Team Chemistry

- Collective intelligence

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• Collective intelligence

The Female Factor

The chart plots the collective intelligence scores of the 192 teams in the study against the percentage of women those teams contained. The red bars indicate the range of scores in the group of teams at each level, and the blue circles, the average. Teams with more women tended to fall above the average; teams with more men tended to fall below it.

Group Project

• Open-ended topics of your choosing
• Written report, e.g. 5-pages in IEEE two-column format
• In-class conference-style presentations, e.g. 20 minutes
• Recommended Team Size: 3

• Proposal to be submitted in a month or so
Group Project Suggestions

• Analyze some novel or fairly novel network dataset with 50 nodes to 10 million nodes

• Stay grounded in the engineering/science application domain
  – Use/develop analysis techniques that are appropriate

• Have an insightful visualization

• Run your project ideas by me beforehand
Project Ideas

• A novel road network (maybe link to housing): https://cityofsyracuse.github.io/RoadsChallenge/

• A novel neuronal network: “The wiring diagram of a glomerular olfactory system” (Berck et al., 2016) http://dx.doi.org/10.7554/eLife.14859.001

• Grading will largely be based on important things to cover, which include:
  – engineering problem being considered
  – network dataset(s) and their basic properties
  – key network analysis techniques and how they address the engineering problem
  – results from analysis and their interpretation
  – limitations of data, analysis, or interpretation
  – directions for future work
  – importance and interestingness of project
Further Assignment for Grad Students

• The basic idea behind this assignment is to read a recent research paper in the literature that develops principled analysis technique(s) in network science, provide your own summary and interpretation, create a solid implementation, and apply the technique on several real network datasets.
Submission

• Include the following items:
  – Posting of implemented computer code on github or equivalent venue
  – Written document that provides summary/interpretation and results from application of the technique to several real network datasets
**Ideas**

Software for Network Analysis
• Clauset:  
  http://tuvalu.santafe.edu/~aaronc/powerlaws

• Sporns: https://sites.google.com/site/bctnet/

• Louvain:  
  https://perso.uclouvain.be/vincent.blondel/research/louvain.html
• https://networkx.github.io/
Now we reproduce Figure 6B from the paper, the survival function of the in-degree distribution. First, compute the relevant quantities:

```python
def in_degrees = list(wormbrain.in_degree().values())
in_deg_distrib = np.bincount(in_degrees)
avg_in_degree = np.mean(in_degrees)
cumfreq = np.cumsum(in_deg_distrib) / np.sum(in_deg_distrib)
survival = 1 - cumfreq
```

Then, plot using Matplotlib, as shown in Figure 3-18:

```python
fig, ax = plt.subplots()
ax.loglog(np.arange(1, len(survival) + 1), survival)
ax.set_xlabel('in-degree distribution')
ax.set_ylabel('fraction of neurons with higher in-degree distribution')
ax.text(avg_in_degree - 0.5, 0.003, 'mean=7.86', fontsize=12)
ax.set_xlim(0.862, 1.8);
```

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Figure 3-18. The degree distribution of the worm connectome

There you have it: a reproduction of a scientific analysis using SciPy. We are missing the line fit…but that’s what exercises are for.
Figure 6-6. Spectral layout of the neurons of a nematode worm

There you are: a worm brain! As discussed in the original paper, you can see the topdown processing from sensory neurons to motor neurons through a network of interneurons. You can also see two distinct groups of motor neurons: these correspond to the neck (left) and body (right) body segments of the worm.
• https://nodexl.codeplex.com/
Social media network connections

Created with NodeXL Basic (http://nodexl.codeplex.com) from the Social Media Research Foundation (http://www.smrfoundation.org)
• https://gephi.org/
• http://www.graphviz.org/