



# Trust and Reputation for inferring quality of resources

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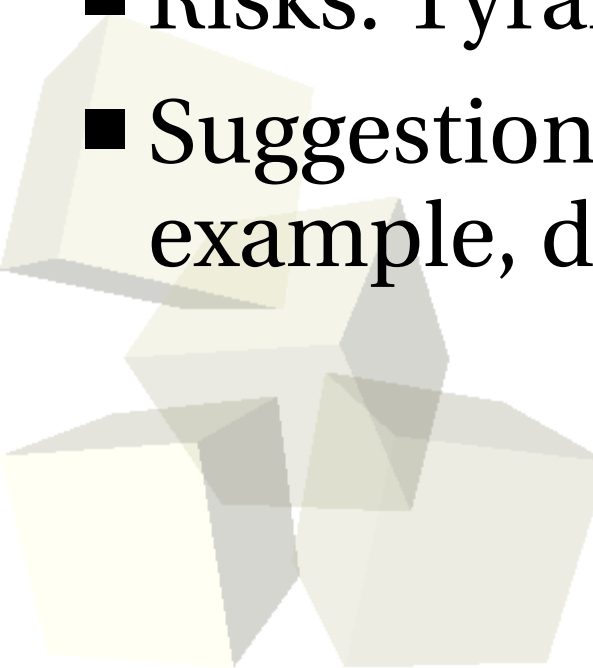
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- Recommender Systems
- New trend: explicit trust and trust metrics
- Local and Global Trust Metrics
- Space for subjectivity? Experiments on real community of Epinions.com
- Risks: Tyranny of the majority / Daily Me
- Suggestion in modelling online systems (for example, digital libraries)



# Recommender Systems in digital libraries

- Recommender Systems suggest items the user might like

0) Users express ratings (opinions)

1) RS find users similar to active user (neighbours)

2) RS recommends to active user items liked by neighbours

## **SIMILAR USERS**

Works for every domain: songs, movies, jokes, ..., **digital libraries and museums.**

Recommendations are personalized based on active user's opinions and tastes.



# New trend: explicit trust

- New trend: consider explicit trust between users
  - Problems in computing user similarity --> ask it directly
  - Users can express which other users they trust (friends),
    - And specifying the level of trust (i.e. In  $[0,1]$ )
    - Concept used in E-marketplaces (**Ebay.com**, Epinions.com, Amazon.com), News sites (**Slashdot.org**, Kuro5hin.org), **P2P** networks (eDonkey, Gnutella, JXTA), Jobs sites (LinkedIn, Ryze), Advogato.org, CouchSurfing, blogs (blogroll!), Semantic Web (FOAF, XFN), Search engines (Google's PageRank)

