The Wisdom of Crowds (Who Surf)

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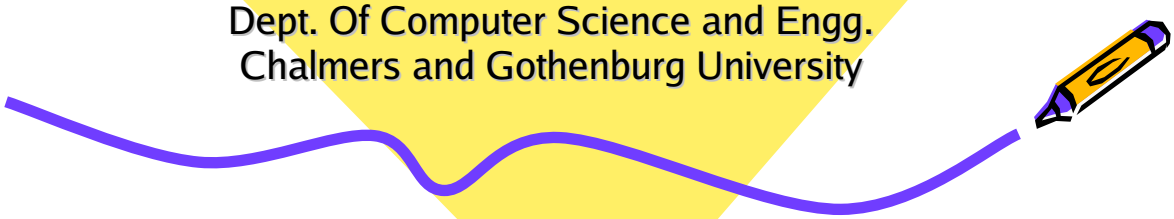
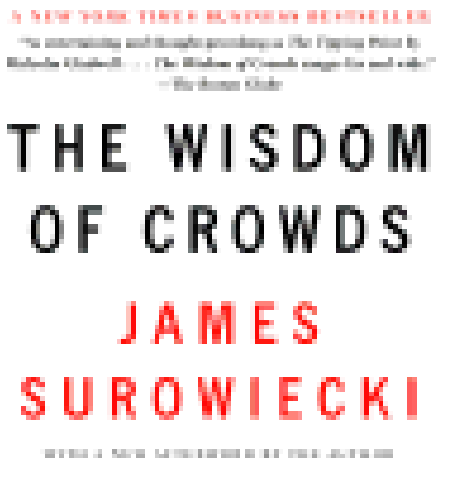
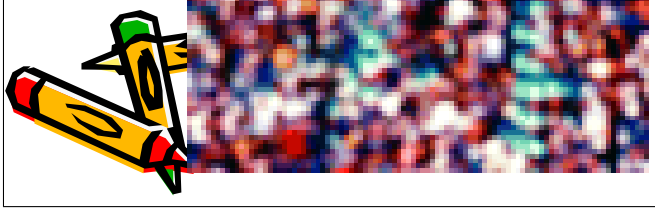


The Wisdom of Crowds



- Why the Many are smarter than the Few
- Crowds better than experts
- Discovery
- Coordination
- Cooperation



Francis Galton visits a Country Fair (1906)

- Crowd guesses what the Ox would weigh
- Crowd's average guess: 1,197 lb
- Correct weight: 1,198 lb!

Wisdom of Crowds on the Web

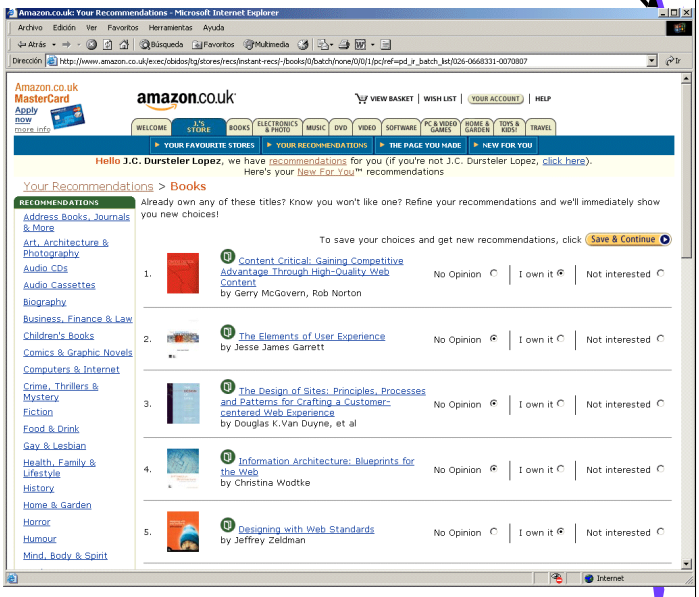
- Exponentially growing
- Also quite accurate: a recent comparsion with Encyclopaedia Britannica

