

CSE 591: Visual Analytics

Lecture 5: Computational Modeling and Graph-Based Analytics

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Motivating Quote

Gary Ackerman

(Director of the Center for Terrorism and Intelligence Studies)

“There are tools where they build a world in a bottle. They put down every single mosque, river, camel, and school in, say, Saudi Arabia. Then they have millions of software agents who each have desires, grievances, all these different variables. They go about their little lives and then you ask a question: What if we build a McDonald’s in Mecca? Does this lead to more people joining terrorist groups or not?”

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The key message here: build of model of the “enemy” and predict what they will do given some input and situation

- bound to overcome many of issues that came up in the “Psychology of Analysts” book

Simulations via Game Technology: The Sims

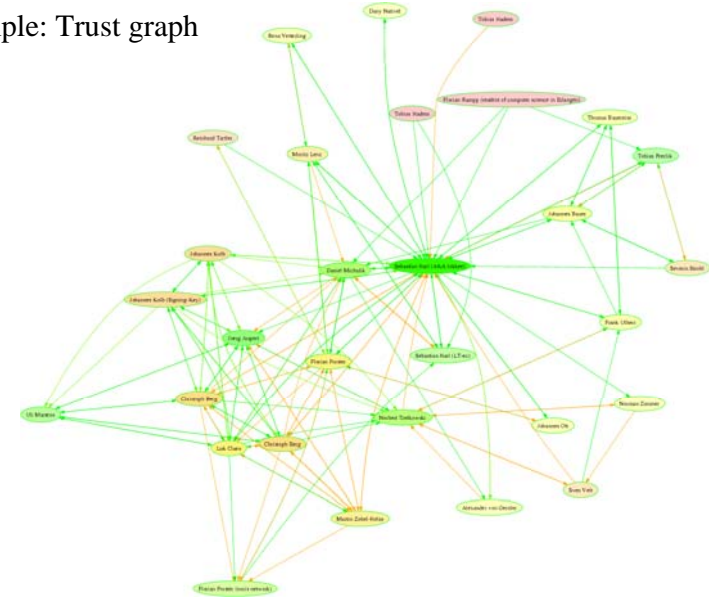


Simulations via Game Technology: Unreal Tournament



Games Have Analytical Tools

Example: Trust graph



Barry Silverman (U Penn):

“A jihadist terrorist has a preferred state of the world: the whole world is fundamentalist, and no loose-valued Westerner should walk on the land that Muhammad felt was sacred,”

Long-term preferences of the “jihadist terrorist”:

- control of the land
- control of who’s allowed to do what

Moral standards:

- it’s okay to kill
- in fact, I’ll go to heaven and be a martyr
- and my family will get money

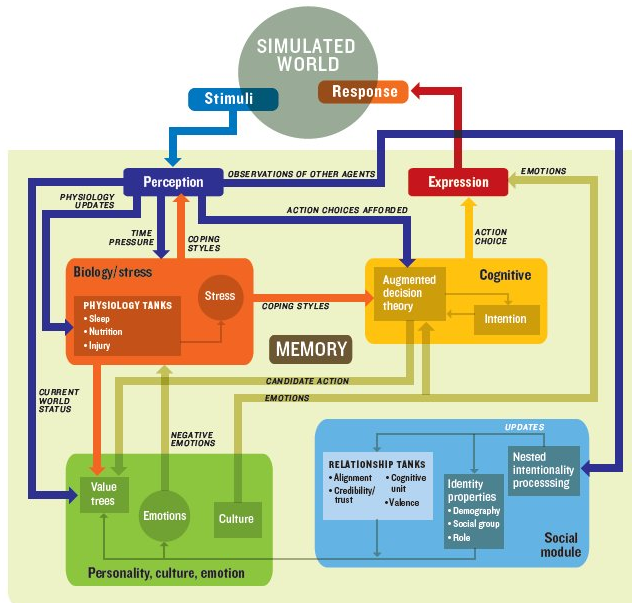
Marc Sageman (U Penn)

A typical jihadist terrorist:

- Is a male who grows up in a decent family, never gets into much trouble.
- Goes to a religious school. There he learns Islamic fundamentalist credos.
- In many cases he goes abroad to study—often engineering and often in Europe, where he feels alienated and has trouble finding work.
- He then gravitates to mosques to find comfort in the familiar, and there he meets men with similar feelings of isolation.
- Gradually, he is drawn toward a politicized existence and into a terrorist cell.

By incorporating more than a dozen such models and data sets, some of Silverman’s simulations can emulate how a jihadist agent might feel about his group, when he will become radicalized, and what he might do as a result.

