

Semester projects

Complex Networks, Course 303A, Spring, 2009

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The Plan

Suggestions for
Projects

References

Frame 1/30



Outline

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Semester projects

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Frame 2/30



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Requirements:

1. \approx 5 minute introduction to project (fourth week)
2. 15 to 20 minute final presentation
3. Report: \geq 5 pages (single space), journal-style

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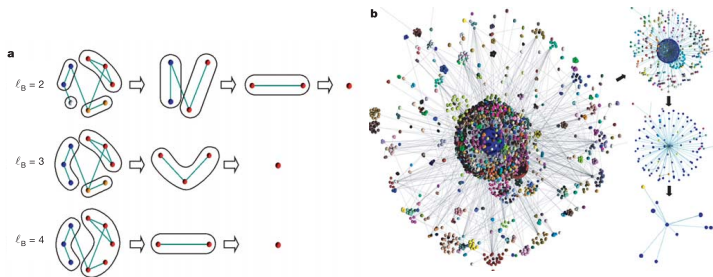
Presenting at many scales:

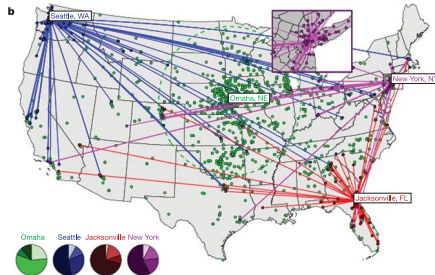
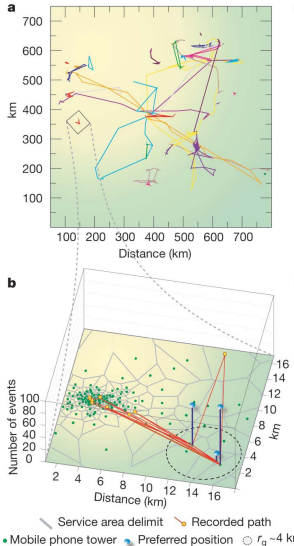
- ▶ 1 to 3 word encapsulation, a soundbite,
- ▶ a sentence/title,
- ▶ a few sentences,
- ▶ a paragraph,
- ▶ a short paper,
- ▶ a long paper,
- ▶ ...

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- ▶ e.g., collective search, cooperation, cheating, influence, creation, decision-making, etc.

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- ▶ Explore “self-similarity of complex networks” [11, 12]
First work by Song *et al.*, Nature, 2005.
- ▶ See accompanying comment by Strogatz [13]





- ▶ Study movement and interactions of people.
- ▶ Brockmann *et al.* [2] “Where’s George” study.
- ▶ Barabasi’s group: tracking movement via cell phones [5].

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- ▶ Study **collective tagging** (or folksonomy)
- ▶ e.g., del.icio.us, flickr
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- ▶ 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." [9]
- ▶ Much work to explore: voter models, contagion-type models, etc.

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- ▶ **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^[4]
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- ▶ What kind of relational networks do safety codes form? How have they evolved?

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- ▶ **Statistics: Study Peter Hoff's (and others') work on latent variables.**
- ▶ Idea: explain connection pattern in a network through hidden individual or dyadic variables
- ▶ This method has been applied to the study of international relations networks.
- ▶ Related and large: explore work on p^* networks.

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- ▶ Study Stuart Kauffman's *nk boolean networks* which model regulatory gene networks^[7]

- ▶ Engineering: Read and critically explore Bejan's book "Shape and Structure, from Engineering to Nature."^[1]
- ▶ Bejan asks why we see branching network flow structures so often in Nature—trees, rivers, etc.

- ▶ Explore work by Doyle, Alderson, et al. as well as Pastor-Satorras et al. on the structure of the [Internet\(s\)](#).

- ▶ Review: Study Castronova's and others' work on massive multiplayer online games. How do social networks form in these games? ^[3]

- ▶ Study **bipartite networks**: structure and dynamics
- ▶ Rich and interesting both mathematically and practically speaking.

- ▶ Study scientific collaboration networks.
- ▶ Mounds of data + good models.
- ▶ See seminal work by De Solla Price^[10]. plus modern work by Redner, Newman, *et al.*

- ▶ Study Kearns et al.'s experimental studies of people solving classical graph theory problems^[8]
- ▶ “An Experimental Study of the Coloring Problem on Human Subject Networks”
- ▶ (Possibly) Run some of these experiments for our class.

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- ▶ Biology: Study leaf network patterns (taken).
- ▶ Key on very interesting work by Xia.
- ▶ Classic Monge problem: how to move stuff from one place to another.
- ▶ Bulk flow versus network flow.

- ▶ Vague/Large:
Study amazon's recommender networks.

Customers Who Bought This Item Also Bought

LOOK INSIDE!



[Harry Potter Schoolbooks: Fantastic Beasts and...](#) by J.K. Rowling

★★★★★ (465) \$10.19



[The Tales of Beedle the Bard, Collector's E...](#) by J. K. Rowling

★★★★★ (153)

LOOK INSIDE!



[Harry, A History: The True Story of a Boy Wizar...](#) by Melissa Anelli

★★★★★ (52) \$10.88

LOOK INSIDE!



[Inkdeath \(Inkheart\)](#) by Cornelia Funke

★★★★★ (41) \$16.49

- ▶ 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, . . .

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Shape and Structure, from Engineering to Nature.
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