PageRank (Extra Material)

Introduction to Network Science

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Topic 16

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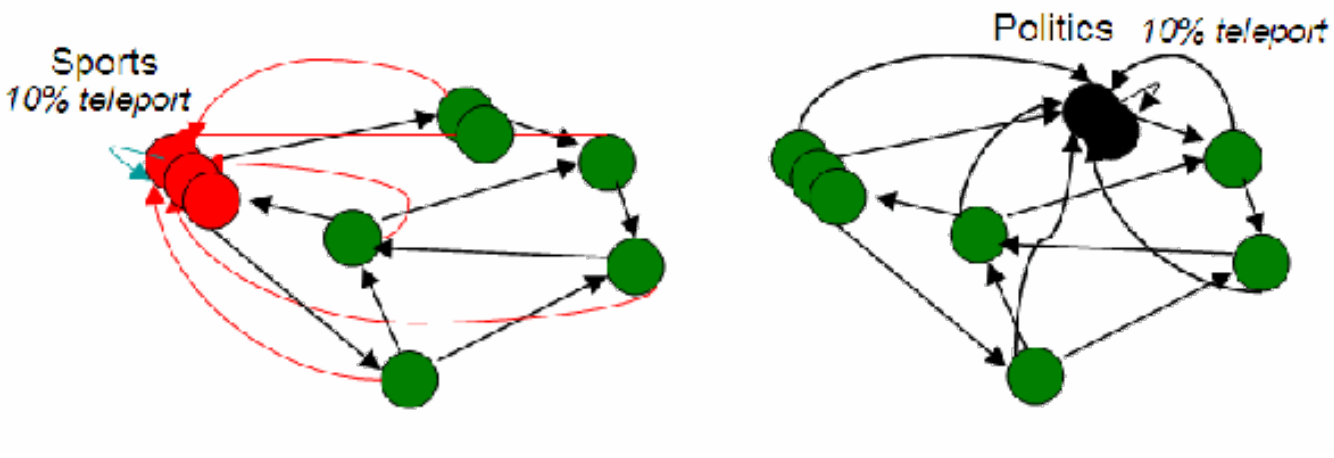
Sources

- Networks, Crowds, and Markets Ch 14
- Fei Li's lecture on PageRank
- Evimaria Terzi's lecture on link analysis.
- C. Castillo: Link-based ranking slides 2016

Variant: personalized PageRank

- Modify R(i) according to users' tastes (e.g. user interested in sports vs politics)



http://nlp.stanford.edu/IR-book/html/htmledition/topic-specific-pagerank-1.html

PageRank and internal linking

- A website has a maximum amount of Page Rank that is distributed between its pages by internal links [depends on internal links]
- The maximum amount of Page Rank in a site increases as the number of pages in the site increases.
- By linking poorly, it is possible to fail to reach the site's maximum Page Rank, but it is not possible to exceed it.

http://www.cs.sjsu.edu/faculty/pollett/masters/Semesters/Fall11/tanmayee/Deliverable3.pdf

PageRank Implementation

- Suppose there are n pages and m links
- Trivial implementation of PageRank requires O(M+N) memory

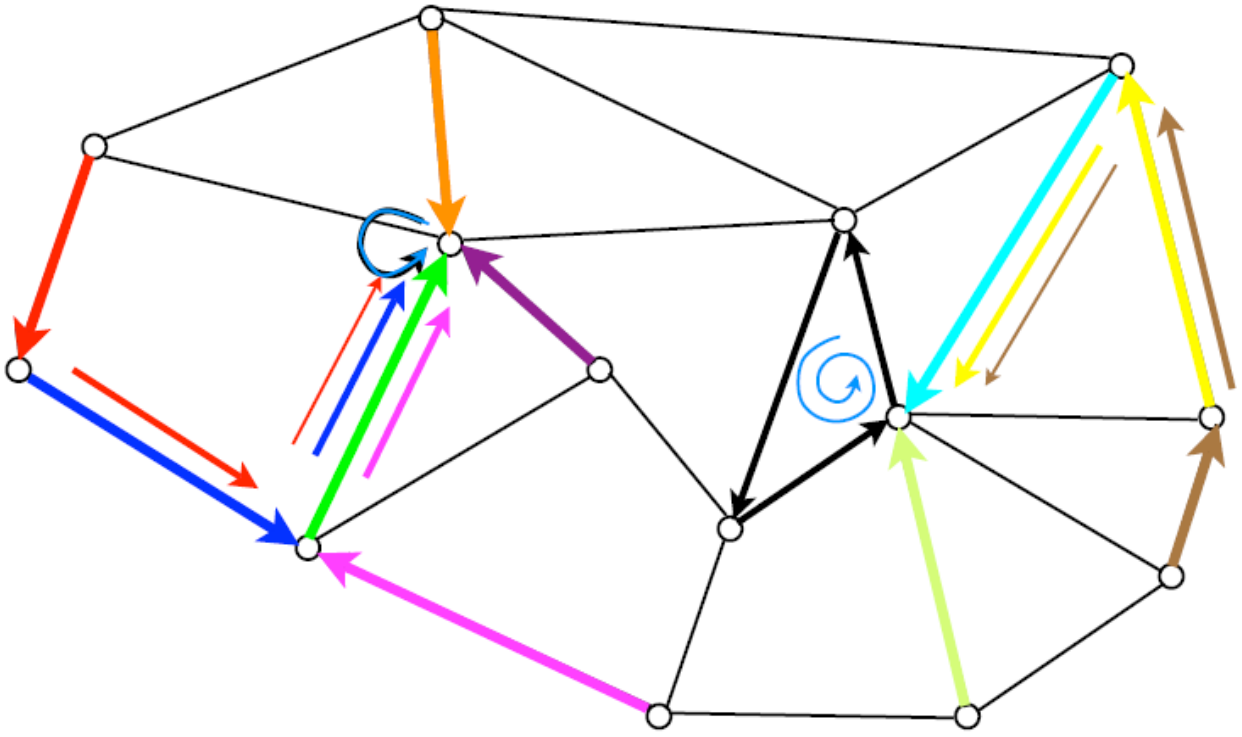
Streaming implementation requires O(N) memory … *how?*
”Streaming” means the graph is never held on memory