Wisdom of Crowds on the Web: Google

- Link analysis
- Basic idea is that more people linking to a page is more votes for it
- Subtle re-inforced version of the ”wisdom of crowds”

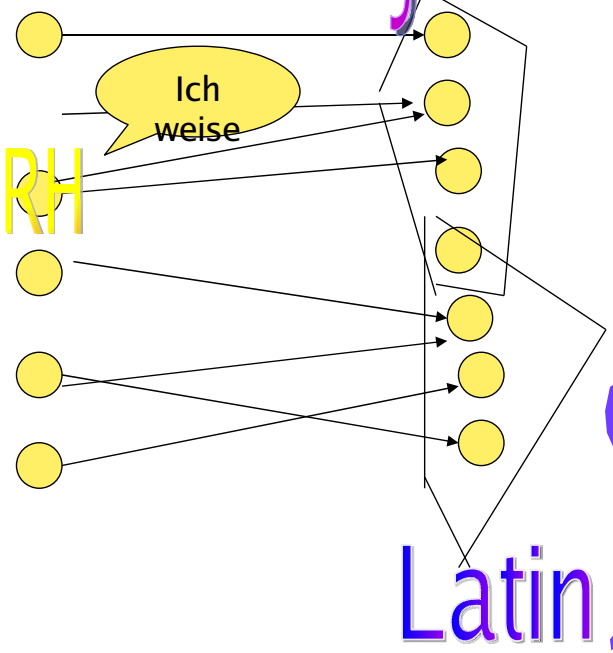
Mining the Internet

- Collaborative Filtering
- Simultaneous categorization of people and products based on mathematical models.

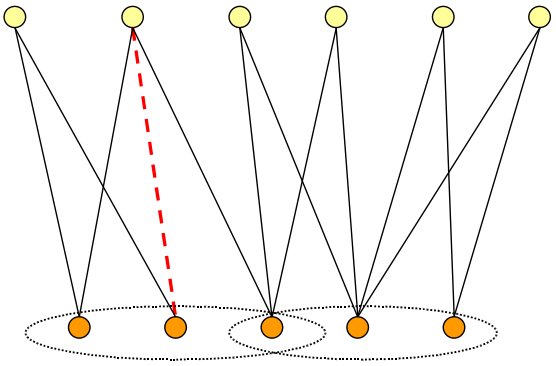


People and Music

- People and music they buy often shows a distinct bi-clustering
- Mathematical Mixture models try to capture this structure



