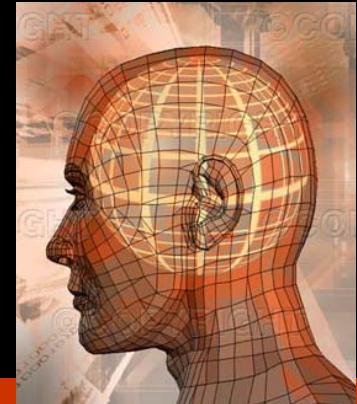


Combating Spam in Tagging Systems

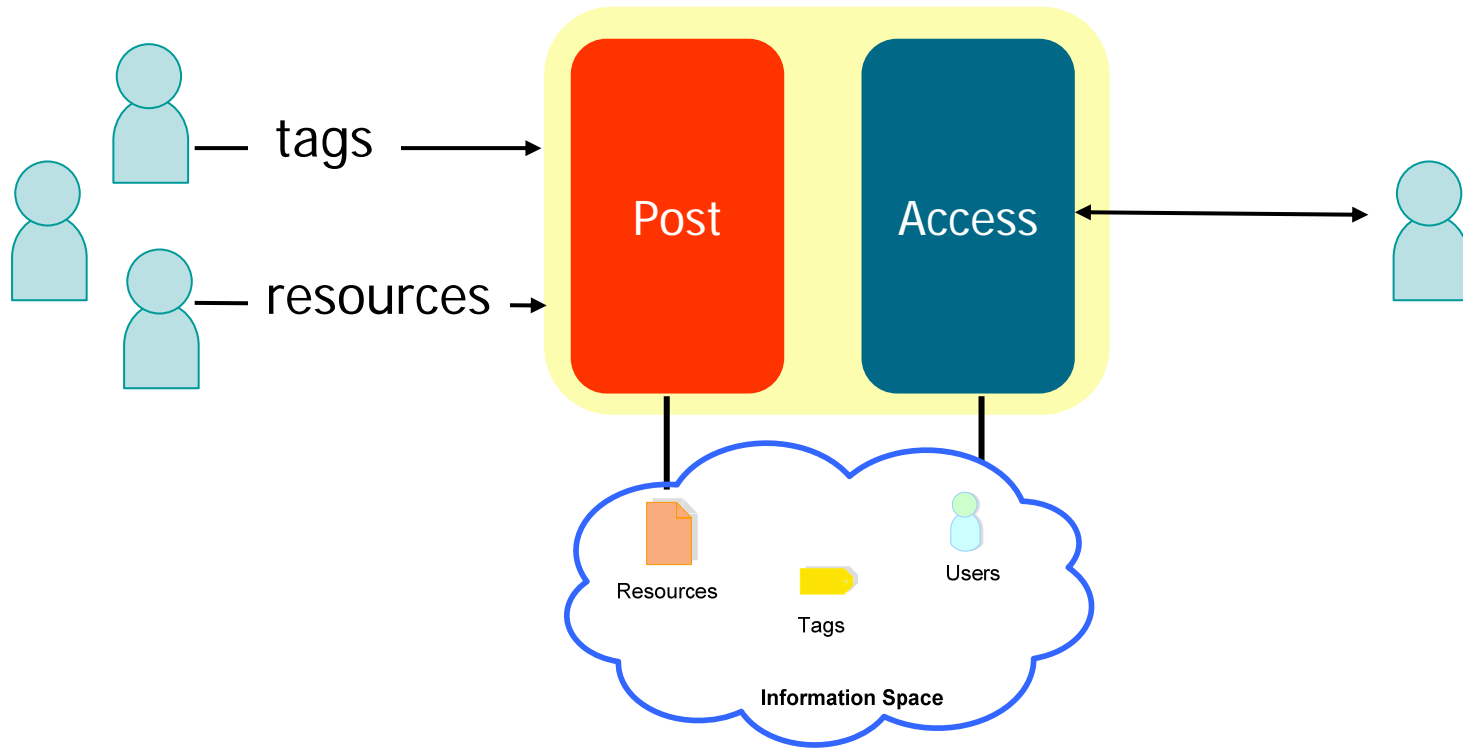
Stanford University

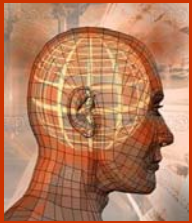
Georgia Koutrika, Frans Effendi
Zoltan Gyongyi, Paul Heymann
Hector Garcia-Molina