Liquid democracy

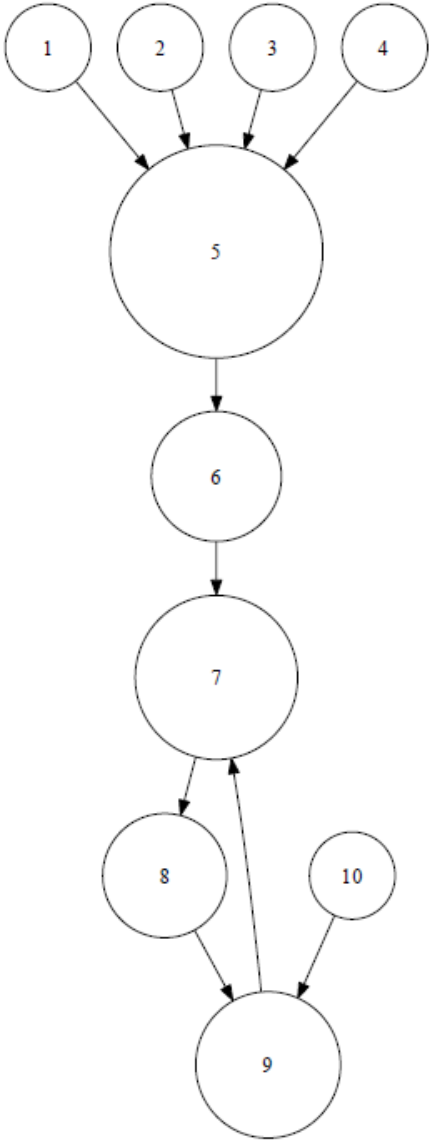
PageRank as a form of actual voting (liquid democracy)

- If $\alpha = 1$, we can implement liquid democracy
  - In liquid democracy, people chose to either vote or to delegate their vote to somebody else
- If $\alpha < 1$, we have a sort of “viscous” democracy where delegation is not total

PageRank as a form of liquid democracy

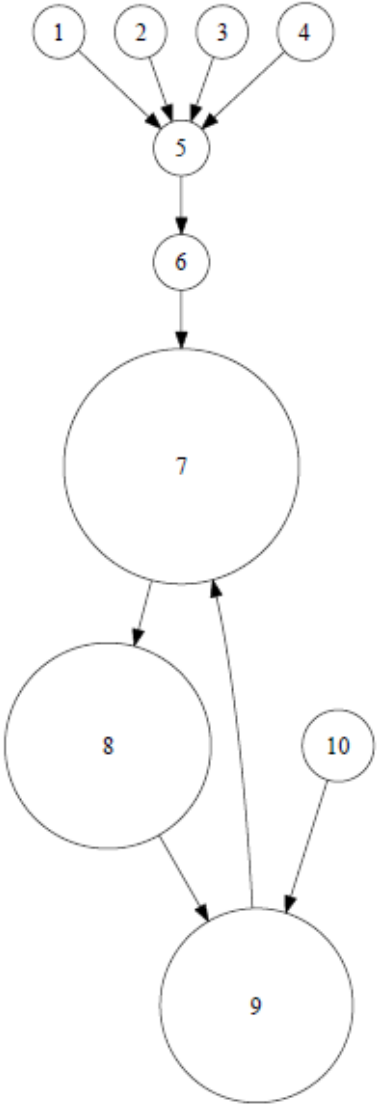


Boldi, P., Bonchi, F., Castillo, C., & Vigna, S. (2011). Viscous democracy for social networks. Communications of the ACM, 54(6), 129-137.



These two graphs have different alpha (0.2 and 0.9)

Which one is which?



Summary

Things to remember

- Personalized PageRank
- Liquid democracy example, will help you understand the role of the parameter alpha