Analyzing the impact of science funding programs on the evolution of research fields

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A Visual Analytics Approach

A more comprehensive approach to reveal scientific impact & innovation.

- General data-driven methods for revealing trends, events, relationships, possible cause & effect.
- Interaction is essential for putting the human analyst in the loop.
- Tools that can be put in the hands of impact or policy analysts and program managers.

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Visual Analytics Tools

Tools embodying general methods for comprehensive analysis:

- Exploration, discovery, and general trends (Example: ParallelTopics, LeadLine)
- Deeper, detailed analysis (Example: Lead-Lag)
- Forecasting impact and decision support for science policy (Example: Knowledge Encapsulation Framework and dynamic Bayesian nets model)

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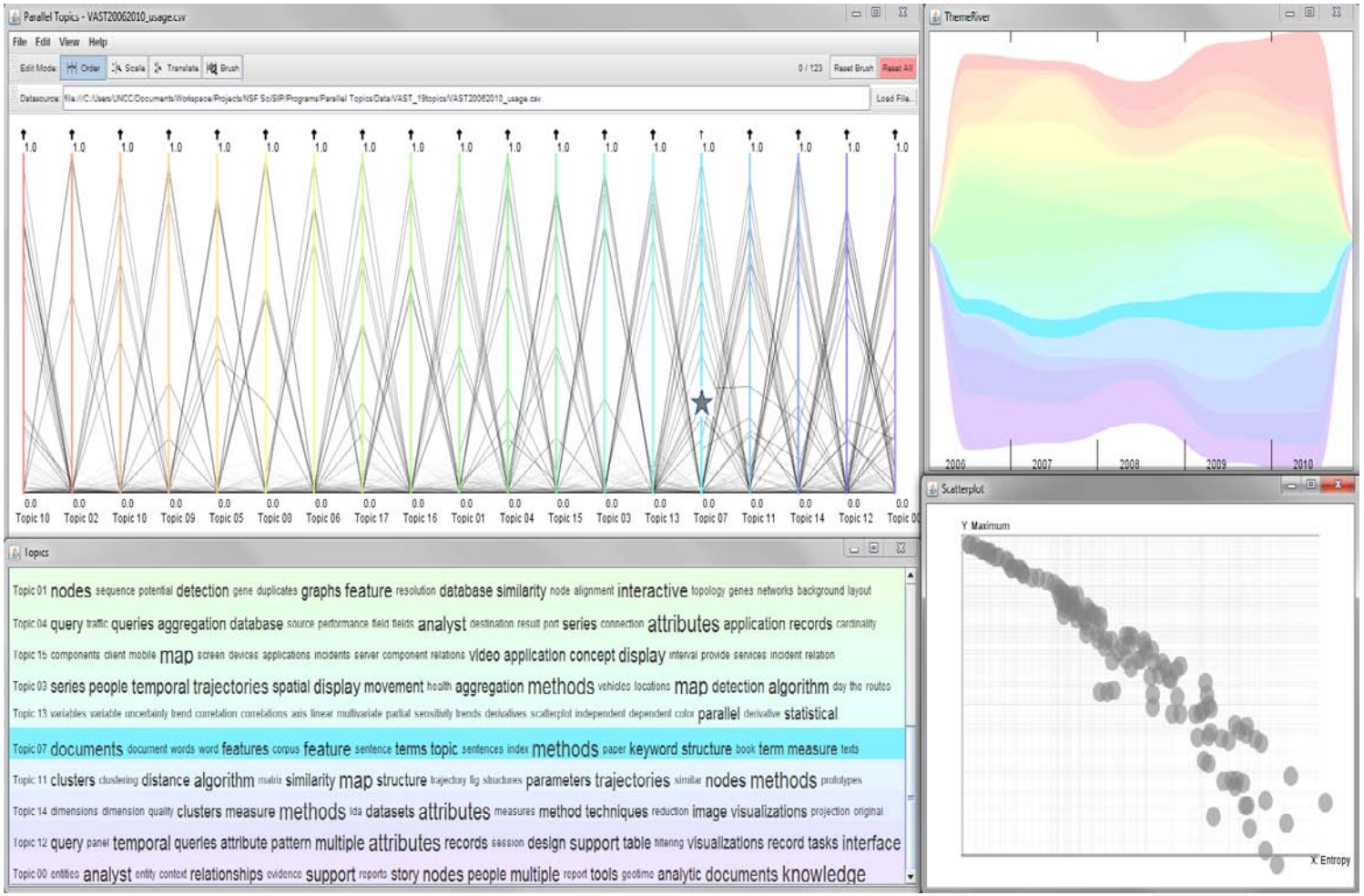
ParallelTopics