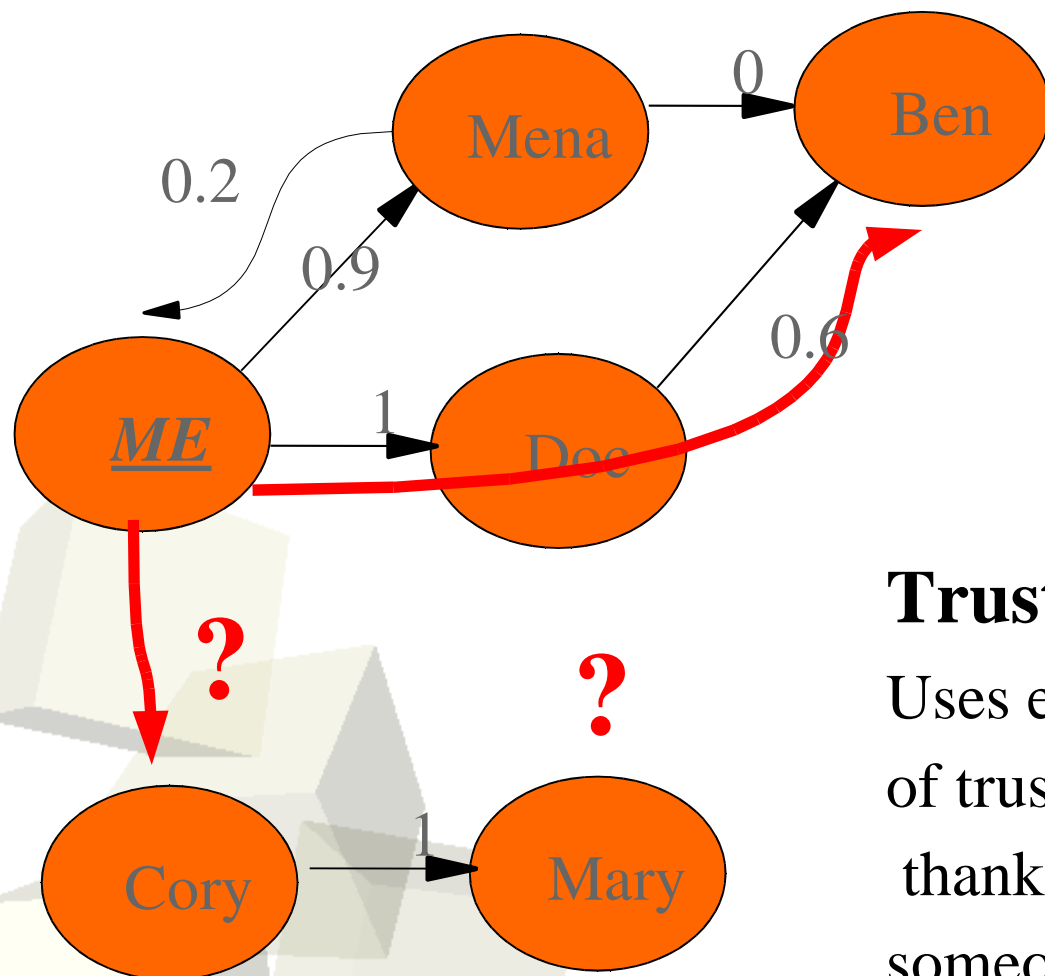


# Trust networks

- Aggregate all the trust statements to produce a trust network.

A node is a user.

A direct edge is a trust statement



*Properties of Trust:*

- weighted (0=distrust, 1=max trust)
- subjective
- asymmetric - context-dependent

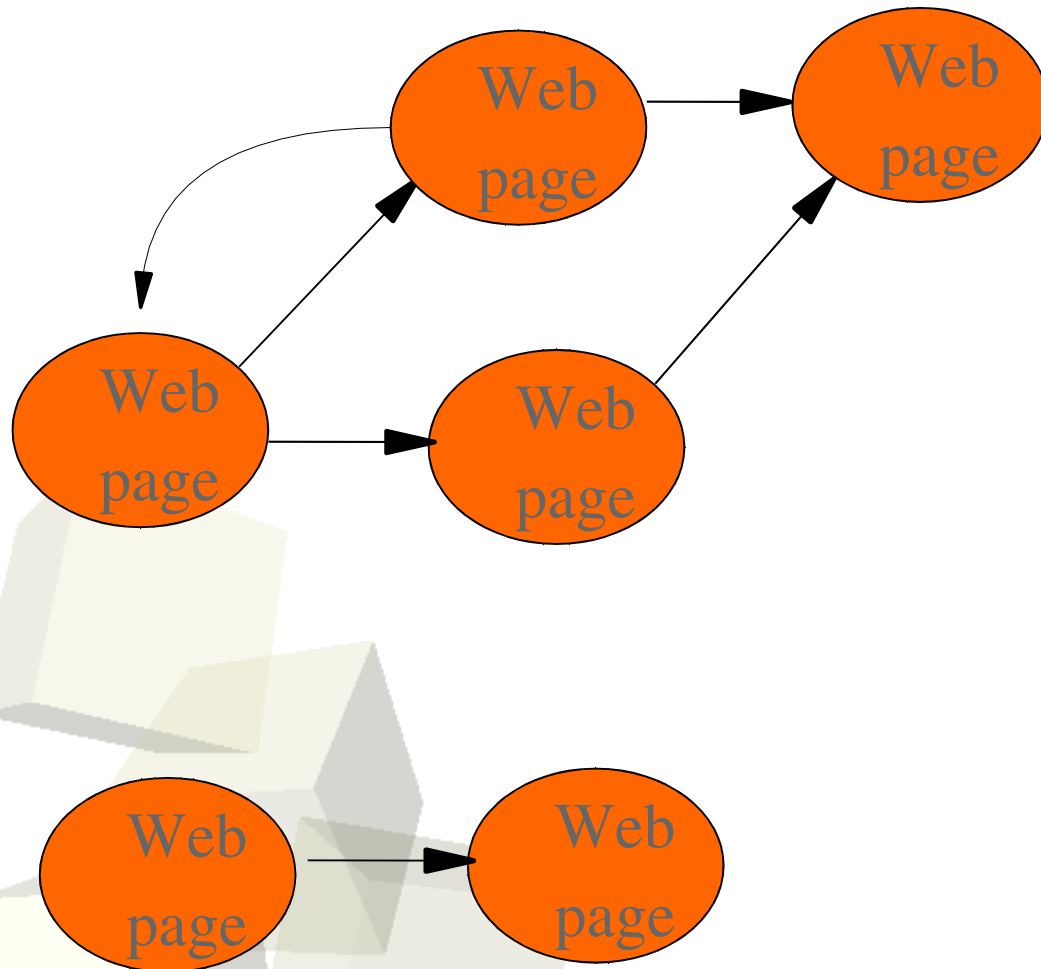
## Trust Metric (TM):

Uses existing edges for predicting values of trust for non-existing edges, thanks to trust propagation (if you trust someone, then you have some degree of trust in anyone that person trusts).



