Semester projects

Complex Networks, Course 295A, Spring, 2008

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Outline

The Plan

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Semester projects

Requirements:

1. $\approx$ 5 minute introduction to project (fourth week)

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2. 15 to 20 minute final presentation

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2. 15 to 20 minute final presentation
3. Report: $\geq$ 5 pages (single space), journal-style

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,
- . . .

topics

- Develop and elaborate an online experiment to study some aspect of social phenomena

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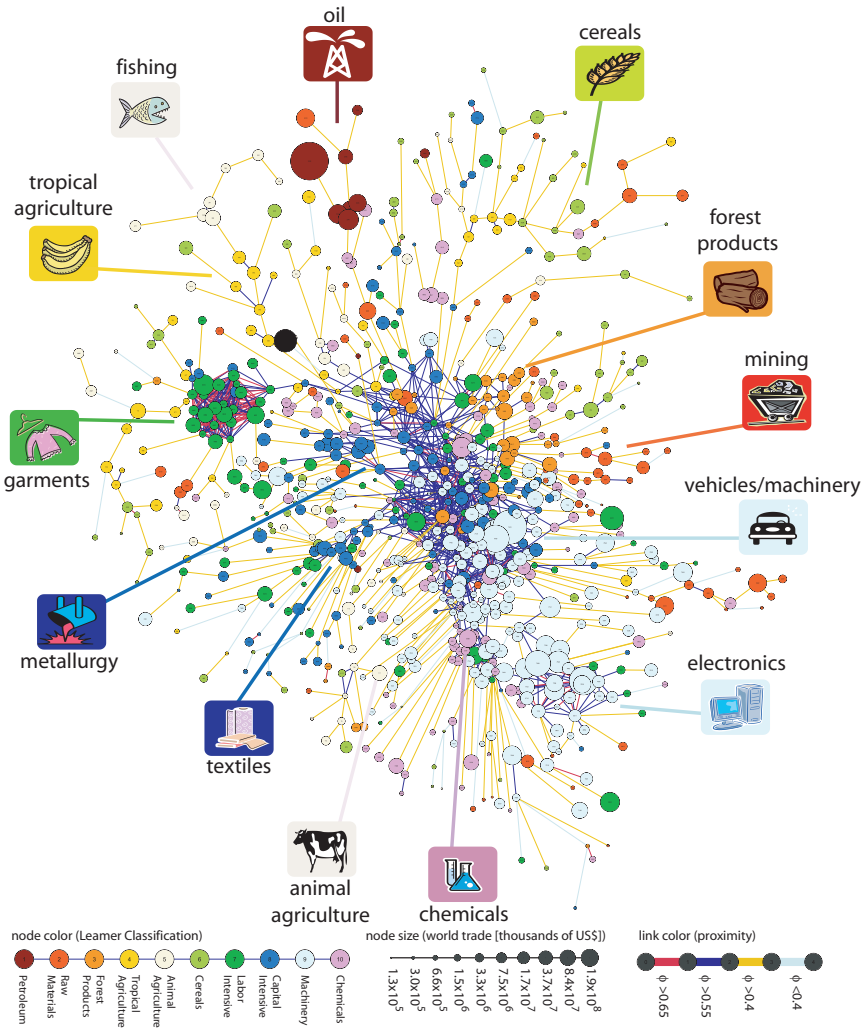
- e.g., cheating, cooperation, influence, decision-making, etc.

topics

- Study collective creativity arising out of social interactions
- Productivity, wealth, creativity, etc. appear to increase superlinearly with population
- Start with Bettencourt et al.'s "Growth, innovation, scaling, and the pace of life in cities" [2]

topics

- Study Hidalgo et al.'s "The Product Space Conditions the Development of Nations" [9]
- How do products depend on each other, and how does this network evolve?



topics

- Physics/Society—Wars: Study work that started with Lewis Richardson's "Variation of the frequency of fatal quarrels with magnitude" in 1949.

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- Specifically explore Clauset et al. and Johnson et al.'s work [4, 10] on terrorist attacks and civil wars

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- See work by Bernardo Huberman et al. at HP labs.

topics

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- For cooperation: Review Martin Nowak's recent piece in Science: "Five rules for the evolution of cooperation." [13]
- Much work to explore: voter models, contagion-type models, etc.

topics

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

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- More general: Explore language evolution

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- More general: Explore language evolution
- One paper to start with: “The small world of human language” by Ferrer i Cancho and Solé [8]

topics

- Investigate Service Science, which doesn't sound very good but IBM believes will be bigger than computer science.

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- Definition: "Service Science, Management, and Engineering (SSME) is an interdisciplinary approach to the study, design, and implementation of service systems—complex systems in which specific arrangements of people and technologies take actions that provide value for others."

topics

- Investigate safety codes (building, fire, etc.).

topics

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- What kind of relational networks do safety codes form? How have they evolved?

topics

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- Idea: explain connection pattern in a network through hidden individual or dyadic variables

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- 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.

topics

- Study Stuart Kauffman's *nk* boolean networks which model regulatory gene networks [11]

topics

- 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.

topics

- Read and critique “Historical Dynamics: Why States Rise and Fall” by Peter Turchin. [14]

topics

- Explore work by Doyle, Alderson, et al. as well as Pastor-Satorras et al. on the structure of the Internet.

topics

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

topics

- Study Michael Kearns and others' work on Cobot. Very cool.
- See `http://cobot.research.att.com/`.

topics

- Study Kearns et al.'s experimental studies of people solving classical graph theory problems [12]
- "An Experimental Study of the Coloring Problem on Human Subject Networks"

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- "An Experimental Study of the Coloring Problem on Human Subject Networks"
- (Possibly) Run some of these experiments for our class.

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- Study phyllotaxis, how plants grow new buds and branches.

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- Some delightful mathematics appears involving the Fibonacci series.

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- Some delightful mathematics appears involving the Fibonacci series.
- Excellent work to start with: “Phyllotaxis as a Dynamical Self Organizing Process: Parts I, II, and III” by Douady and Couder [5, 6, 7]

topics

- Biology: Study leaf network patterns.

topics

- Biology: Study spider webs.

topics

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

topics

- Vague/Large:
  Study Netflix's open data (movies and people form a bipartite graph).

topics

- Vague/Large:
  Study how the Wikipedia's content is interconnected.

topics

- Vague/Large:
  How do countries depend on each other for water, energy, people (immigration), investments?

topics

- Vague/Large:
  How is the media connected? Who copies whom?

topics

- Vague/Large:
  How does advertising work collectively? For example, does one car manufacturers' ads indirectly help other car manufacturers?

topics

- Vague/Large:
  Anything interesting to do with evolution, biology, ethics, religion, history, influence, food, international relations, . . .

topics

- Vague/Large:
  Study spreading of neologisms.

topics

- Vague/Large:
  Study spreading of anything where influence can be measured.

References I

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