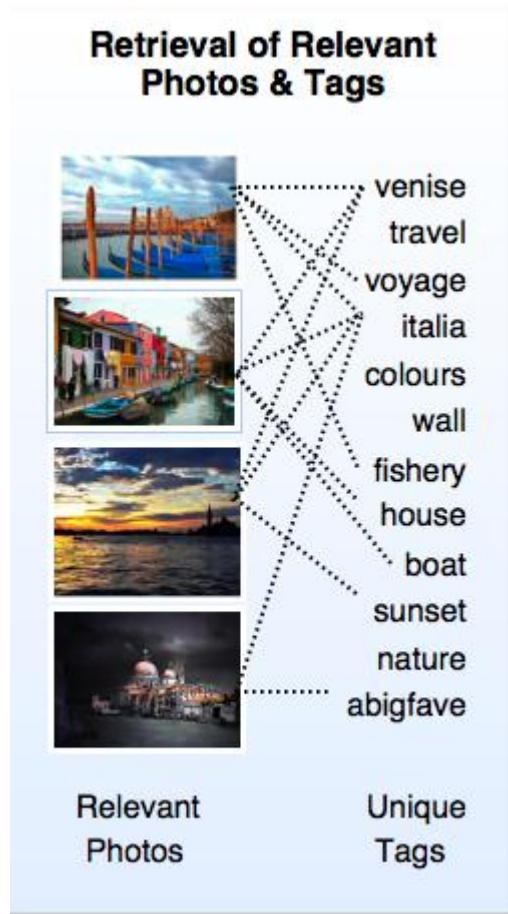
**Target Photo:**



**Initial tags:** italy, venice

- Require initial set of tags
- Initial tags:
  - used for retrieving relevant images.

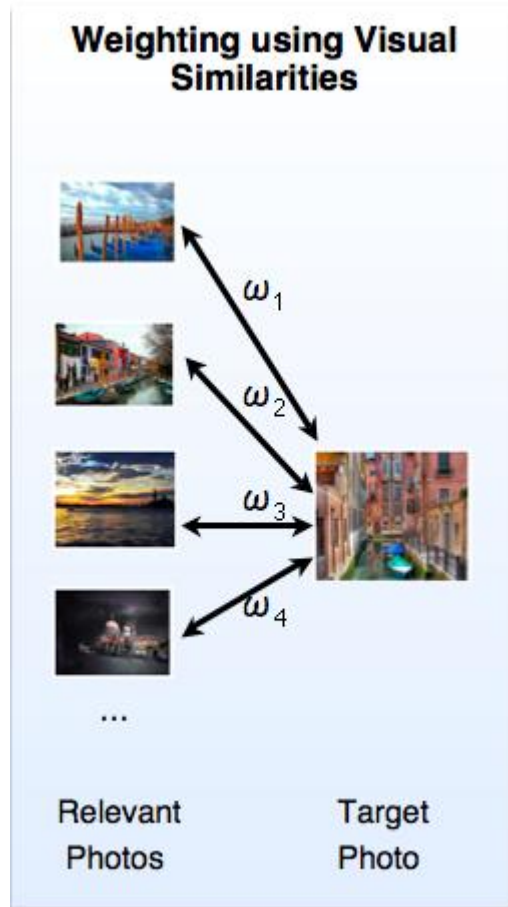
# Approach – Relevant Photos



- Photos including all initial tags..
- Retrieve corresponding tags.
- Form set of distinct tags.