Collaborative filtering

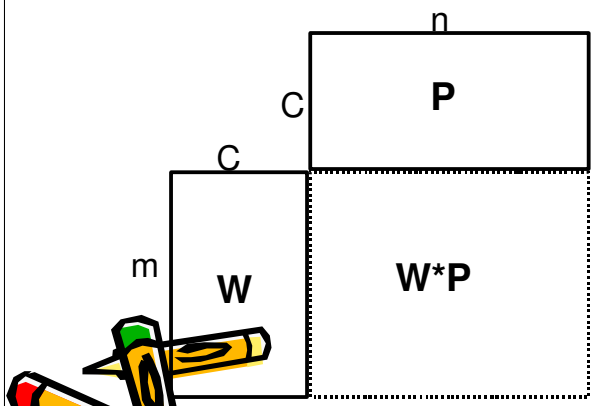


Mixture model

$\forall$ *u* : preference $p(u,c)$ $\left(\sum_c p(u,c)=1\right)$

$\forall$ *a* : weight $w(a,c)$ $\left(\sum_a w(a,c)=1\right)$

Pr(*u* selects *a*) = $\sum_c p(u,c)w(a,c)$



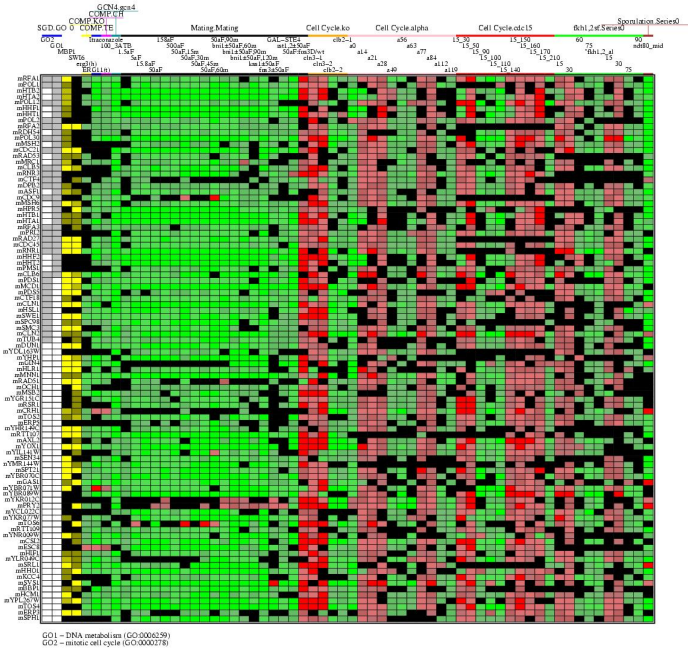
number of users: n

number of items: m

number of clusters: C

Biclustering Genes

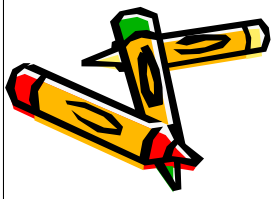
Genes



Disease exps

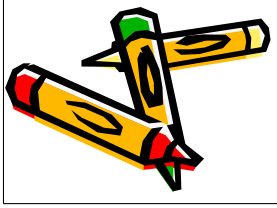
Bi-clustering algorithms

- Exploit clusterting structure simultaneously on both sides.
- ”Biclustering is a relatively young area … it has great potential to make significant contributions to biology and other fields.” [Tanay, Sharan and Shamir, 2006]



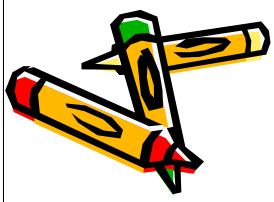
Collaborative Filtering in Mixture Models

- Kleinberg and Sandler (2004) gave the first rigorous analysis and guarantees on algorithms for the mixture model
- Uses LP and spectral methods
- We wanted to explore light-weight practical methods.



A Porfolio of Iterative Bi-clustering Algorithms

- Start with an initial soft clustering on one side.
- (HITS) Iteratively use the current clustering on one side to refine the clustering on the other side
- Parameters: no. of iterations, update weighting.

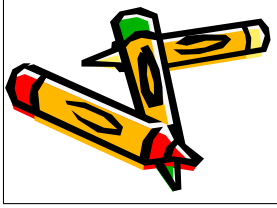


Tests on generated data

Planted partition Model

- Disjoint model
- Intermediate model
- Completely mixed model

- Generated:
  - 1000 users
  - 300 items
  - 10 clusters
  - sample size: 10, 15, 20
- $\Theta \in [0,1]$



Results for the disjoint model

		Sample 10		Sample 20	
Θ	Method	F10	F20	F10	F20
0	1	4.7	14.9	6.3	16.1
	2	4.2	14.5	6.0	15.8
	3	4.0	14.3	5.9	15.8
	4	4.3	14.6	6.1	15.9
0.4	**1**	**8.7**	**19.0**	**8.7**	**19.4**
	2	3.7	13.9	6.2	16.1
	3	3.7	14.0	6.2	16.2
	4	3.7	14.0	6.2	16.1

Results for the intermediate model

		Sample 10		Sample 20	
Θ	Method	F10	F20	F10	F20
0	**1**	**4.1**	**14.2**	**4.3**	**14.9**
	2	2.7	12.1	3.2	13.2
	3	0.0	0.9	0.1	0.6
	4	2.8	12.4	3.4	13.6
0.4	1	1.1	2.2	1.2	2.3
	2	1.9	13.1	0.8	12.1
	3	0.0	0.2	0.0	0.3
	4	2.1	13.3	0.8	12.2

