Journal Status*

Using the PageRank Algorithm to Rank Journals

Motivation: Why Rank Journals?

- We need methods to compare the impact of research done by scientists
  - Examples:
    - Hiring or promoting researchers
    - Assigning funding to different research groups

- Publications are often the only direct output of academic research

- Rank of a journal can be used as a measure of the quality of the research published in it

ISI Impact Factor

- One of the most commonly used measures to rank journals

- Calculated and published annually by Institute of Scientific Information (ISI)

- Definition:

$$IF(J, 2006) = \frac{\text{Number of citations in 2006 made to articles published in J during 2004, 2005}}{\text{Number of articles published in J during 2004, 2005}}$$

Assumptions and Limitations of Impact Factor

- Citations count as a measure of quality of research

- Ignores the context of citations

- Arbitrary time limit

- High variance within different research areas

- Popularity vs. Prestige

Popularity

vs.

Prestige

# Popularity vs. Prestige

- In a Social Network:
  - A popular actor is linked by many other actors

  - A prestigious actor is linked by other prestigious actors
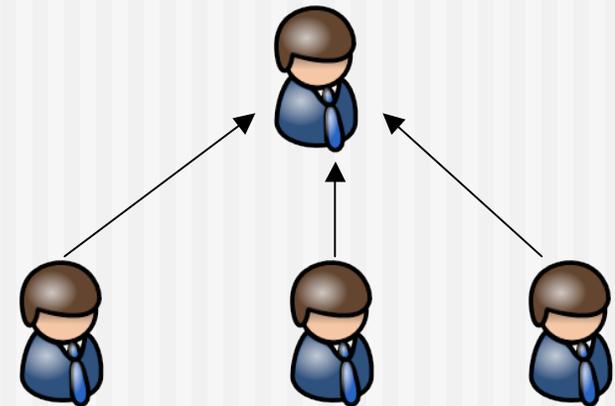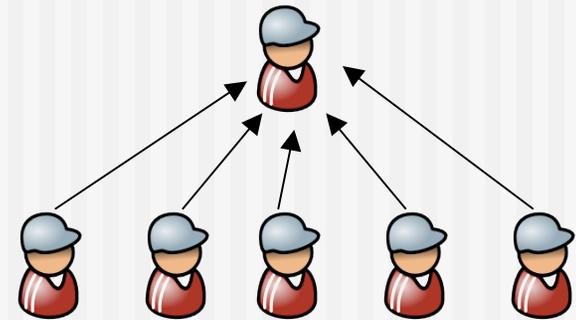
Popularity vs. Prestige
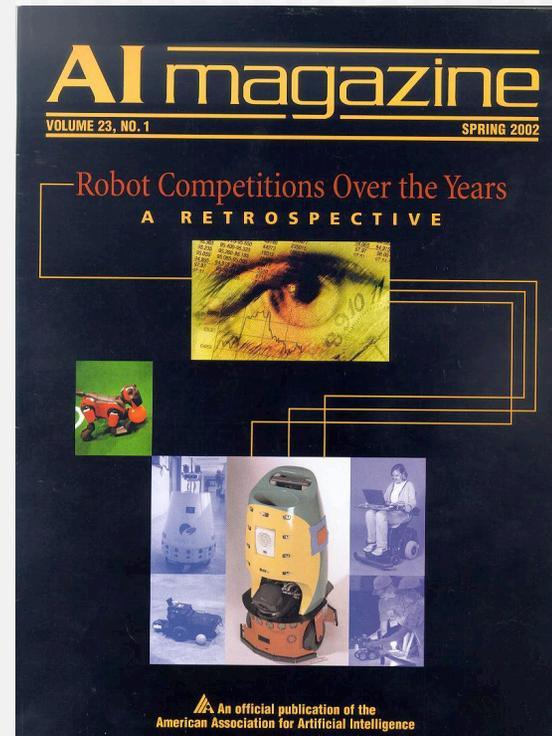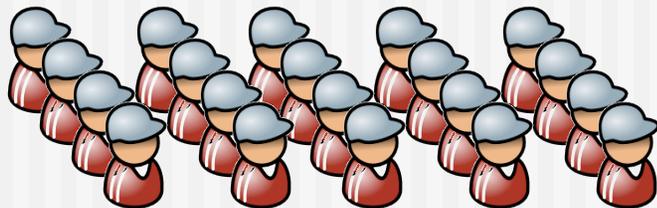
Popularity vs. Prestige

- Impact Factor counts the number of citations, regardless of the prestige of the citing articles, and therefore is a measure of **Popularity** of journals