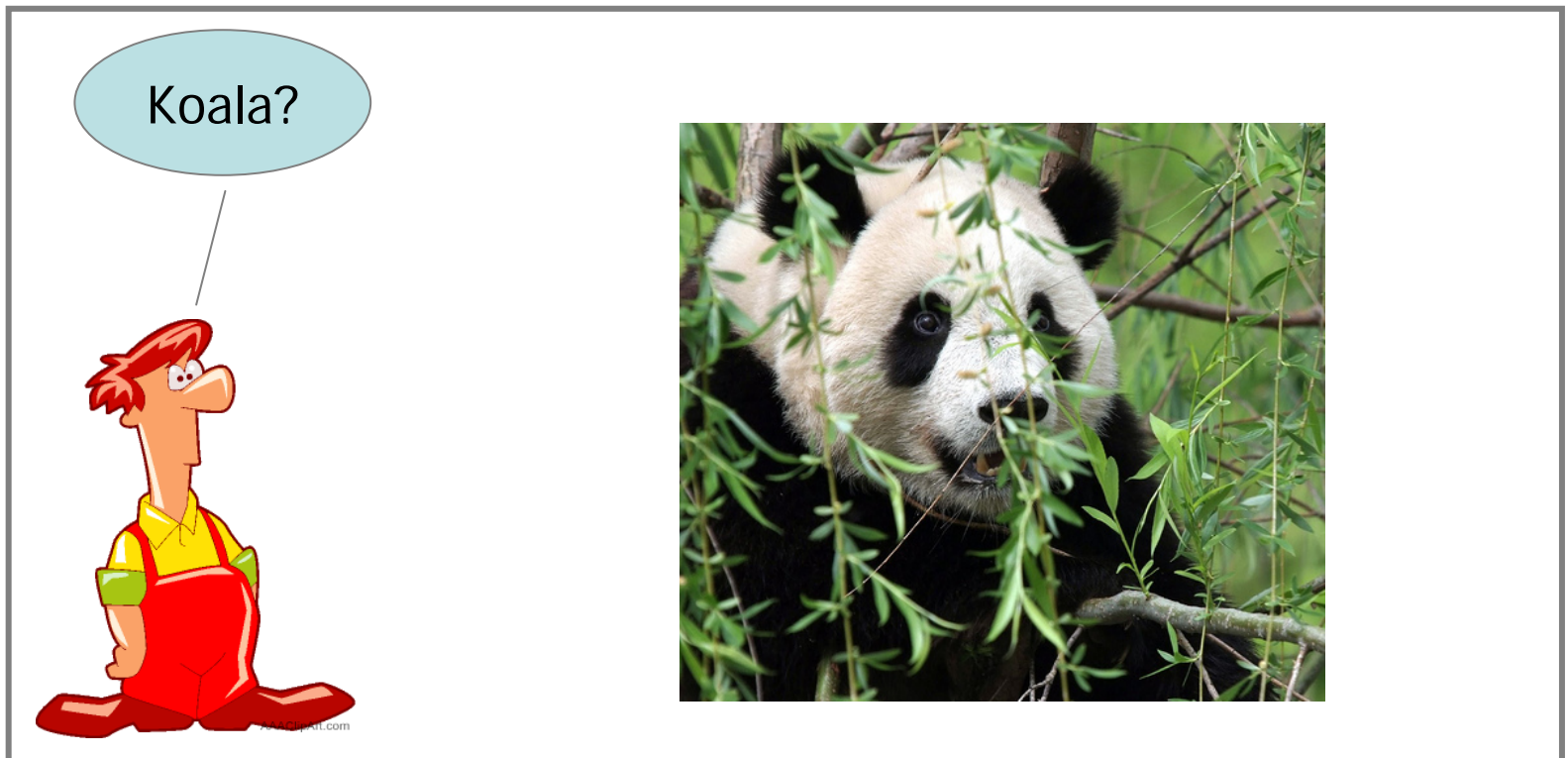
Tagging Systems





Tag Spam

- Lousy tagging





Tag Spam

- Lousy tagging
- Malicious tagging





Tag Spam

- Lousy tagging
- Malicious tagging
- Promotional tagging

Britney

PC's For All

NEED A COMPUTER
BUT YOUR CREDIT IS LESS THAN PERFECT?

