Semester projects
Complex Networks, Course 303A, Spring, 2010

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Semester projects
Requirements:
1. ≈ 5 minute introduction to project (fourth week)
2. 15 minute final presentation
3. Report: ≥ 5 pages (single space), journal-style

Outline
The Plan
Suggestions for Projects
References

Narrative hierarchy
Presenting at many scales:
- 1 to 3 word encapsulation, a soundbite,
- a sentence/title,
- a few sentences,
- a paragraph,
- a short paper,
- a long paper,
- ...
Explore and critique Fowler and Christakis et al. work on social contagion of:

- Obesity [5]
- Smoking cessation [6]
- Happiness [9]
- Loneliness [3]

One question: how does the (very) sparse sampling of a real social network affect their findings?

- How do products depend on each other, and how does this network evolve?
Study movement and interactions of people.
Barabasi’s group: tracking movement via cell phones [10].

Physics/Society—Wars: Study work that started with Lewis Richardson’s “Variation of the frequency of fatal quarrels with magnitude” in 1949.
Specifically explore Clauset et al. and Johnson et al.’s work [7, 12, 1] on terrorist attacks and civil wars.

Study the human disease and disease gene networks (Goh et al., 2007):

Study collective tagging (or folksonomy)
E.g., del.icio.us, flickr
See work by Bernardo Huberman et al. at HP labs.
Study games (as in game theory) on networks.

For cooperation: Review Martin Nowak’s recent piece in Science: “Five rules for the evolution of cooperation.”

Much work to explore: voter models, contagion-type models, etc.

Semantic networks: explore word-word connection networks generated by linking semantically related words.

More general: Explore language evolution

One paper to start with: “The small world of human language” by Ferrer i Cancho and Solé.

Related: Study spreading of neologisms.

Study Stuart Kauffman’s nk boolean networks which model regulatory gene networks.

Explore work by Doyle, Alderson, et al. as well as Pastor-Satorras et al. on the structure of the Internet(s).
▸ **Review:** Study work on massive multiplayer online games. How do social networks form in these games? [4]

▸ Study scientific collaboration networks.
▸ Mounds of data + good models.

▸ Vague/Large:
   Study amazon’s recommender networks.
▸ See work by Sornette et al., Huberman et al.

▸ Study Kearns et al.’s experimental studies of people solving classical graph theory problems [14]
▸ “An Experimental Study of the Coloring Problem on Human Subject Networks”
▸ (Possibly) Run some of these experiments for our class.
Vague/Large:
Study network evolution of the Wikipedia's content.

Vague/Large:
How is the media connected? Who copies whom?
Possibly use NY Times API.
http://memetracker.org/
Problem: Need to be able to measure interactions.

Vague/Large:
Anything interesting to do with large-scale networks in evolution, biology, ethics, religion, history, influence, food, international relations, . . .
Data is key.

References I


References II

*Synthetic Worlds: The Business and Culture of Online Games.*

The spread of obesity in a large social network over 32 years. 

The collective dynamics of smoking in a large social network. 

References III

On the Frequency of Severe Terrorist Events. 

The small world of human language. 

Dynamic spread of happiness in a large social network: longitudinal analysis over 20 years in the Framingham Heart Study. 
*BMJ,* 337:article #2338, 2008. pdf

References IV

Understanding individual human mobility patterns. 

The product space conditions the development of nations. 

Universal patterns underlying ongoing wars and terrorism, 2006. pdf

References V

*The Origins of Order.* 

An experimental study of the coloring problem on human subject networks. 

Five rules for the evolution of cooperation. 

Networks of scientific papers. 
References VI

Self-similarity of complex networks.

Origins of fractality in the growth of complex networks.

Romanesque networks.