# PageRank: a trust metric?

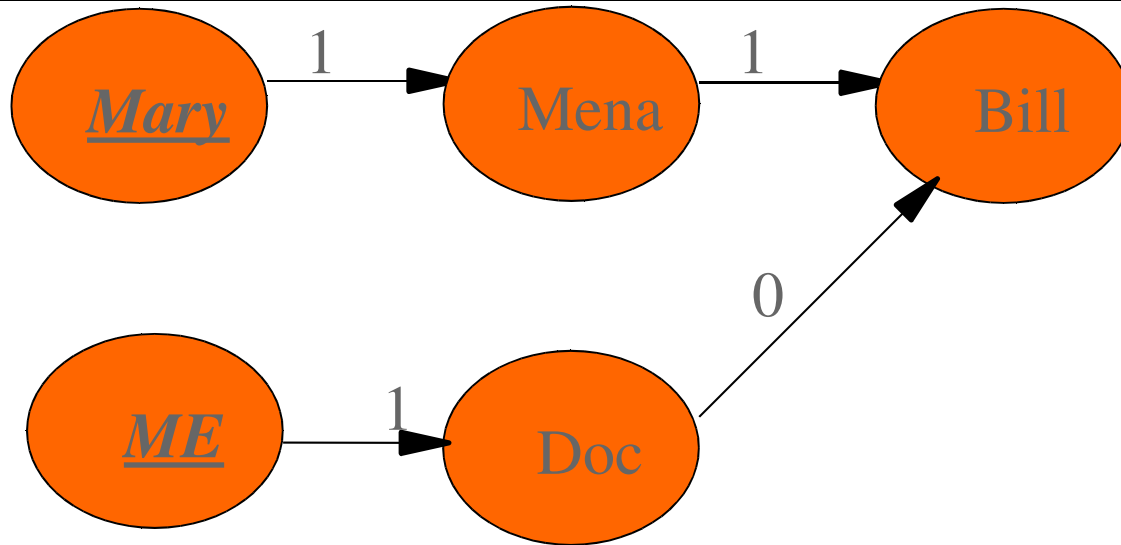
Imagine the web as a trust network



- Nodes are web pages, Edges are links (not weighted).
- PageRank (Google) computes the “importance” of every single page based on number and quality of incoming edges...
- So, YES: PageRank is a trust metric.
- Web IS a library!



# TM perspective: Local or Global



How much Bill can be trusted?  
On average (by the community)?  
By Mary?  
And by ME?

## ■ Global Trust Metrics:

- “*Reputation*” of user is based on number and quality of incoming edges. *Bill* has just one predicted trust value (0.5).  $\text{pred\_trust}(\text{Bill})=0.5$
- PageRank (eBay, Slashdot, ). Work bad for controversial people (bush)

## ■ Local Trust Metrics

- Trust is subjective --> consider personal views (*trust “Bill”?*)
  - $\text{pred\_trust}(\text{Mary}, \text{Bill})=1$ ,  $\text{pred\_trust}(\text{ME}, \text{Bill})=0$
- AppleSeed, Golbeck TM, Advogato, ...
- Local can be more effective if people are not standardized.

- Most of the systems use global trust metrics (ebay, google, slashdot, ...)
- Most papers assume there are (globally agreed) good peers (that gives correct ratings) and malicious or wrong peers (that don't agree with good peers).
- This assumption is not realistic (next slide)
- It is dangerous: encourages herd behaviour and penalizes creative thinkers, black sheeps, unexpected opinions.





## What is Epinions.com?

- Community web site where users can
    - ♦ Write reviews about items and give them ratings
    - ♦ Express their Web of Trust (*“Users whose reviews and ratings you have consistently found to be valuable”*)
    - ♦ Express their Block List (*“Users whose reviews and ratings ... offensive, inaccurate, or in general not valuable”*)
  - Reviews of TRUSTed users are more visible
  - Reviews of DISTRUSTed users are hidden
- Evidence from real online community of **150.000** users).



Epinions.com - Dr.P's profile - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://www.epinions.com/user-dr.