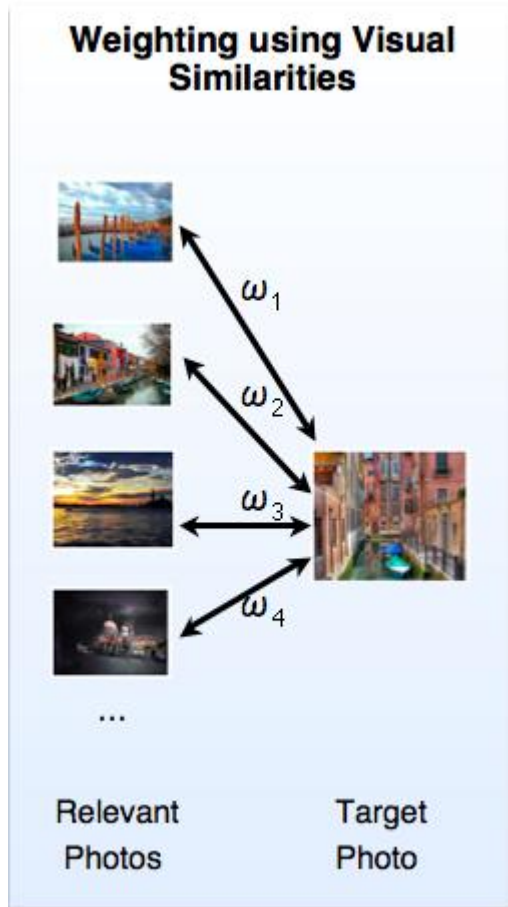


# Approach – Computing Weights



- We need to assign weights to tags.
- Visual similarity between a given image and target image is important.

# Approach – Computing Weights



- Visual similarity computed as:

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

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

# Approach – Computing Weights

- $W_i$  : weight of tag  $i$ .

$$W = \left. \begin{array}{ccccc} & t_1 & t_2 & t_3 & \dots & t_n \\ I_1 & 1 & 0 & 1 & \dots & 0 \\ I_2 & 1 & 1 & 0 & \dots & 0 \\ & & & & & \\ & & & & & \\ & & & & & \\ I_m & 0 & 0 & 0 & \dots & 1 \end{array} \right\} \times \left. \begin{array}{l} \omega_1 \\ \omega_2 \\ \\ \\ \omega_m \end{array} \right\} \Sigma = \begin{array}{cccccc} & t_1 & t_2 & t_3 & & t_n \\ \hline & \square & \square & \square & \square & \square \end{array}$$

# Approach

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## Final Annotation Suggestions

italy  
venice  
venezia  
italia  
abigfave  
bravo  
water  
aplusphoto  
anawesomeshot

- Sort tags according to weights.
- Tags with higher weights are suggested.

# Experimental Work

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- Applied to Flickr: Java API FlickrJ.
  - 100 photos selected
    - ➔ 66 target photos
  - For each target photo
    - ➔ 100 relevant photos
- ~ 7000 images



# Experimental Work

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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

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*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?



# Evaluation Methods

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- Computed precision/recall values and *accuracy*.

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

- 3 approaches evaluated:
  1. Tag Frequency
  2. Color Similarity
  3. SIFT Similarity
- *Frequency approach is the baseline.*





# Evaluation Methods

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



# Evaluation Methods

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## *Suggest-All-Tags*

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



# Evaluation Methods



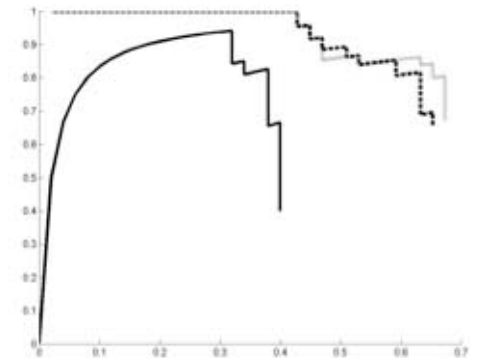
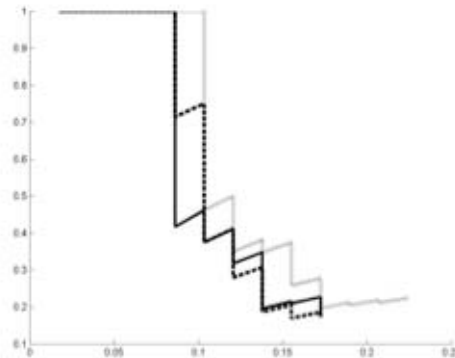
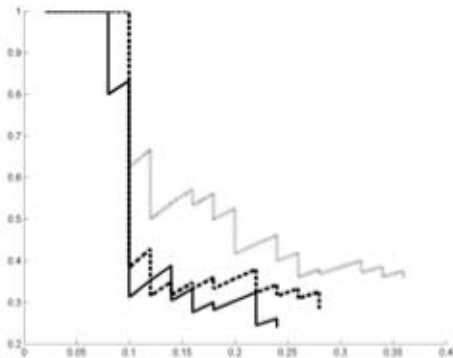
duomo, italy (a)