Results for the completely mixed model

		Sample 10		Sample 20	
Θ	Method	F10	F20	F10	F20
0	1	1.1	6.4	1.5	7.6
	2	0.7	5.6	1.3	7.1
	3	0.0	0.2	0.0	0.1
	4	0.7	5.7	1.3	7.1
0.4	1	1.7	4.7	1.7	4.7
	2	**1.8**	**7.5**	**1.8**	**7.4**
	3	0.0	0.1	0.0	0.1
	4	**1.8**	**7.6**	**1.8**	**7.4**

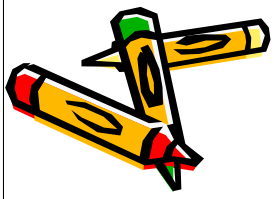
Tests on real data

- http://origo.hu
- Selected:
  - 1000 users
  - 8321 items
- avg. sample size 50
- without iteration $\Theta = 0$

Method	F10	F20	F30
1	8.13	13.77	18.49
2	3.71	8.13	11.15
3	0.42	1.35	3.18
4	3.50	7.73	10.71

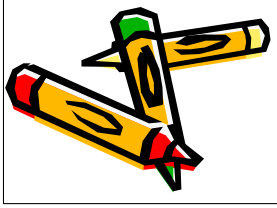
More Applications: Query Recommendations

- Baeza-Yates, Hurtado and Mendoza (2004) suggest a method to make query recommendations based on clustering previous queries.
- Explictly treat it as a bi-clustering problem.

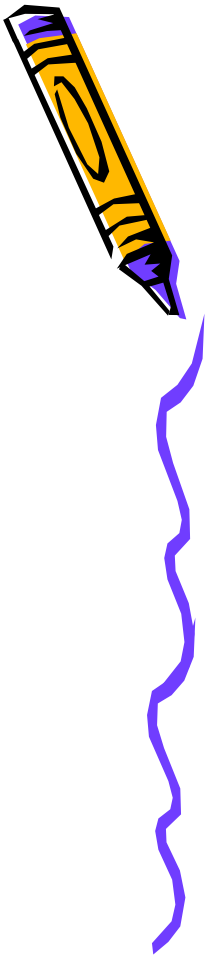


Applications: Physical and Logical Sessions

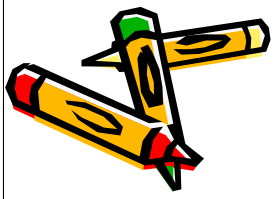
- Segment a physical session into distinct logical sessions based on the user behaviour.
- Exploit bi-clustering structure to uncover the hidden logical sessions.



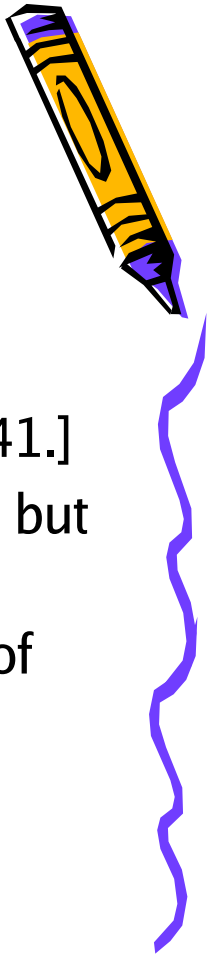
Wisdom of Crowds for Next Generation Exploratory Search



- Paradigm change from query driven search to user-centric information delivery
- Leveraging wisdom of crowds is key
- Biclustering/Multi-clustering is a promising approach.



We've come a Long Way



- "Men go mad in herds, while they only recover their senses slowly one by one." [Charles McKay, *Madness of Crowds*, 1841.]
- "Madness is the exxception in individuals, but the rule in groups" [Nietzsche]
- "I do not believe in the collective wisdom of individual ignorance" [Carlyle]