**Web of Trust**

**Dr.P trusts:**

1. [2buzy](#)
2. [gamblin\\_man](#)
3. [tennis\\_player](#)
4. [Steelfan](#)
5. [omophagia](#)

[View all 255 members whom Dr.P trusts](#)

**Dr.P is trusted by:**

1. [treeseed](#)
2. [Steelfan](#)
3. [LILvoyce](#)
4. [nikefreak](#)
5. [nchoward](#)

[View all 187 members who trust Dr.P](#)

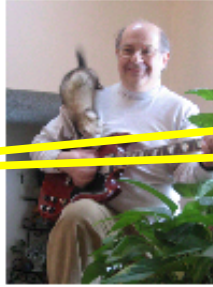
**Web of Trust**

**Trust** Dr.P

**Block** Dr.P

[Whom should I trust?](#)

**Dr.P's Profile**



**About Dr.P**

**ADVISOR** in [Musical Equipment](#)

**TOP REVIEWER** in [Musical Equipment](#)

Epinions.com ID: **Dr.P**

Member Since: **Sep 24 '00**

I am a Psychologist/Musician with a love for music and animals of all species. [more](#)

**Dr.P's Recent Opinions**

Date Written	Review Title	Product / Topic	Product
Apr 06 '05	<a href="#">GIBSON 1954 LES PAUL GOLDTOP GUITAR</a>	Gibson 1954 Les Paul Goldtop in <a href="#">Guitars &amp; Bases</a>	★★★★
Mar 03 '05	<a href="#">GIBSON 1952 LES PAUL GOLDTOP GUITAR</a>	Gibson 1952 Les Paul Goldtop in <a href="#">Guitars &amp; Bases</a>	★★★★
Feb 11 '05	<a href="#">GIBSON PETE TOWNSHEND SIGNATURE SG GUITAR</a>	Gibson Pete Townshend Signature SG Guitar in <a href="#">Guitars &amp; Bases</a>	★★★★
Feb 04 '05	<a href="#">FENDER DYNA TOUCH DELUXE 90 DSP COMBO AMPLIFIER</a>	Fender Dyna Touch Deluxe 90 Combo in <a href="#">Amplifiers</a>	★★★★
Feb 02 '05	<a href="#">FENDER 65 DELUXE REVERB COMBO</a>	Fender 65 Deluxe Reverb Combo	★★★★

## Dr.P profile page

Dr.P's Web of Trust (Block List is hidden)

Do you trust or distrust Dr.P?

Ratings given by Dr.P



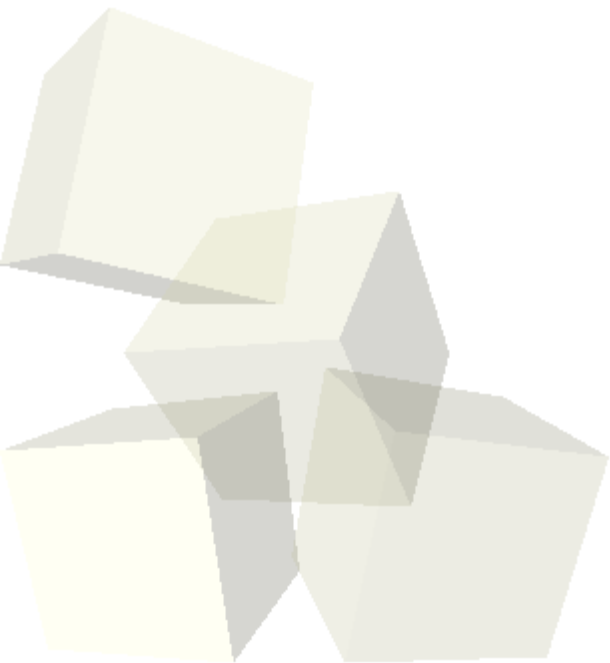
# Are there CORRECT ratings?

- What is the correct rating of movie “Titanic”?
- What is the correct rating of cd “BackStreetBoys”?
- ... what is the correct rating of “Divina Commedia”? Of my paper?
- IF 99% of people likes “Divina Commedia”, I'm forced to like it? Otherwise I'm wrong or malicious?
- No correct ratings. Just different subjective opinions and tastes. --> No experts!