colosseo, roma (b)



taiwan, protest (c)



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

# Evaluation Methods



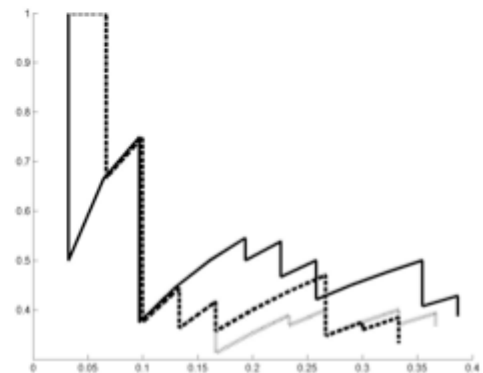
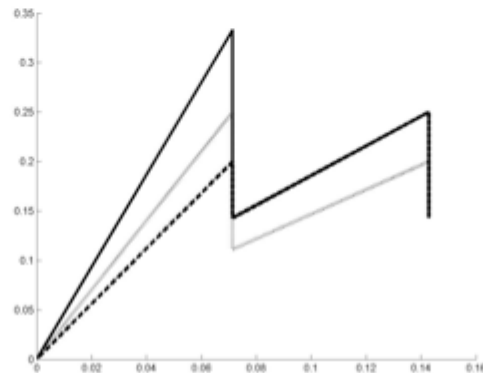
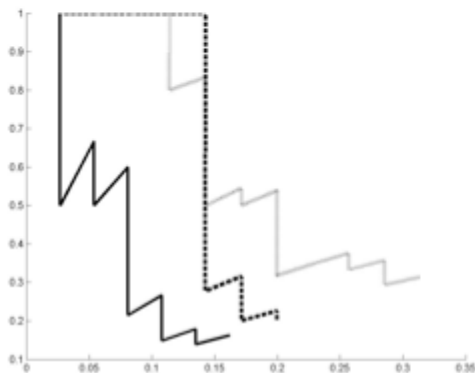
tokyo, city (d)



dog, winter (e)



beyoglu, istanbul (f)



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

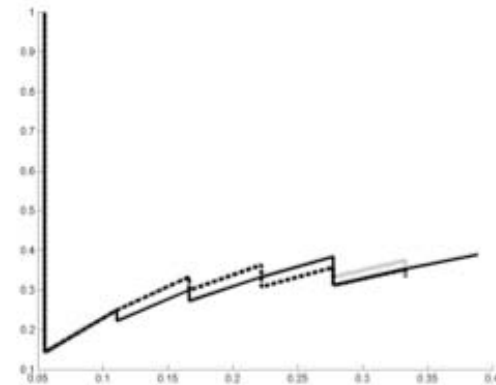
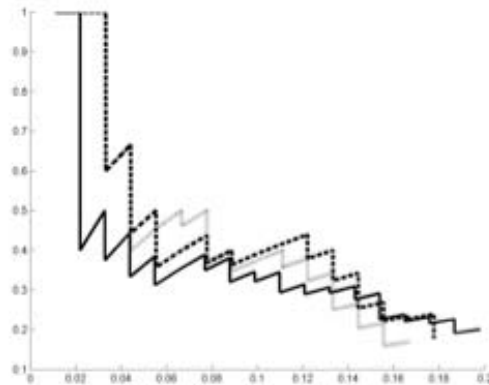
# Evaluation Methods



screen, notebook (g)



office, desk (h)