- We want a measure of **Prestige** for journals

# PageRank

- PageRank* calculates a measure of importance for web pages based on the link structure of the web

- The importance of a page is not only based on the number of other pages that link to it, but also their importance

* Page, Lawrence; Brin, Sergey; Motwani, Rajeev; Winograd, Terry. The PageRank Citation Ranking: Bringing Order to the Web. Stanford Digital Library Technologies Project

PageRank

- Each page distributes its rank uniformly among the pages it links to
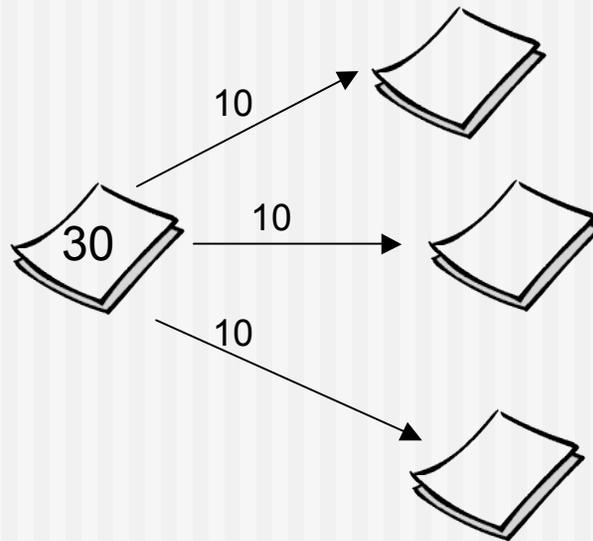
* Needs some more details to converge

PageRank

- Rank Is Recursive
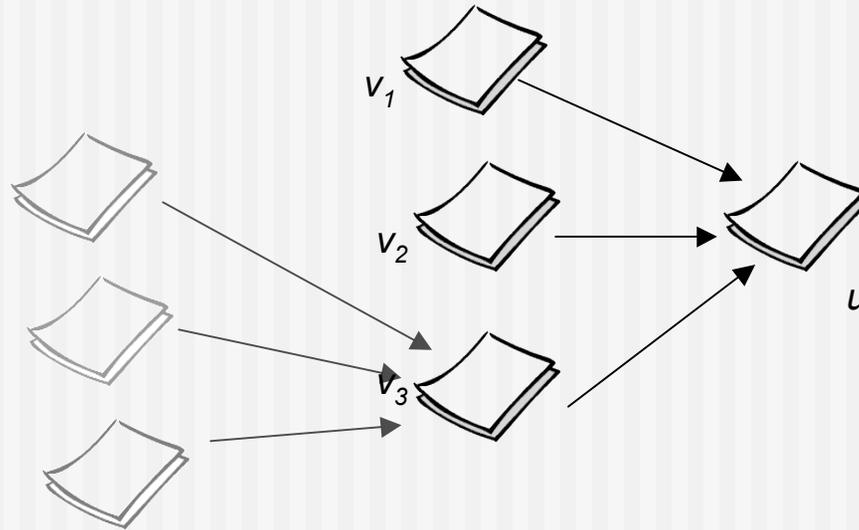
$$Rank(u) = c \sum_{v \in B_u} \frac{Rank(v)}{N_v}$$