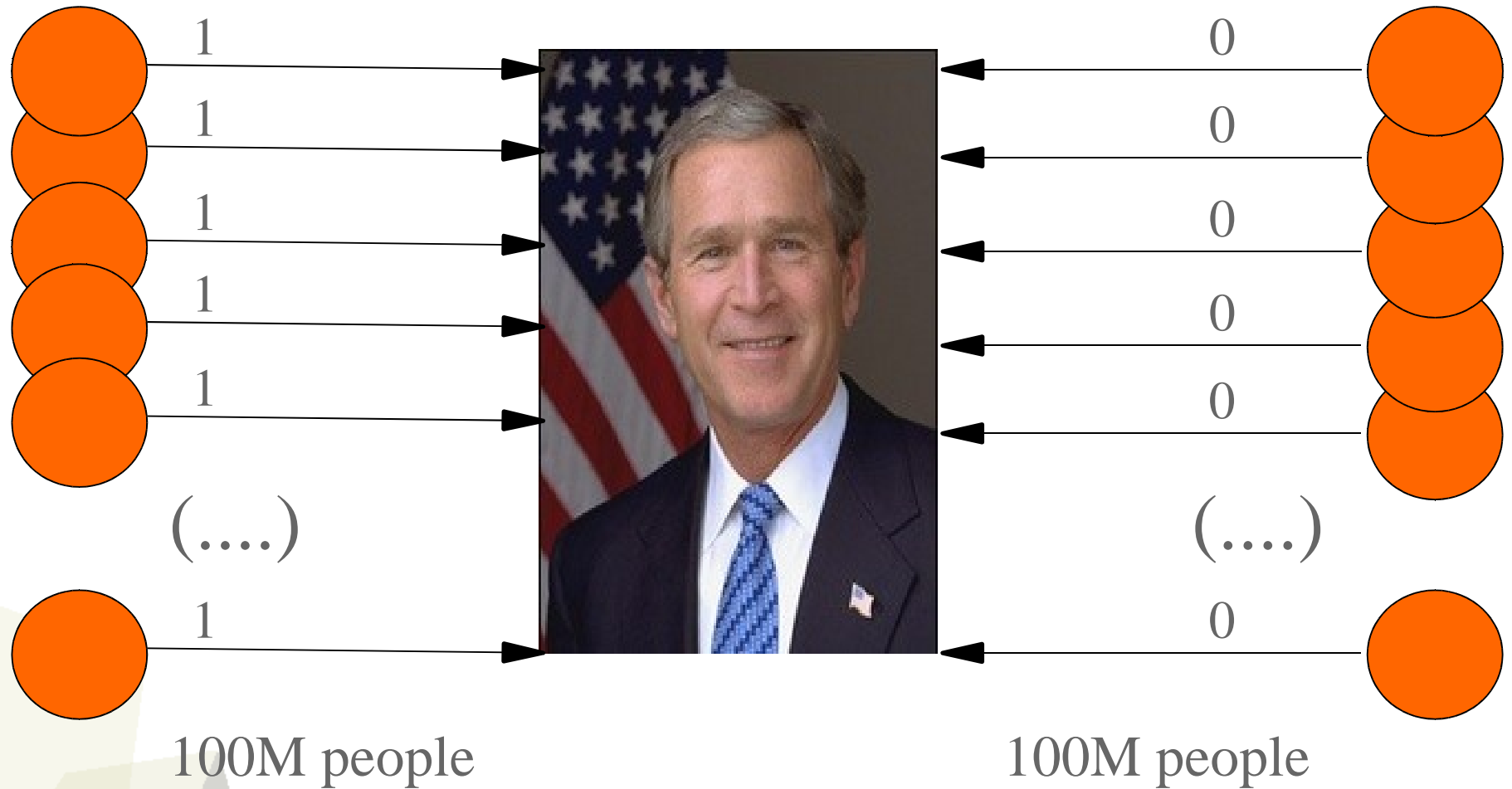
# Are there correct trust statements?

- Intuitively: a Controversial User is
  - ◆ TRUSTED by some users
  - ◆ DISTRUSTED by some users
  
- Do you want an example?





# Controversial Users: an example



If you don't know Bush, should you trust Bush?  
 $T(\text{Bush})=0.5$ ? Make sense? Here global metrics don't.