Topic streams over time

Distribution of proposals over topics



Key word lists for each topic

Distribution of proposals from single topic to multiple topic

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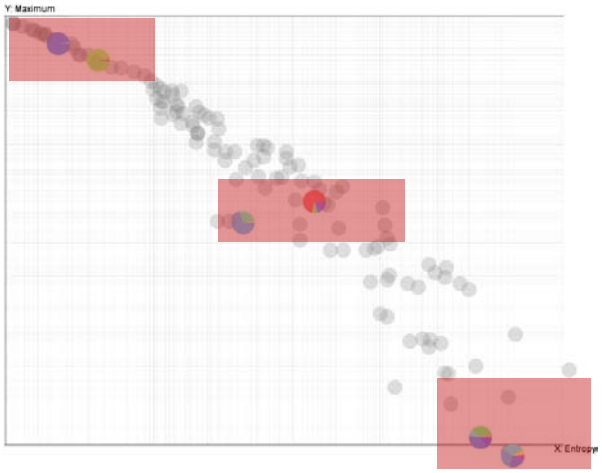
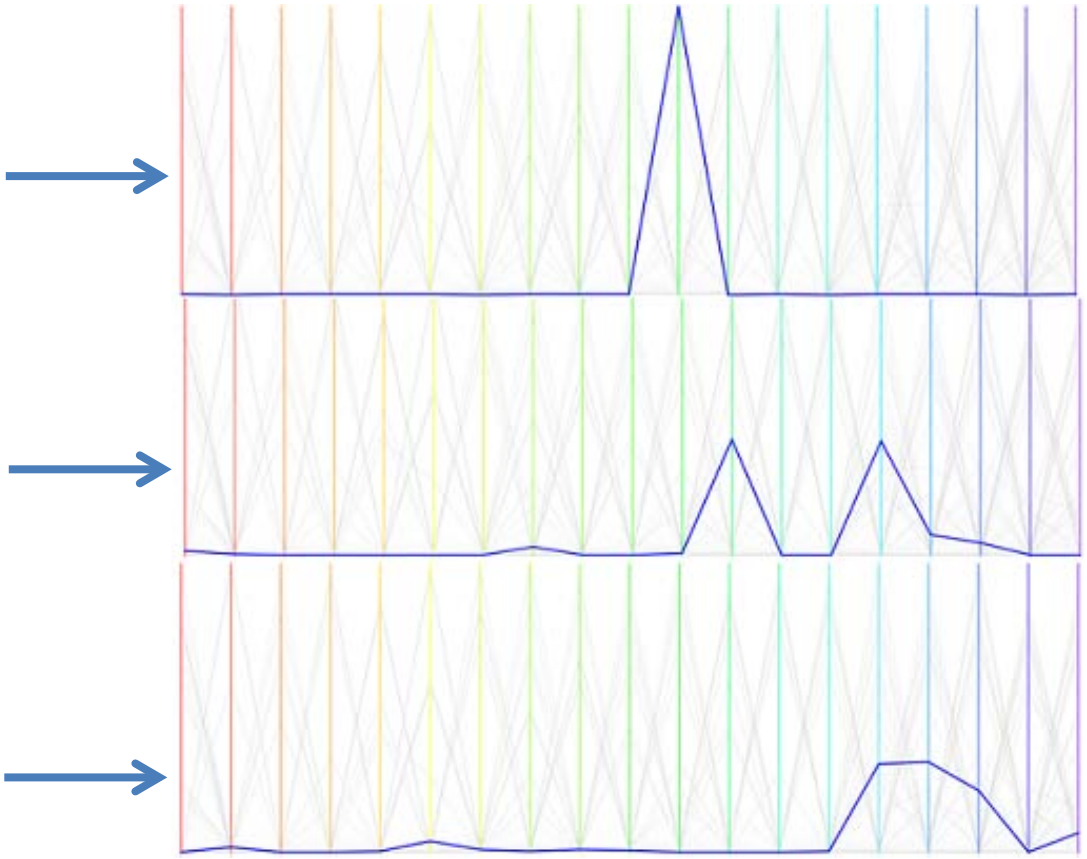
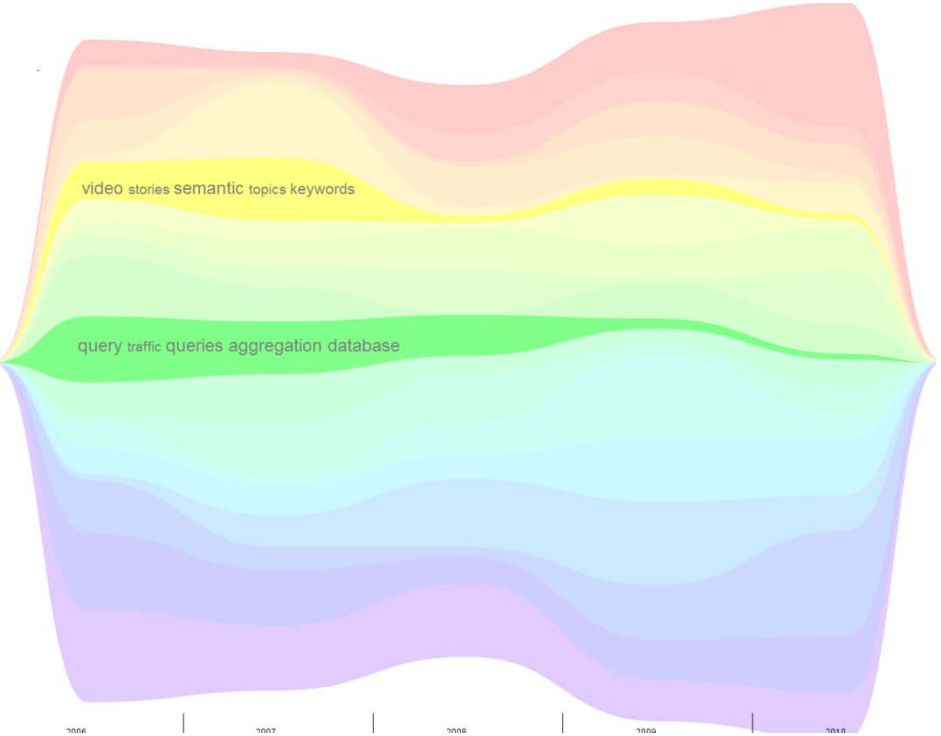
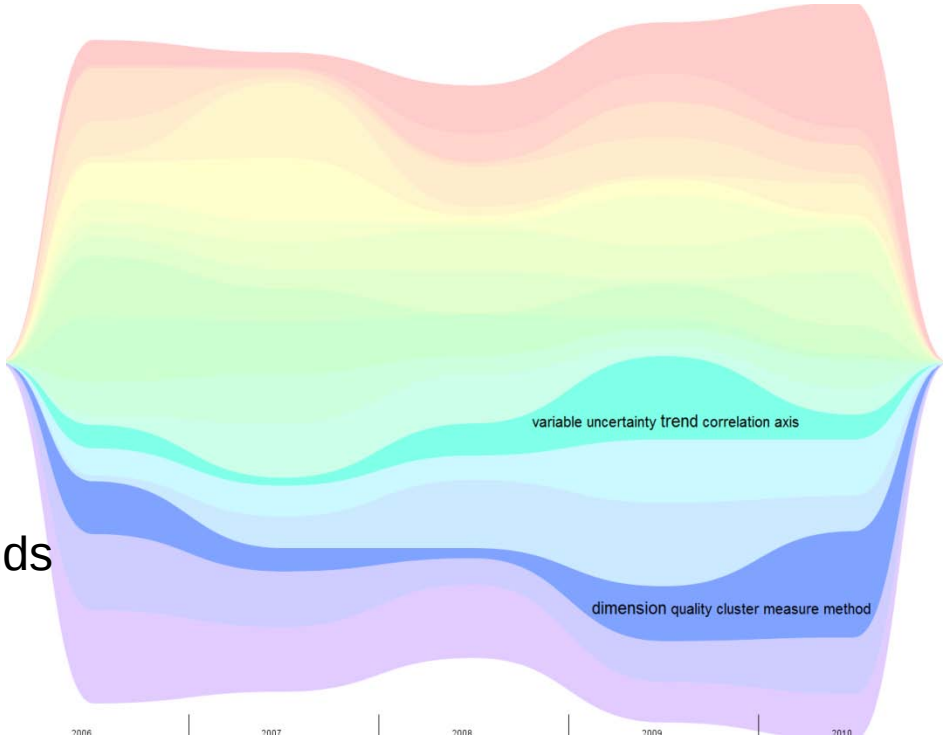
ParallelTopics