- NO CASH NEEDED TODAY
- NO CREDIT CHECK
- APPROVAL GUARANTEED

GET STARTED TODAY
And we'll send you a free digital camera

FREE!

GO NOW



Combating Tag Spam

Objectives

- Tag spam models
- System testing
- Robust algorithms



Combating Tag Spam

Problems

- ! Subjectivity of spam
- ! Evolution of spamming

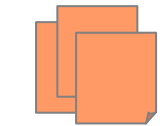
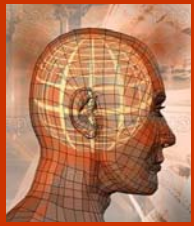


Outline

- Ideal Tagging System
- Tagging Models
- Tag Searches
- Experimental Evaluation
- Ongoing and Future Work



Ideal Tagging System



documents



users



tags



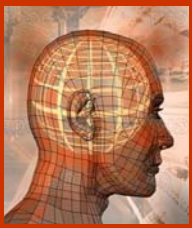
tag budget



postings



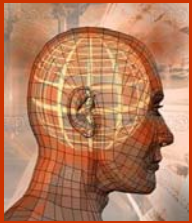
Assumption: for each document we know the set of correct tags



Tagging Models

Simulate good and bad user tagging behavior

- Random behavior
- Targeted attack
- Tag popularity
 - Extremely biased bad user
 - Outlier bad user



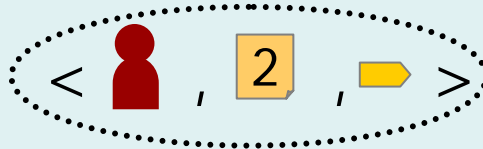
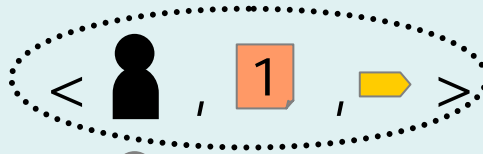
Tag Searches