Getting Inside The Mind: Overall System (Silverman):



Getting Inside The Mind: Narration

Each of the simulated terrorists responds to stimuli through a complex process that mimics human thinking.

An agent's perception is influenced by various physical and psychological stressors and coping styles.

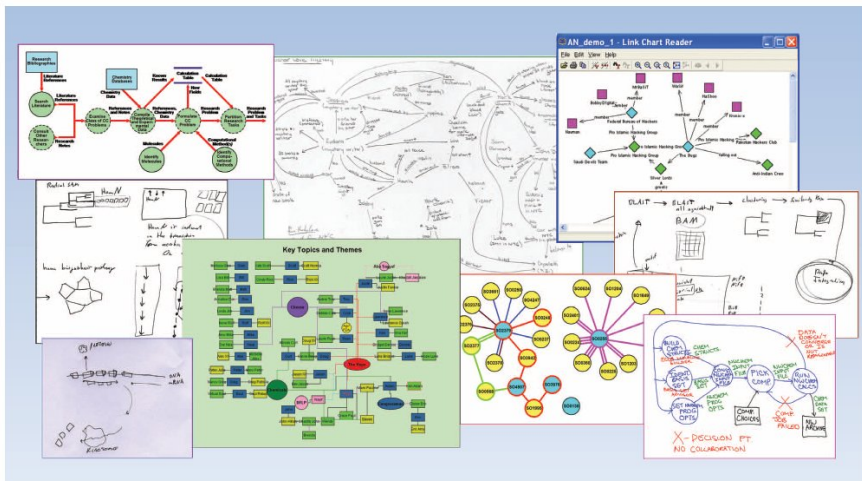
- this perception is then viewed in light of an agent's values, emotions, and culture.

Once the agent has processed its perception of the stimuli, it must decide how to best attain its goals.

- It evaluates which actions will advance its values, but this is subject to constraints of its social relations, emotions, and stress.
- When the agent determines what it wants to do, it expresses that decision through action.

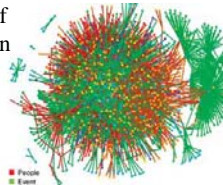
Graphs, Hierarchies, Networks

Powerful way to show relations:

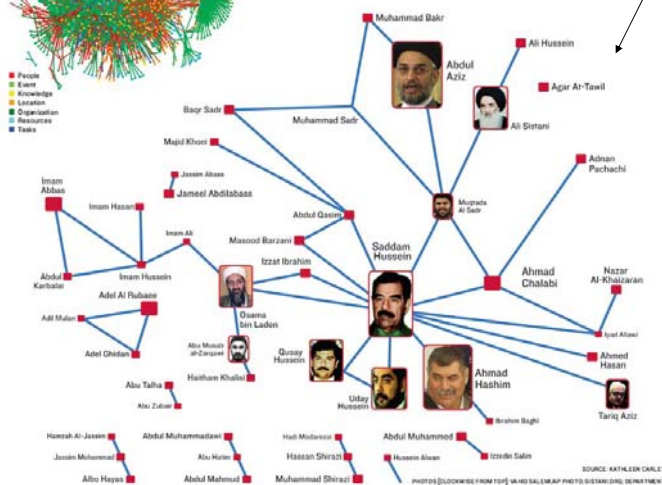


Kathleen Carley (Carnegie Mellon)

compressed view of Iraq's Diyala region



expansion into known connections among suspected insurgents (right after US invasion):



sized relates to importance

Reference

H. Goldstein, "Modeling Terrorists", IEEE Spectrum, pp. 26-34, 9/2006.

News and Blog Analysis

Lydia

- system developed right here at Stony Brook
- Mikhail Bautin, Anand Mallangada, Alex Turner, Lohit Vijayarenu, Steven Skiena
- was presented at SBU-CS Graduate Research Day 2007

Large-Scale News Analysis

Lydia news analysis system does a daily analysis of over 1000+ online English and foreign-language newspapers, plus blogs, RSS feeds, and other news sources.

Currently tracks over 1,000,000 news entities, providing spatial, temporal, relational and sentiment analysis

The data and analysis should be of great interest in political science and related fields.