Topic Trends in ParallelTopics





Visual Analytics research paper trends (2006-2010)

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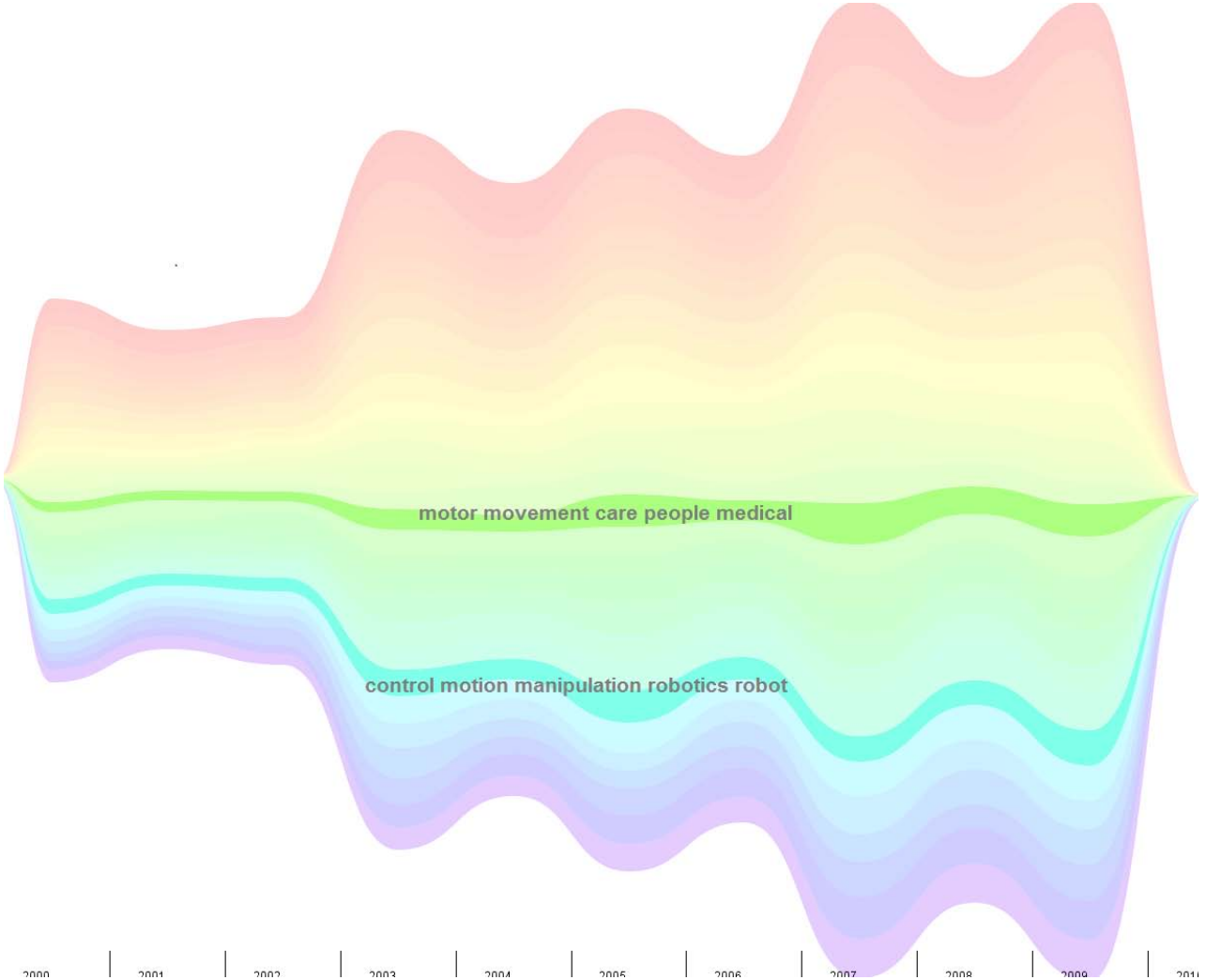
