PageRank computation

Lecture 11, October 8, 2019

See the Excel file for the computations.

Exercise #2

Compute the PageRank values for the following graph for three iterations using $q = 0.5$.

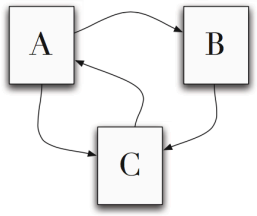

Figure 1: Web graph for Task 1

Algorithm

- In Iteration 0, all pages are given equal page rank $\frac{1}{T}$ (where T is the number of pages)
- For Iterations 1–3, substitute the values and compute new PageRank values using Equation 1

$$PR(a) = \frac{q}{T} + (1-q)\sum_{i=1}^{n}\frac{PR(p_i)}{L(p_i)} \tag{1}$$

Solution

Page	$L(p)$	**Iteration 0**	**Iteration 1**	**Iteration 2**	**Iteration 3**
A	2	0.333	0.333	0.375	0.354
B	1	0.333	0.250	0.250	0.260
C	1	0.333	0.417	0.375	0.385

Table 1: PageRank values.

Remember that you need to consider the **incoming** links of a page.
E.g., for iteration 2, node C:

$$PR(C) = \frac{0.5}{3} + (1-0.5)\Big(\underbrace{\frac{0.333}{2}}_{\text{from A}} + \underbrace{\frac{0.25}{1}}_{\text{from B}}\Big)$$

Exercise #3

Compute the PageRank values for the following graph for three iterations using $q = 0.15$.

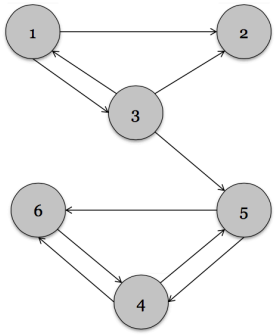

Figure 2: Web graph for Task 2

Algorithm

- Initially, all pages are given equal page rank $\frac{1}{T}$ (where T is the number of pages)
- Substitute the values and compute new PageRank values using Equation 2
- Repeat for the required number of iterations
- Notice that node 2 is a rank sink (no outgoing links); pretend that it links to all other nodes (including itself)

$$PR(a) = \frac{q}{T} + (1 - q) \sum_{i=1}^{n} \frac{PR(p_i)}{L(p_i)} \tag{2}$$

Solution

Page	$L(p)$	**Iteration 0**	**Iteration 1**	**Iteration 2**
1	2	0.167	0.096	0.082
2	6	0.167	0.167	0.123
3	3	0.167	0.119	0.089
4	2	0.167	0.261	0.281
5	2	0.167	0.167	0.193
6	1	0.167	0.190	0.230

Table 2: PageRank values.

We pretend that page 2 links to all other pages (including itself), hence $L(p) = 6$ there.