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

# Evaluation Methods



a



b



c



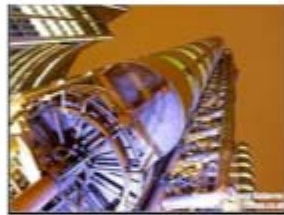
d



e



f



g



h



i



j



k



l



m

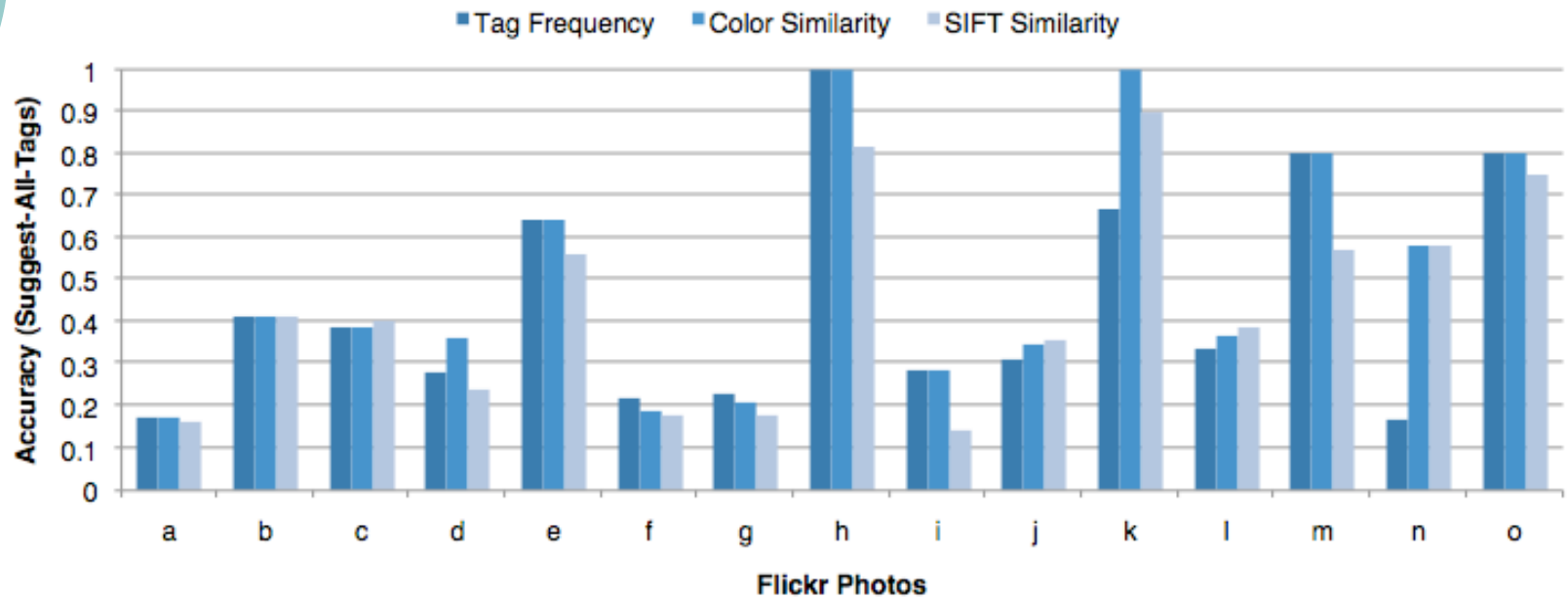


n



o

# Evaluation Methods



# Evaluation Methods

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## *Suggest-Top-5*

- Suggest only the top 5 tags.