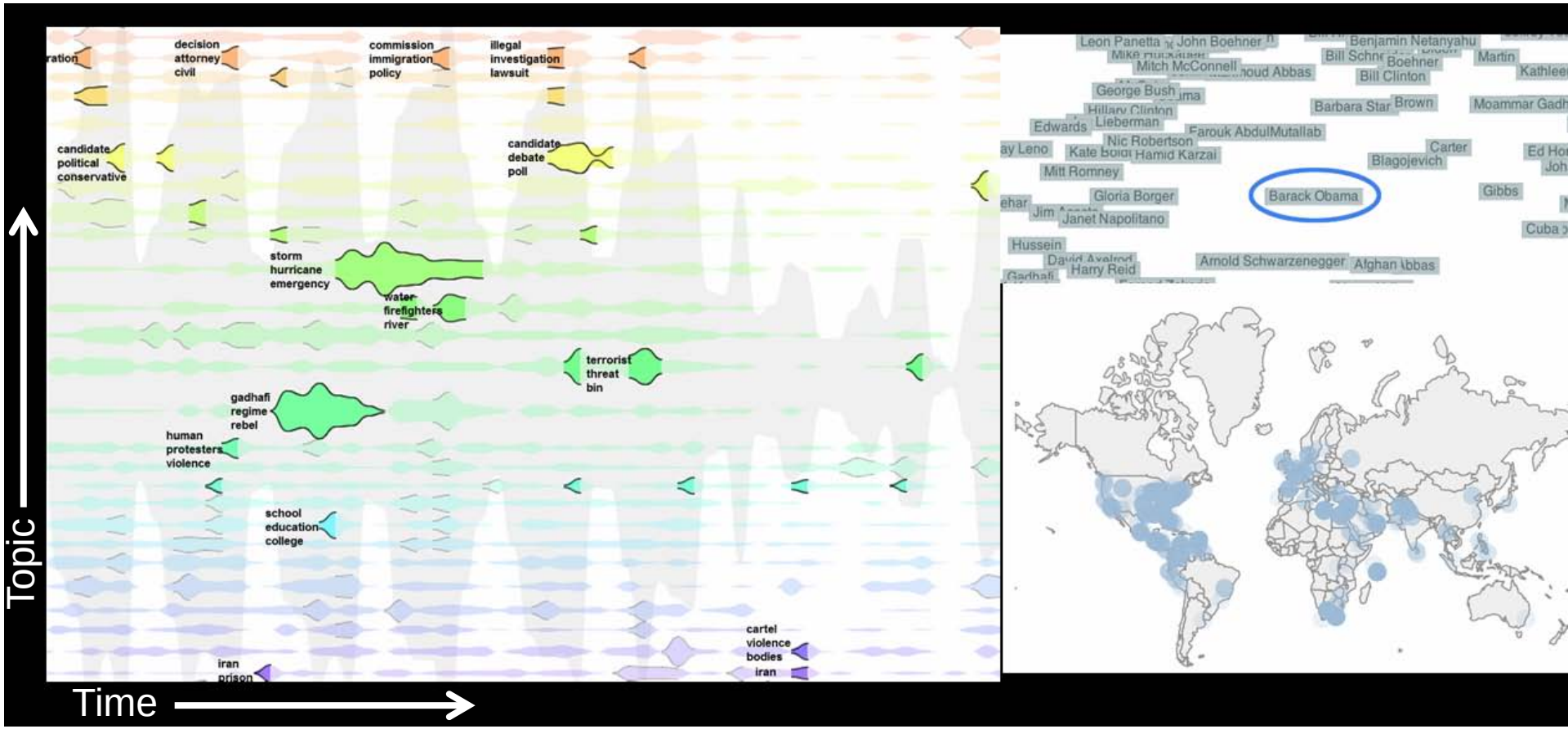
Topic Trends in ParallelTopics



Overview of awarded proposals in NSF Information & Intelligent Systems Directorate from 2000 to 2010.