* Needs some more details to converge

Journal Citation Network

- All papers published in a journal are presented as one node

- The weight of the edge between j_1 and j_2 is the number of papers in j_1 that cite a paper in j_2.
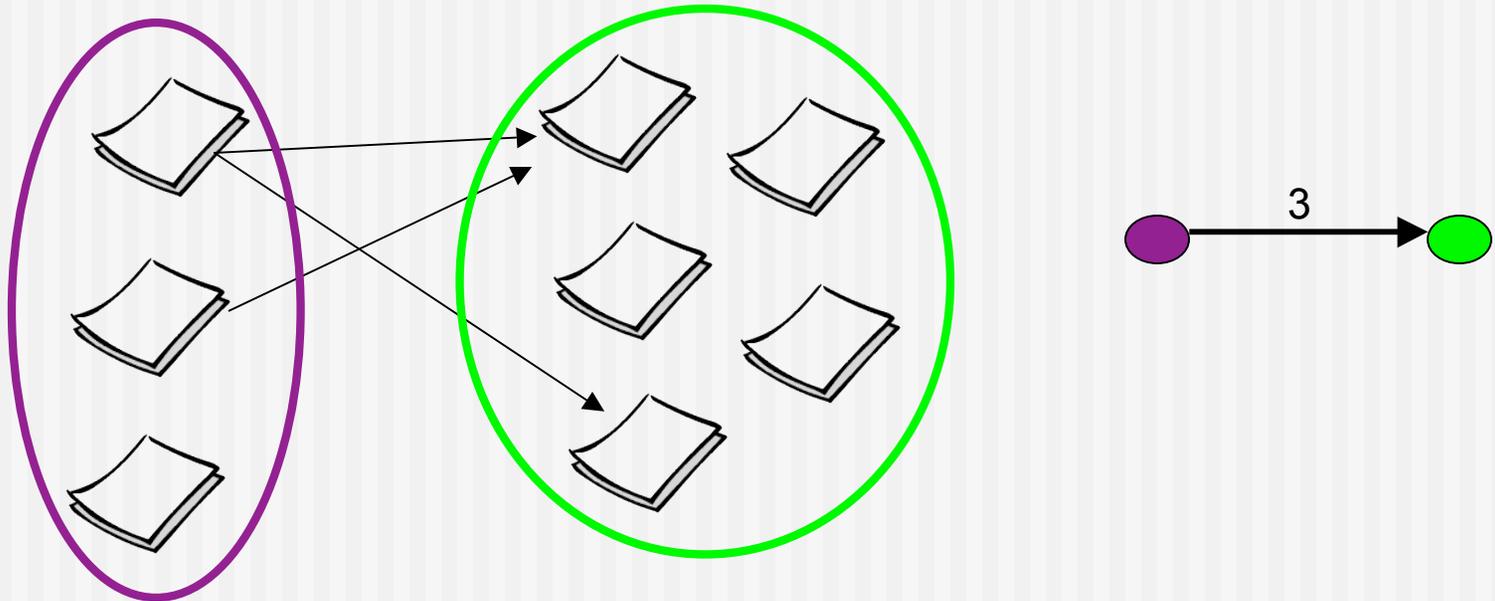
Journal PageRank

- Similar to PageRank, but applied to Journal Citation Network

- Unlike regular PageRank, the rank of a node is <u>not</u> distributed uniformly among the nodes it links to.

$$Rank(v_j) = c \sum_{v_k} Rank(v_k) w(v_k, v_j)$$

* Needs some more details to converge

Y-Factor

- Product of Impact Factor and Journal PageRank

$$Y(v_j) = \text{ISI IF}(v_j) \times \text{PR}_w(v_j)$$

- A high value of Y-Factor indicates both high popularity and high prestige

Experimental Results

- Created the journal citation network on the journal citations in 2003 to publications in 2001 and 2002.

- Ranked journals in different fields, according to their Impact Factor and Journal PageRank

Experimental Results

- Popular vs. prestigious journals in CS

		Popular: ISI IF $\uparrow$, $\mathrm{PR}_w < 40\%$-tile				Prestigious: ISI IF $\downarrow$, $\mathrm{PR}_w > 90\%$-tile			
	Journal title	ISI IF	$\mathrm{PR}_w \times 10^5$	IF_Δ	Journal title	ISI IF	$\mathrm{PR}_w \times 10^4$	IF_Δ
1	ARTIF LIFE	3.17	4.76	2.34	IEEE T INFORM THEORY	2.25	10.08	-2.36
2	INT J HIGH PERFORM C	2.31	5.76	1.44	THEOR COMPUT SCI	0.76	4.95	-1.82
3	NETWORK–COMP NEURAL	2.21	5.82	1.34	COMPUT METHOD APPL M	1.25	5.90	-1.71
4	J MOL MODEL	2.14	5.53	1.28	FUZZY SET SYST	0.58	2.92	-1.21
5	ACM T PROGR LANG SYS	1.68	5.18	0.83	COMPUT STRUCT	0.63	2.81	-1.11
6	FORM METHOD SYST DES	1.46	3.91	0.66	COMMUN ACM	1.55	4.98	-1.05
7	METHOD INFORM MED	1.42	6.29	0.53	J COMPUT PHYS	1.76	5.48	-1.03
8	IEEE MULTIMEDIA	1.15	6.23	0.26	COMPUTER	1.55	4.35	-0.80
9	NEW GENERAT COMPUT	1.03	4.11	0.23	MATH PROGRAM	1.29	3.10	-0.57
10	SCI COMPUT PROGRAM	1.06	5.39	0.21	PATTERN RECOGN	1.61	3.33	-0.34

- Popular journals tend to be frequently cited as background material
- Prestigious journals are likely to be appreciated by domain experts

Conclusion

- Impact factor treats all citations as equal ➔ It is a measure of **Popularity** of journals

- Journal PageRank takes into account the importance of citing source ➔ It is a measure of **Prestige** of journals

- Is it a better measure ❓