Home Assignment 1.5

Version 1.0

Task

1 Link Analysis & Search (one-mode network):

(a) Develop an Octave function page_rank.m that applies the Original Summation Formula to every node in a given directed, unweighted one-mode network. The result of your function should be a num_nodes x 2 matrix where the first column consists of the node labels and the second column consists of the calculated PageRanks after a given number of iterations.

(b) Create a directed network Bdir derived from your undirected network B where each undirected edge is replaced by a directed one. The direction of the edge is determined by the alphanumeric ordering of your node labels (e.g. "gabi" $\rightarrow$ "mstrohm", and "123MUSTERMAN" $\rightarrow$ "ALEXMUSTER", but "456MUSTERMAN" $\leftarrow$ "123MUSTERMAN", ignoring upper and lower case)

(c) Apply page_rank.m to your Network Bdir for 10 iterations (k0-k9). Interpret the result in your report.

2 Network Evolution (one-mode network):

(slides are already available on the website)

(a) "Grow" your network B with the following two methods random_grow.m and barabasi_albert_grow.m to approximately double its node size via

1. random introduction of nodes to the network (use Octave random number generation to identify nodes to link to)
2. Barabasi / Albert Model

In both methods, introduce m=3 edges per iteration.

(b) Plot the degree distribution before and after "growing" it, what is the difference between the two generators?

(c) Attack your original network B (deletion of nodes) via

1. Random attacks, random_attacks.m
2. Informed attacks (highest degree nodes), informed_attacks.m

(d) Show the impact of your attack on the connectivity of the network by plotting the size of the largest component over the number of nodes attacked

(e) Infect your network (percolate) with an epidemic

1. Using a simple SI model
2. Choose a suitable rate of reproduction (infection rate)

Doing 11 trials

1. Start infecting the network at the node with the highest degree (informed_infection.m)

2. Start infecting the network at 10 random nodes (random_infection.m)

(f) Compare I) the number of iterations and II) the resulting number of infected nodes for each iteration (highest degree vs. avg. of random nodes).

Document your observations in your report.
Detailed interface descriptions are provided in a separate file (see below).

Provided files

`http://www.kmi.tugraz.at/staff/markus/courses/SS2010/707.000_web-science/ass15.zip`

- `nodeLabelsB.txt`
- `networkB.csv`
- `script15.m` contains interface descriptions for the required Octave functions. Your Octave functions must comply with these interfaces!

Structure of your repository

- `report.pdf` (contains your results, plots, and interpretations; keep it VERY short!)
- `octave/`
  - `page_rank.m`
  - `random_grow.m`
  - `barabasi_albert_grow.m`
  - `informed_attacks.m`
  - `informed_infection.m`
  - `random_infection.m`

Your file `report.pdf` and every source code file has to have a header containing your name and matriculation number.

Submission

Home Assignment 1.5 is due **May 17, 2010 12:00** (high noon).
The due date is a *soft deadline*. That is, your score on the assignment will be rated 100% if you hand in the assignment before 12:00. The following 12 hours are suitable for a submission as well, *but* your points will be rated 66%. Read: 1/3 of your points will be substracted if you hand in your assignment between 12:00 and 23:59. 24:00 is the *hard deadline*; if you hand in anything after 24:00 you will not receive any points.
Submission is done using the SVN version control system. (See instructions on the course website.)

Policies

- No external Octave packages are allowed.
- Your code will be tested with independent datasets in an automated way, assuming your functions comply with the interfaces in the provided files.
- Your code and report will be checked for plagiarism.

Resources

- MatLab/Octave:
  - http://www.math.umn.edu/~lerman/math5467/matlab_adv.pdf
  - http://www-mdp.eng.cam.ac.uk/web/CD/engapps/octave/octavetut.pdf
  - http://en.wikibooks.org/wiki/Octave_Programming_Tutorial