Discussed here: **Processing of Foreign Language Content, Entity Relation Extraction and News Storm detection of Lydia**

Textmap.com

The screenshot shows the TextMap website interface. At the top, there is a search bar with the text "Search 236,494 entities:" and a "Search!" button. Below the search bar, there are navigation links: "TextMap", "TextMed", "TextEq", "TextEg", "MakeHomepage!", "Link to us", and "Help2". The main content area is titled "TextMap Directory" and shows results for "Person" entities. The results include a list of names and links to more information, such as "Bush, Democrat, King, Republican, Samuel Alito, Hamas, Kenneth Lay, Americans, Smith, Mike Holmgren, more, random". There are also sections for "City of the Day" (Albany, NY) and "What's New" (May 5, 2005: TextMap system goes live!). The footer contains copyright information: "Copyright (c) 2005 The Research Foundation of State University of New York, Computer Science Department at Stony Brook University".

Relationship Identification

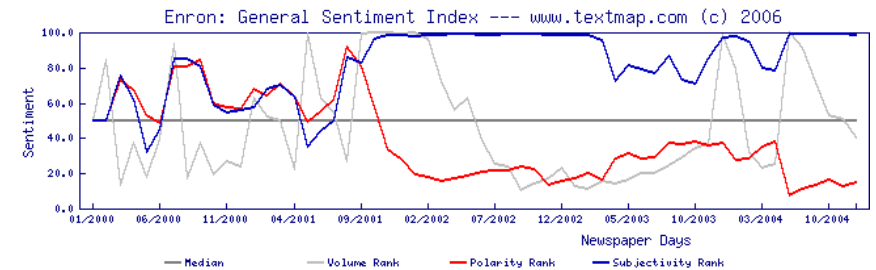
Uses hand-crafted regular expression rules that are fast and efficient in processing gigabytes of newspaper data.

Looks for several specialized classes of relations like relations between family members, employer-employee relations, political relations etc.,

Regex rules enable to trap relations such as "*Maurice is the brother of Curtis Jones, who is the grandfather of Karli Jones*"

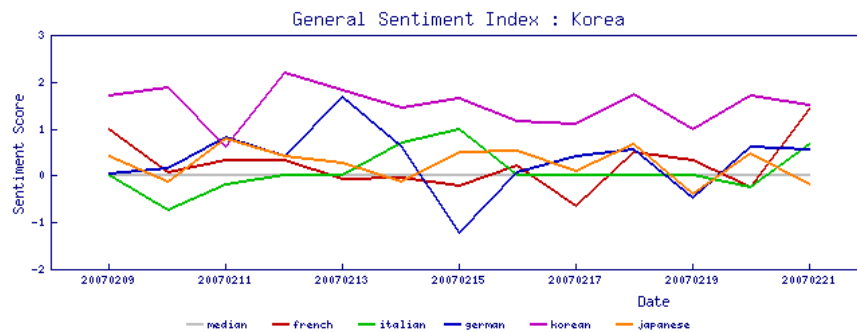
Sentiment Analysis

Sentiment analysis allows one to measure how positively/negatively an entity is regarded, not just how much it is talked about



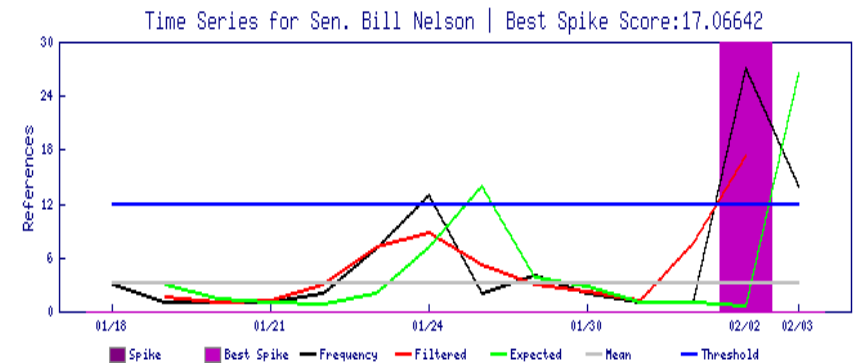
Sentiment Analysis

Sentiment Index of "Korea" for five different languages



Sentiment Analysis

News Storm for "Sen. Bill Nelson"



Agenda For Remaining Weeks

Remaining lectures (13 sessions):

- somewhat follow the book “Illuminating the Path”
- use references therein to identify papers to read and present (plus a few more)
- 2-3 papers per presenter and session
- pick a topic and correspond with me to identify suitable papers
- topics will be announced next Tuesday in class and then on the website

Final project:

- chosen presentation topic can relate to final project (but does not have to be)
- suggest a final project shortly after picking the paper topic
- communicate with me to define project more closely

Week after next (Tuesday or Thursday):

- guest lecture by Prof. IV Ramakrishnan
- topic: machine reasoning and learning