PageRank (Additional Materials)

Social Networks Analysis and Graph Algorithms

Prof. Carlos Castillo — https://chato.cl/teach

Universitat Pompeu Fabra
Barcelona

Sources

- D. Easley and J. Kleinberg (2010): Networks, Crowds, and Markets – Chapter 14

- Fei Li's lecture on PageRank (2011)

- Evimaria Terzi's lecture on link analysis (2013)

- URLs in the footer of specific slides

Variant: personalized PageRank

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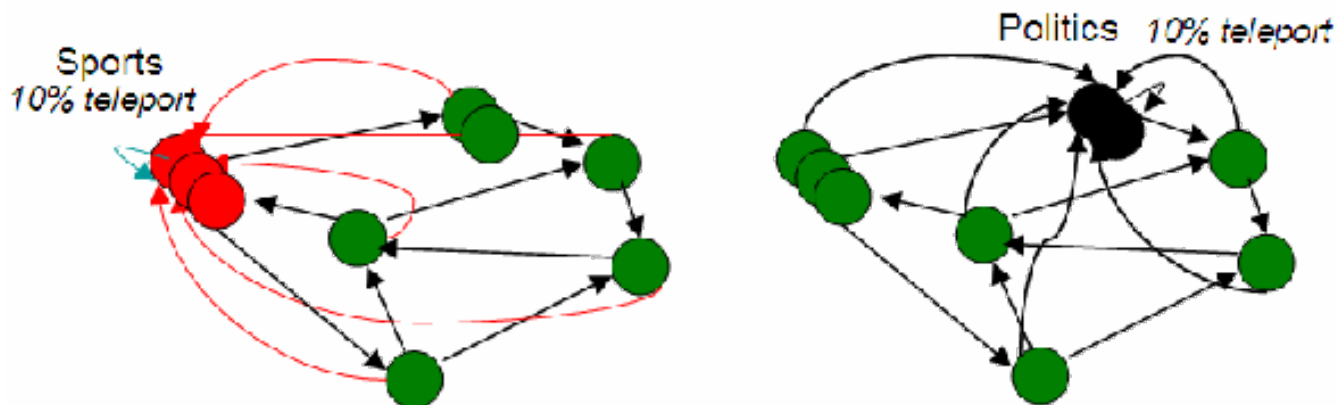
PageRank and internal linking