# Some numbers about controversiality

## ■ Epinions.com dataset

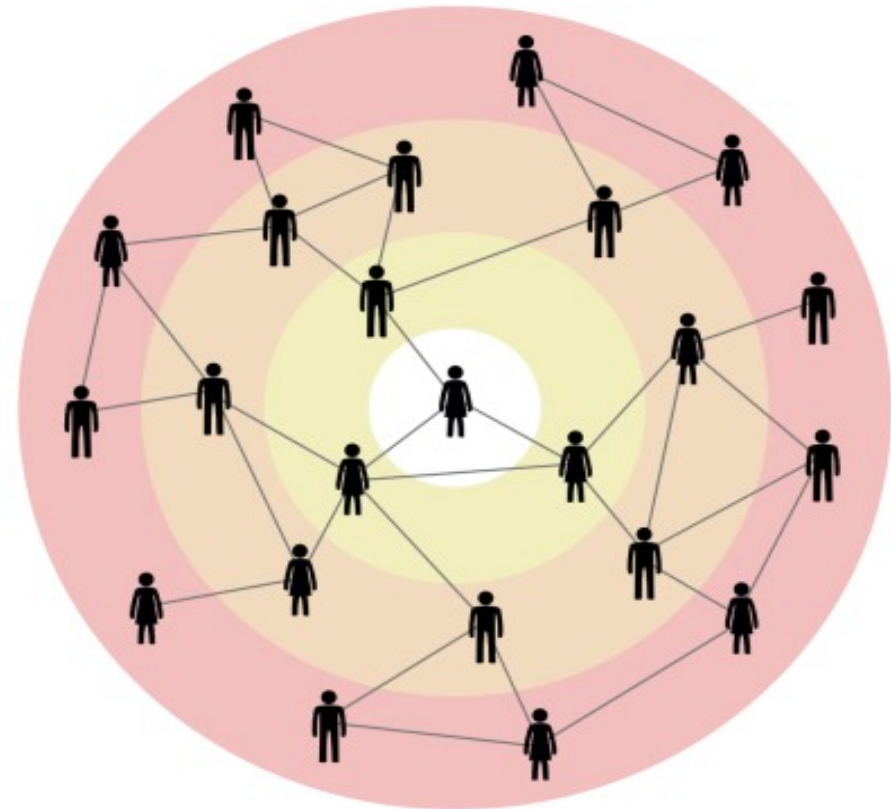
- ◆ Real Users: ~**150K**
- ◆ Edges (Trust / Distrust): 841K (717K / 124K)
- ◆ ~85K received at least one judgement (trust or distrust)
- ◆ 17.090 (>20%) are at least 1-controversial (at least 1 user disagrees with the majority) --> Non negligible portion!
- ◆ 1.247 are at least 10-controversial
- ◆ 144 are at least 40-controversial
- ◆ 1 user is 212-controversial! (~400 trust her, 212 distrust her)



# Experiment

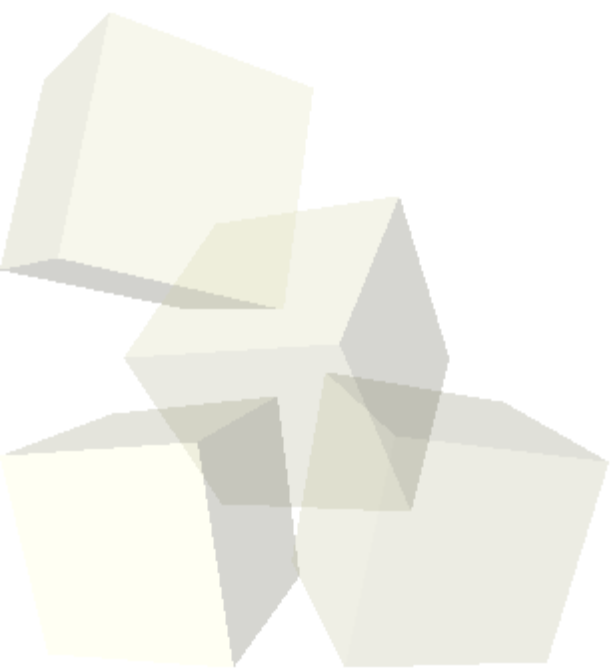
- Comparing 2 metrics about accuracy in trust/distrust prediction.
  - ◆ Global: ebay-like.  $\text{Trust}(A) = \frac{\# \text{trust}}{\# \text{trust} + \# \text{distrust}}$
  - ◆ Local: MoleTrust, based on Trust Propagation from current user (simple and fast)

Cycles are a problem --> Order peers based on distance from source user  
Trust of users at level  $k$  is based only on trust of users at level  $k-1$  (and  $k$ )  
Trust propagation horizon & decay





- How do we compare metrics?
- Leave-one-out: Remove an edge in Trust Network and try to predict it. Then compute error as absolute difference between Real and Predicted value.