Boolean

Query tag

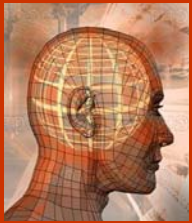


Postings



Answer

2



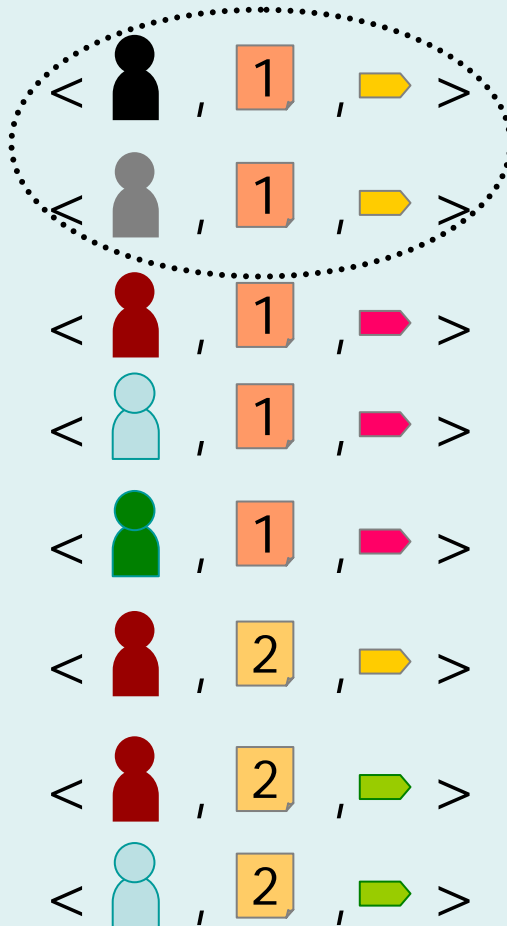
Tag Searches

Occurrences

Query tag



Postings



Answer





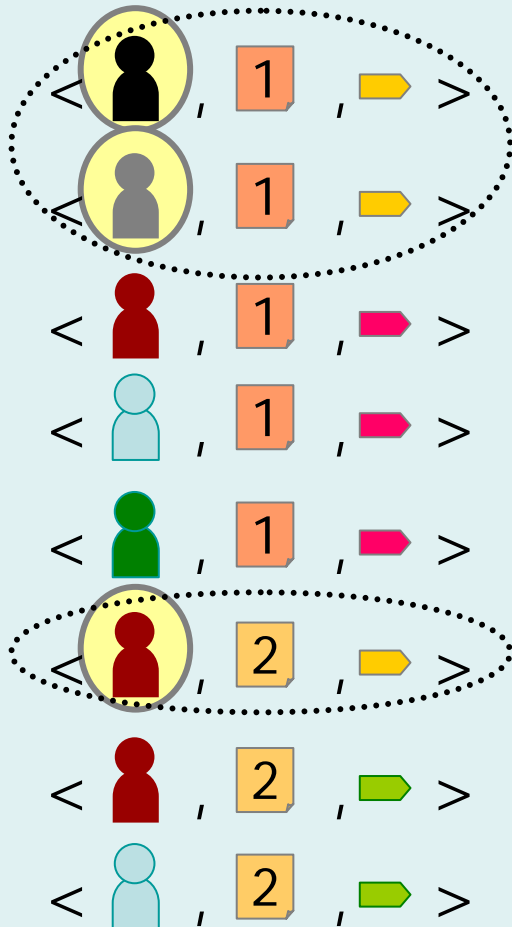
Tag Searches

Coincidences

Query tag



Postings



Answer

Rank documents based on:

- # of postings
- reliability of taggers



Tag Searches

Coincidences: Taggers Reliability

Postings



<		,		,		>
<		,		,		>



<		,		,		>
<		,		,		>
<		,		,		>

Thus:



is more reliable than



<		,		,		>
---	--	---	--	---	--	---

<		,		,		>
---	--	---	--	---	--	---

<		,		,		>
---	--	---	--	---	--	---



Tag Searches

Coincidences

Query tag



Postings




<  ,  ,  >

<  ,  ,  >

<  ,  ,  >

<  ,  ,  >

<  ,  ,  >

<  ,  ,  >

<  ,  ,  >

<  ,  ,  >

Answer



$$c(u) = \sum_{d,t:\exists P(u,d,t)} \sum_{u_i \neq u} |P(u_i, d, t)|$$

$$rank(d, t) = \frac{\sum_{u:\exists P(u,d,t)} c(u)}{c_o}$$



Experimental Evaluation

SpamFactor

$$SpamFactor(t) = \frac{\sum_{d_i} w(d_i) * 1/i}{\sum_{d_i} 1/i}$$

1 2 3 4

SpamFactor=0

1 2 3 4

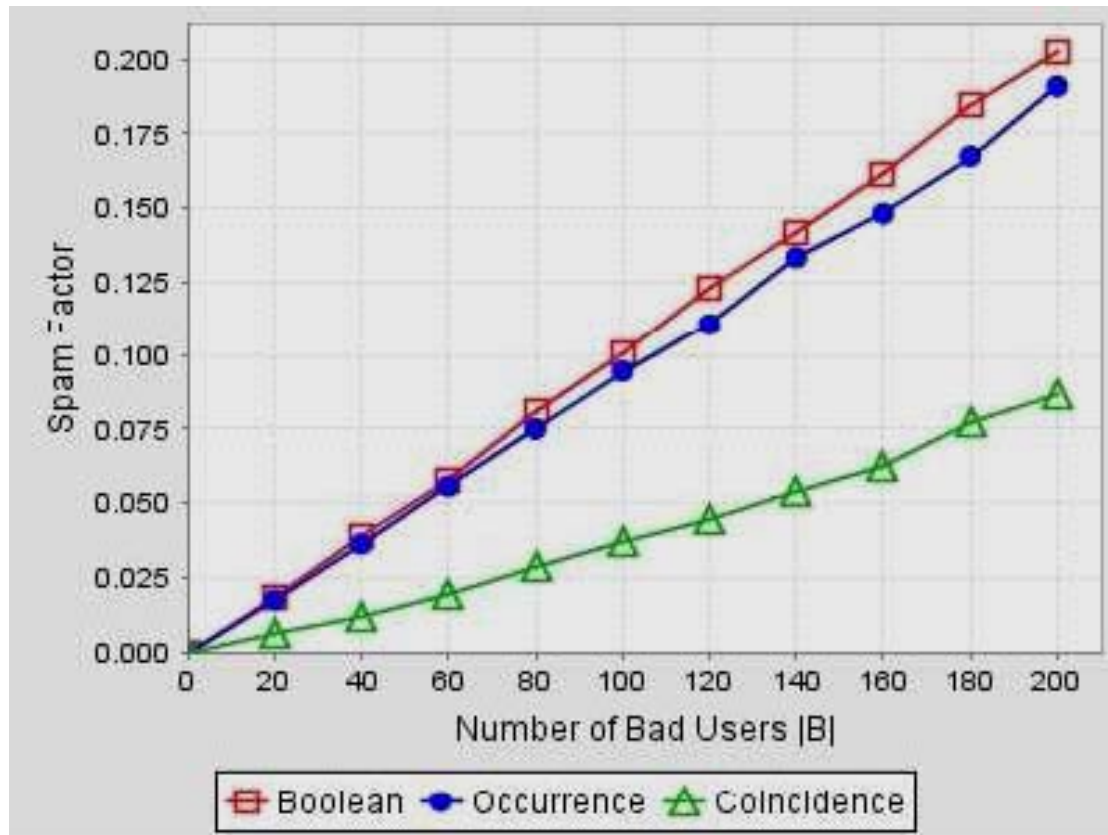
SpamFactor=1

1 1/2 1/3 1/4



Experimental Evaluation

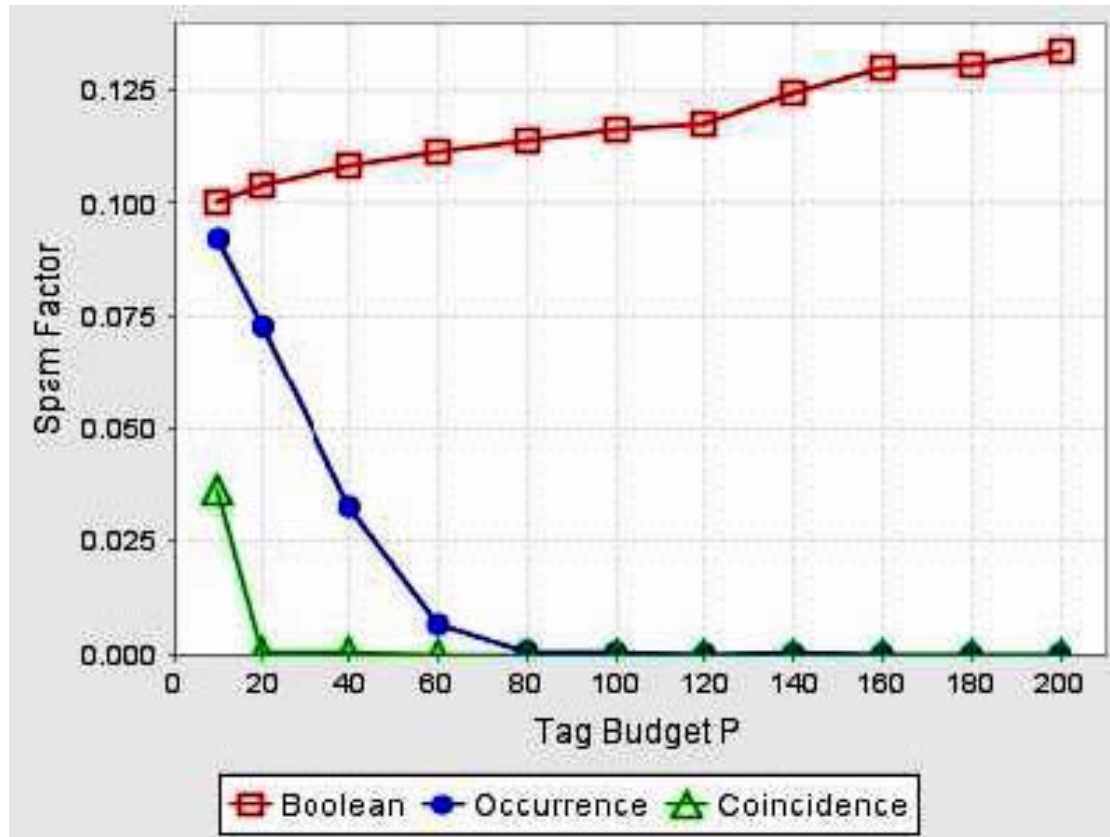
Impact of number of bad users





Experimental Evaluation

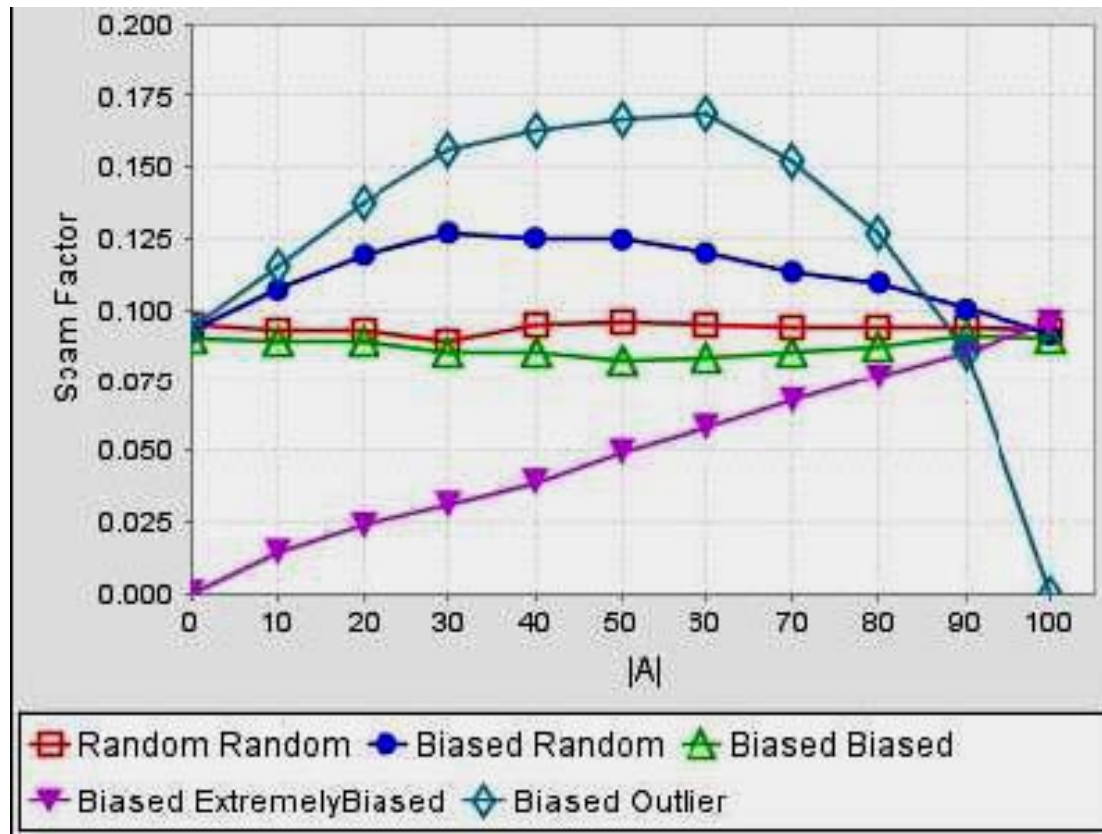
Impact of tag budget





Experimental Evaluation

Impact of number of popular tags





Ongoing and Future Work



- Elaborated tagging system model
- Sophisticated spam models
- Detection Algorithms
- Tag Searches, Tag clouds, ...



Questions?