LeadLine

Entity View



Event View

Geo View

Lead-Lag

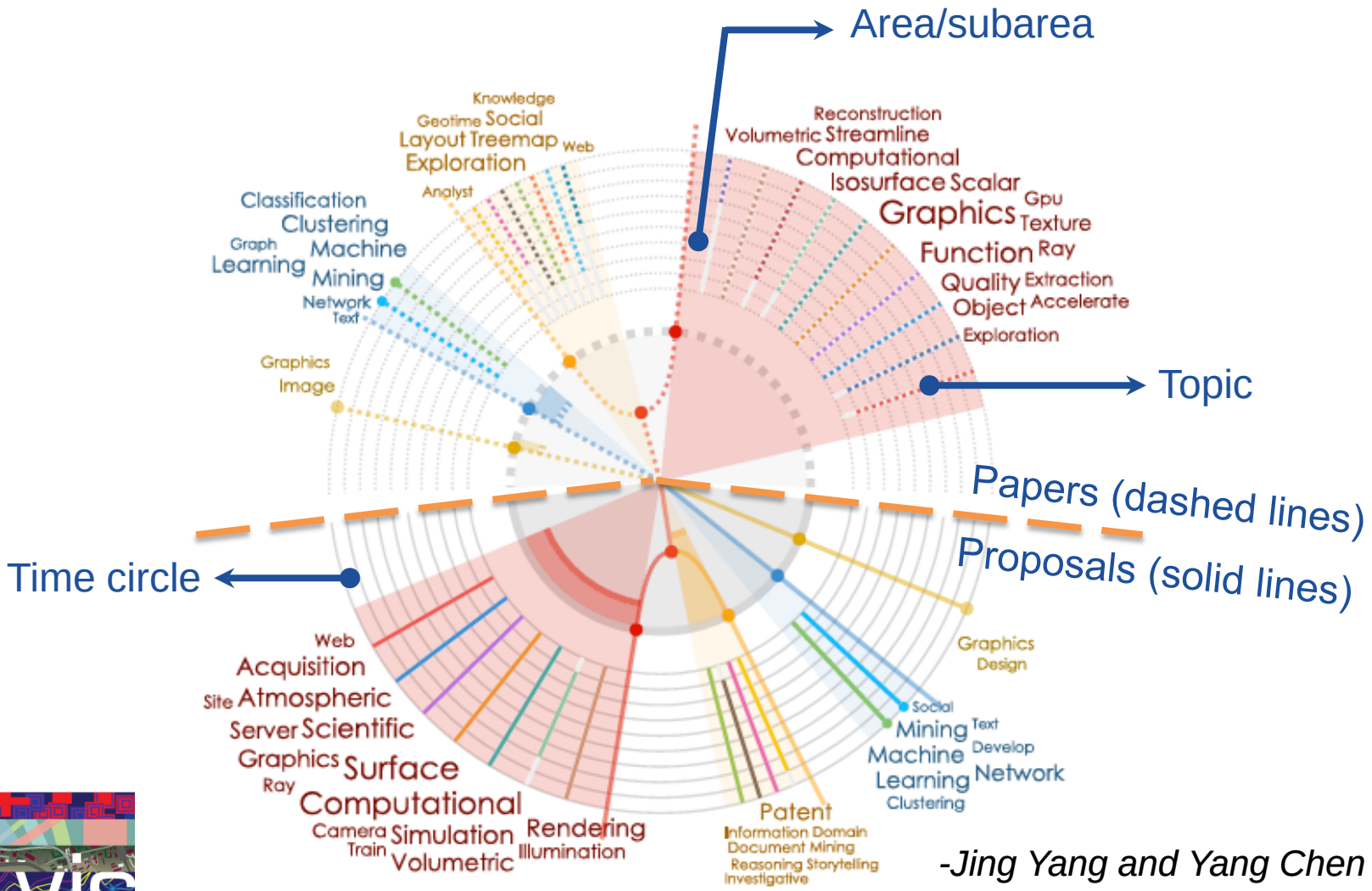
Investigate the lead-lag relations between funding and research (Collaboration of Jing Yang with Dr. Shixia Liu and her group at Microsoft Research Asia)