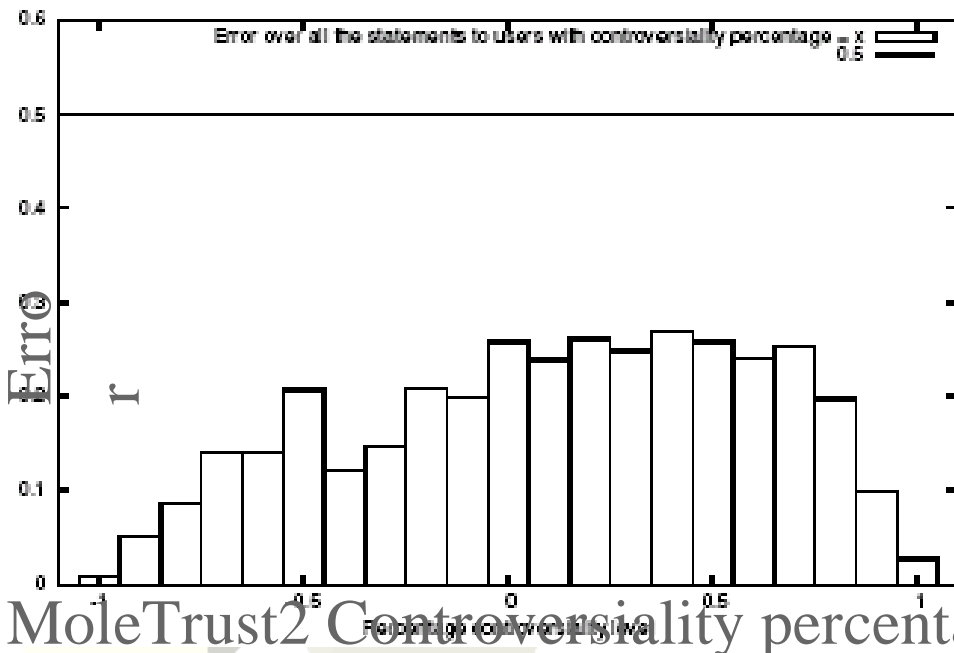
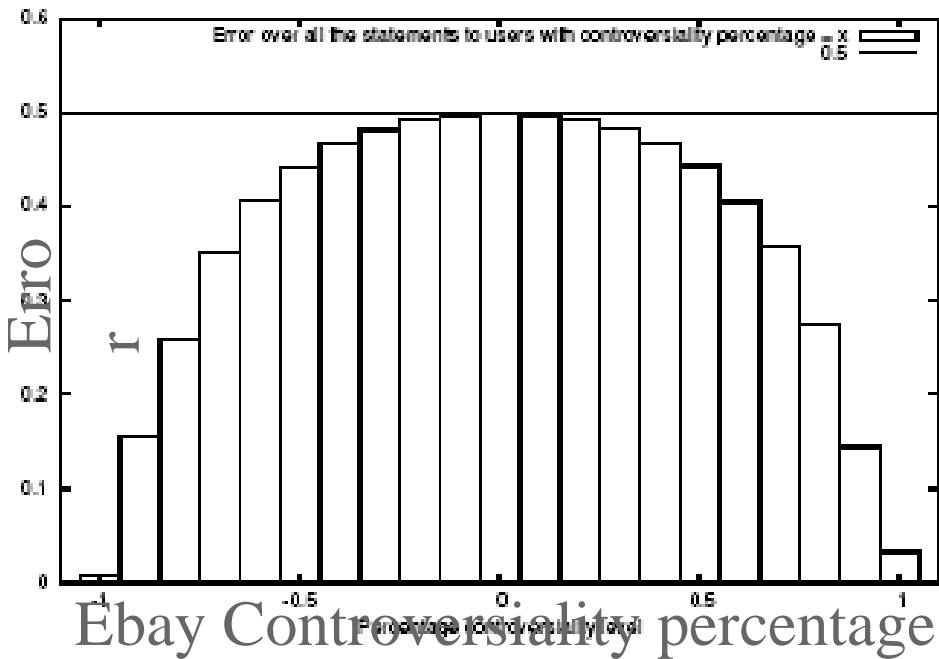