# Evaluation Methods



a



b



c



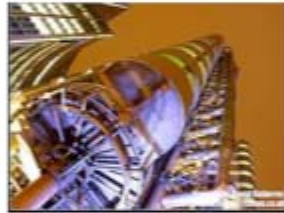
d



e



f



g



h



i



j



k



l



m

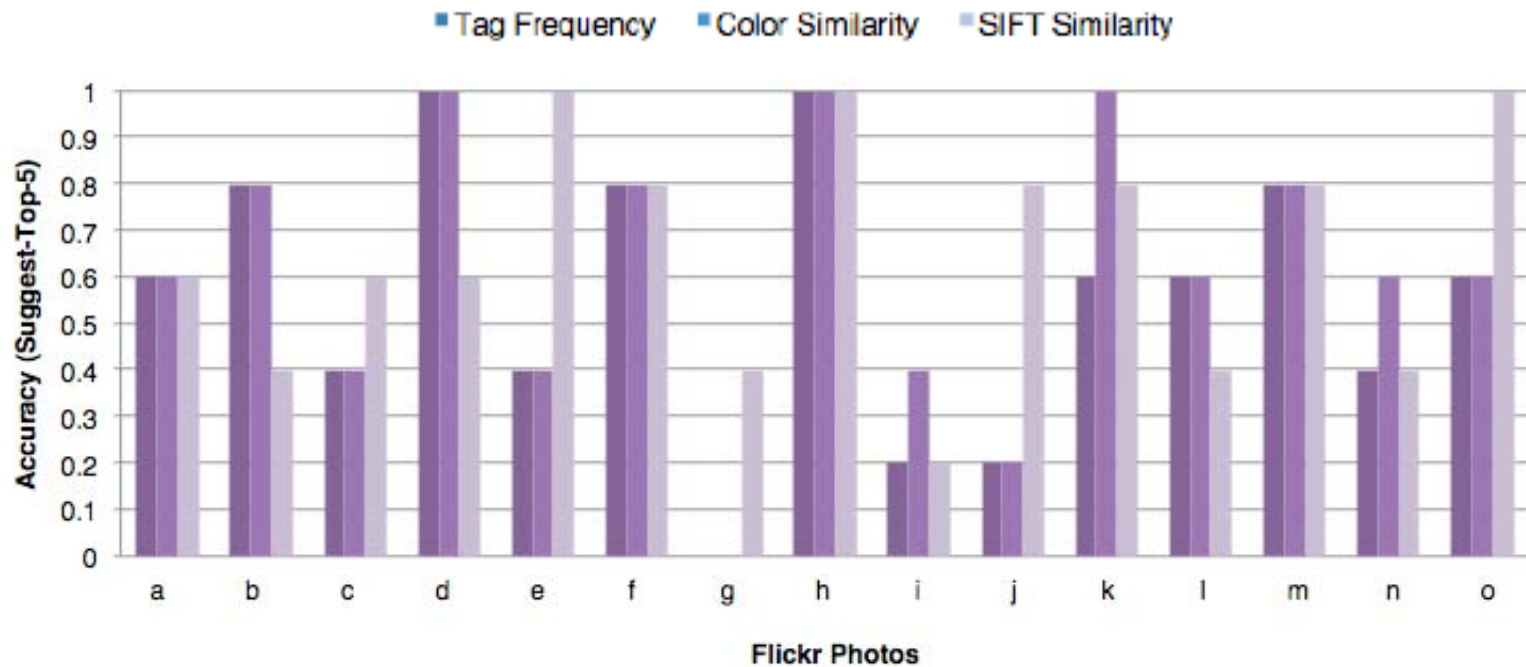


n



o

# Evaluation Methods



# Evaluation Methods

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- 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

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- Difficulty of selecting a ground truth
- Tag lists are
  - Noisy
  - incomplete
  