- 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

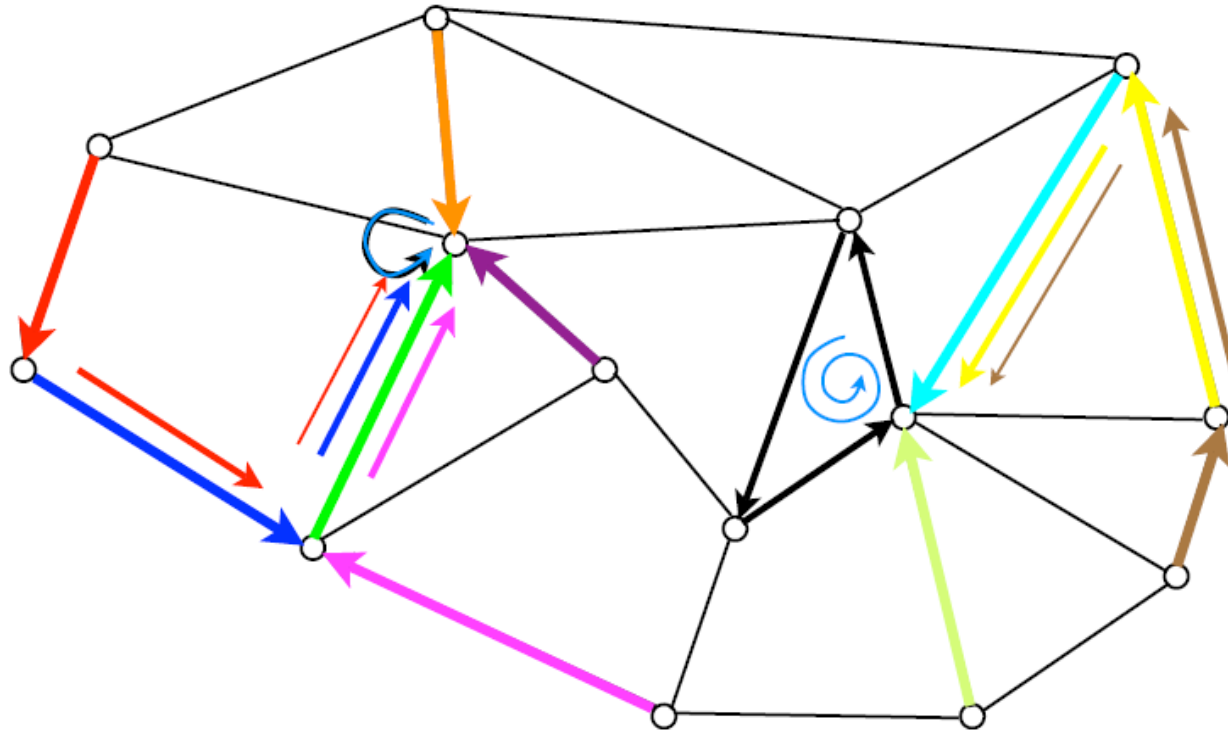**Streaming** implementation requires O(N) memory ... *how?*
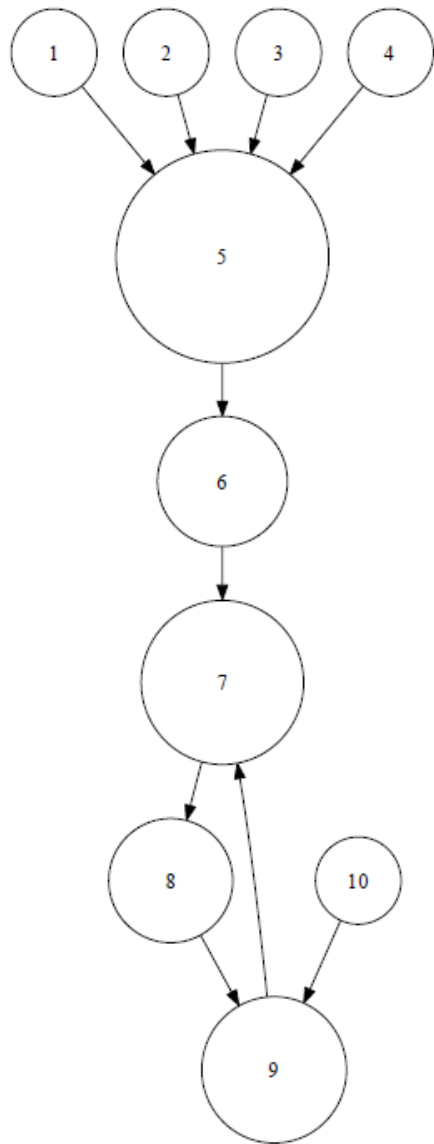   "Streaming" means the graph is never held on memory

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
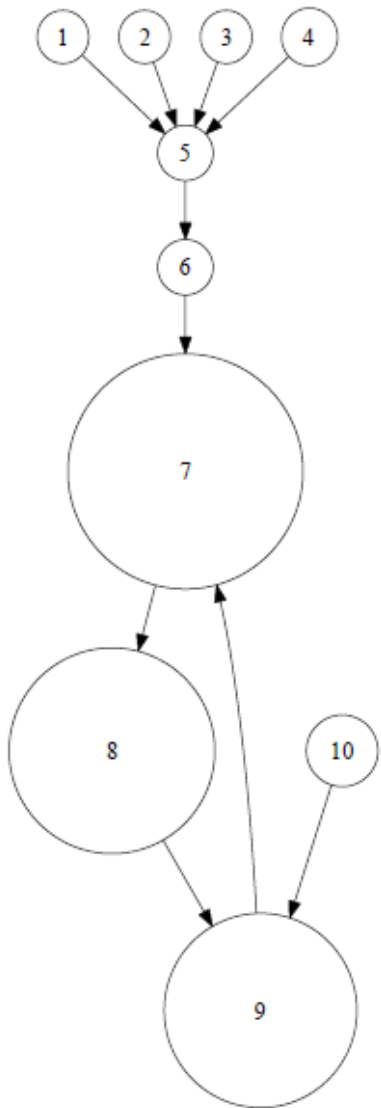
PageRank as a form of liquid democracy

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