# Exp. on Controversiality Percentage

CP~0 = Controversial User

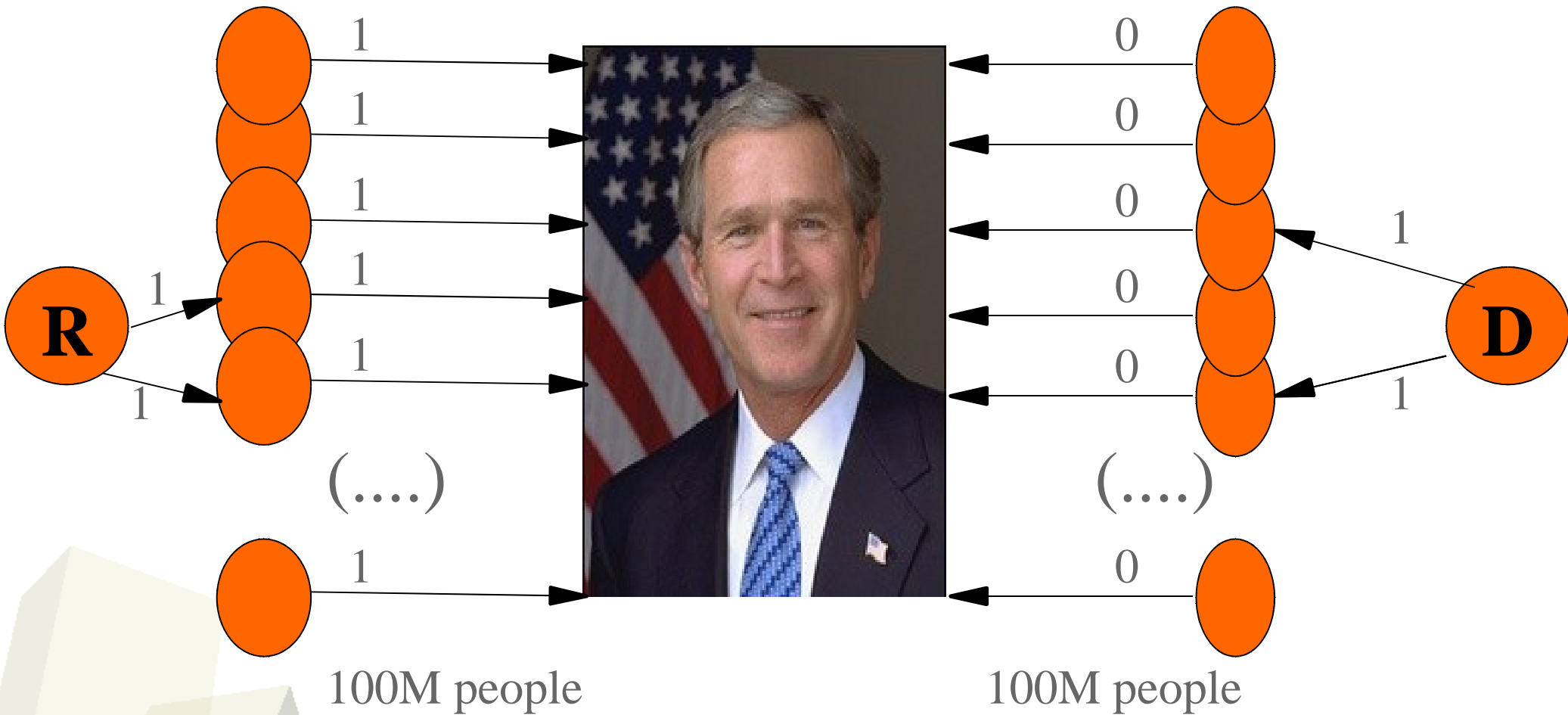
Error Ebay = 0.5 on Controversial Users

**Error MoleTrust2 smaller**  
but not as small as we would like: can we reach 0?





# Controversial Users: an example



Local Metric makes more sense. Your trust in Bush depends on your trusted users!

$$T(R, \text{Bush}) = 1$$

$$T(D, \text{Bush}) = 0$$



# Controversiality Epinions: summary

- Most papers assume a peer has a unique quality value (there are good peers and bad peers, goal is to spot bad)
- IRREALISTIC assumption (Evidence from real online community of *150,000* users).
- Consequence: we need **Local Trust Metrics** (personalized) [But most papers propose Global Metrics]
- Ref: [Controversial Users demand Local Trust Metrics: an Experimental Study on Epinions.com Community, Massa, Avesani, AAAI 2005]



# Tyranny of the Majority

- Resist the temptation to model your system (i.e. digital library) with good and bad peers because this is not realistic.
- And it is dangerous
  - ◆ Tyranny of the majority
    - [Democracy in America, de Tocqueville, 1835] and [On Liberty, John Stuart Mill, 1859]
  - ◆ for one minority, which by definition has opinions that are different from the ones of the majority, there is no way to be protected “against the tyranny of the prevailing opinion and feeling”.

# Tyranny of the Majority: examples

## Examples of minorities

- Einstein
- Galileo
- 
- ... basically evolution in society happens only if there is someone who “thinks different”.
- Suggestion: don't crush (or burn!) different thinkers! Minority's opinions are opportunities.
- No need to introduce it: online systems allow (local) personalization ... however ...



# Risk on the opposite side: DAILY ME

- “Daily me” (aka “echo chambers”)
  - ◆ [Cass Sunstein. Republic.com. Princeton University Press, 1999]
- “technology has greatly increased people's ability to filter what they want to read, see, and hear, to encounter only opinions of like minded people and never again be confronted with people with different ideas and opinions”
- Risk: segmentation of society

Tyranny of the majority <---> Daily me

Is there a **balance** in the middle?

Could be no ratings at all? ... Wikipedia works

Why not stopping assigning “Nobel” prizes?

But what we teach to school pupils as  
“correct”?

Forced by law to discuss with people we don't  
agree with?

... this is more sociology than anything else ...



- The more decentralized the environment (read “open publishing”),
- the more needed to rely on decentralized assessment and control of quality (ratings, trust --> recommender systems, reputation systems, trust metrics).
  - ◆ Community of peers self-moderate itself







## Final suggestion:

- Resist temptation to design systems in which there are concepts as “correct” and “wrong” rating, “good” and “bad” user.
- Offer both global and a local view.
  - ♦ (global is needed? --- Need for a nobel prize? What is culture?)
  - ♦ For example with a sidebar that lets you explore the personalized view (daily me) and global view (majority) and mixes of them.



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Thanks for your attention

Thanks!  
Questions?