- Limited dataset
  - Results are data dependent



# Future Work

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



# Demo

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TagSuggestr

**Step1: Upload Photo**

**Step2: Manual Tagging**

**Step3: Feature Selection**

# of Photos :

**Color Features**

RGB     HSV

CieLAB

Texture Features

SIFT Features

**Step4: Retrieve Suggestions**

**Step5: Final Step**


Photo	ID	Name	Tags



TagSuggestr

**Step1: Upload Photo**

219058076\219058076.jpg



**Step2: Manual Tagging**

kitchen  
color

**Step3: Feature Selection**

# of Photos :

**Color Features**

RGB  HSV

CieLAB

Texture Features

SIFT Features

**Step4: Retrieve Suggestions**

**Step5: Final Step**

kitchen  
color

Photo	ID	Name	Tags






TagSuggestr

**Step1: Upload Photo**

219058076\219058076.jpg



**Step2: Manual Tagging**

color

kitchen  
color

**Step3: Feature Selection**

# of Photos : 100

**Color Features**

RGB  HSV

CieLAB

Texture Features

SIFT Features

**Step4: Retrieve Suggestions**

food (9.973133957914591) ▲

macro (6.86962540187768)

hdr (6.191130976981636)

light (6.051827320991725)

home (5.88345489519455)

green (5.767590988839859)

colorphotoaward (5.7405345)

abigfave (5.49542333787243)

bigfave (4.367632804888109)

emmedibi33 (4.367632804888109)

wine (4.3676328048881095)





close (4.153875440598675)

tasty (4.0146995065169495)

digital (3.9090909070263717) ▼

**Step5: Final Step**


kitchen  
color

Photo	ID	Name	Tags
	219058076	Colorful kit...	kitchen hdr home color wine food bigfave abigfave emmedibi33 colorphotoaward
	129536790	Lemons an...	lemons limes lemon lime lemonandlime yellow sour food colour colourful color bright light jani...
	2778365205	MonstaKit...	stickathing monster thunder thunderbolt doodle red black yellow cozinha kitchen küche rock roc...
	101288156	a lot going ...	water drop droplet splash fz20 macro bigfav abigfave raynox panasonic fun kitchen green color ...

TagSuggestr

**Step1: Upload Photo**

219058076\219058076.jpg



**Step2: Manual Tagging**

color

kitchen  
color

**Step3: Feature Selection**

# of Photos :

**Color Features**

RGB  HSV

CieLAB

Texture Features





SIFT Features

**Step4: Retrieve Suggestions**

emmedibi33 (4.36763280488)  
wine (4.367632804881095)  
close (4.153875440598675)  
tasty (4.0146995065169495)  
digital (3.8989808970263717)  
closeup (3.484337861441455)  
fruit (3.4843378614414555)  
colour (3.4505484339400674)  
yellow (3.375674188791005)  
juicy (3.266767414960823)  
sour (3.266767414960823)  
cooking (3.19528727615469)  
panasonic (3.062970343367046)  
fz20 (3.062970343367046)

**Step5: Final Step**

kitchen  
color  
food  
light  
home  
green  
wine  
yellow  
cooking

Photo	ID	Name	Tags
	219058076	Colorful kit...	kitchen hdr home color wine food bigfave abigfave emmedibi33 colorphotoaward
	129536790	Lemons an...	lemons limes lemon lime lemonandlime yellow sour food colour colourful color bright light jani...
	2778365205	MonstaKitc...	stickathing monster thunder thunderbolt doodle red black yellow cozinha kitchen küche rock roc...
	101288156	a lot going ...	water drop droplet splash fz20 macro bigfav abigfave raynox panasonic fun kitchen green color ...



# Conclusion

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# Thank You for Listening.

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Questions?





# References

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- [www.wikipedia.org](http://www.wikipedia.org)
- [www.flickr.com](http://www.flickr.com)