- Does funding lead/lag research in a given research field or topic?
- How do the relationships between funding and research evolve over time?
- What are the most important proposals/papers that shape the lead of funding/research?
- Has consequences for:
  - Scientific investment assessment
  - Funding allocation and program establishment
  - Review panel organization

Methodology

- Compare two or more corpora
- Perform topic modeling on the combined corpora to identify research areas, subareas, and topics.
- Conduct lead-lag analysis on multiple levels of detail
  - Overall lead
  - Dynamic change of lead over time
- Visualize the results
  - Radial tree: overall lead-lag
  - Twisted-ladder: temporal change
- Example
  - NSF funded grant abstracts (2000-2009)
    - 1K grant abstracts (IIS, CCF, and CNS)
  - Abstract of papers (2000-2009)
    - 5k conference papers (Vis, InfoVis, KDD, SIGGRAPH, etc.)

Lead-Lag
NSF vs. Papers: Overall leads



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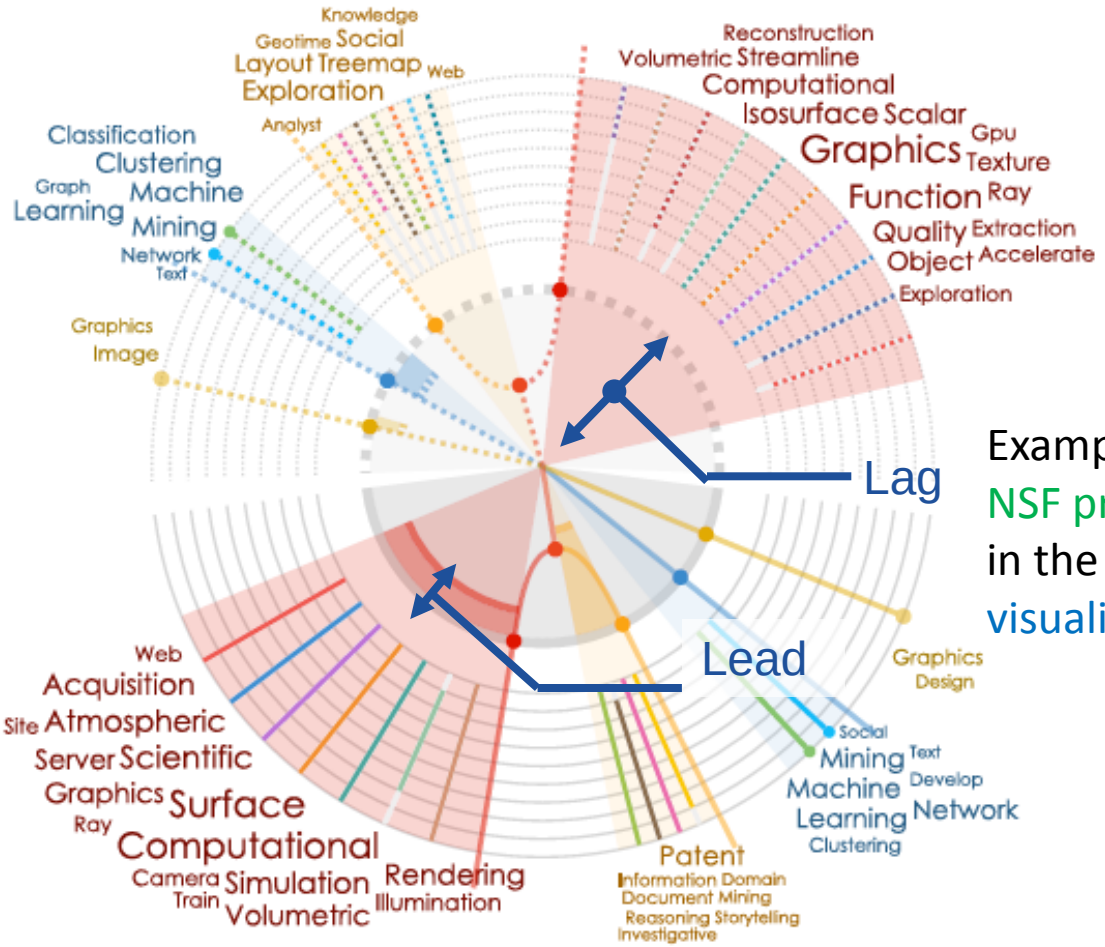
NSF proposals vs. Papers: Overall leads



Example:
NSF proposals lead papers in the subarea of scientific visualization

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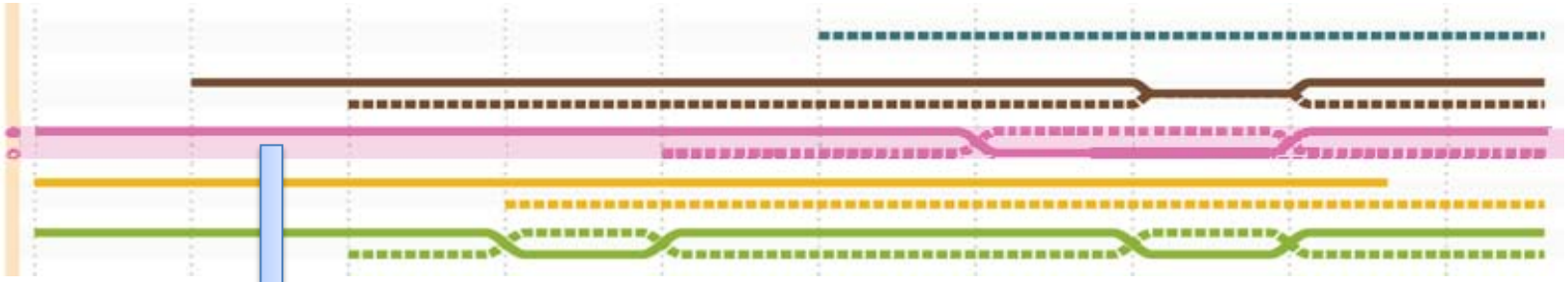
NSF Proposals vs. Papers: Local changes

Subarea of information visualization NSF leads Paper



A topic of "analytic/knowledge/reasoning". Paper (dash) leads in 2006 and 2007. NSF (solid) leads over the rest of the years.

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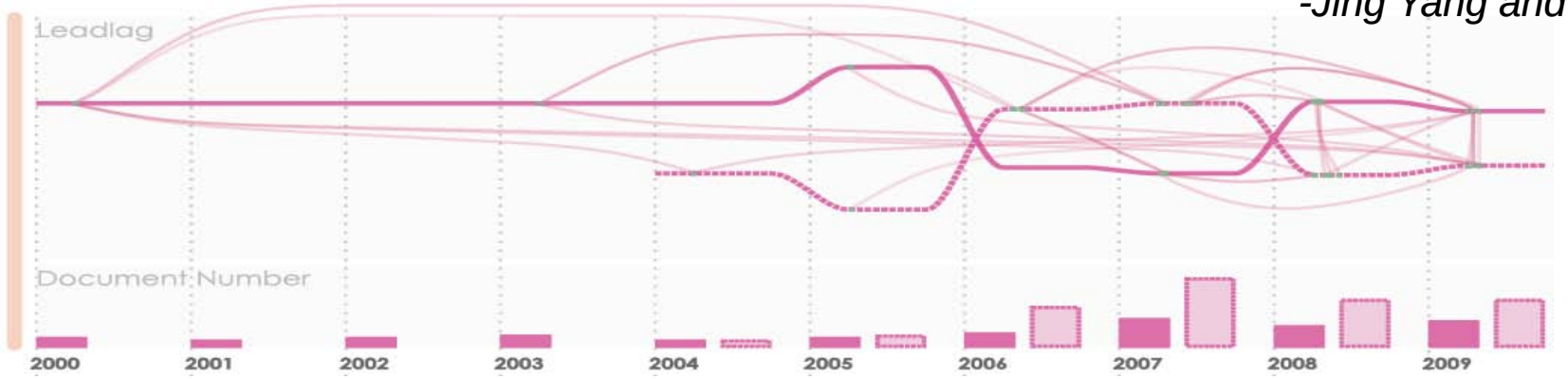
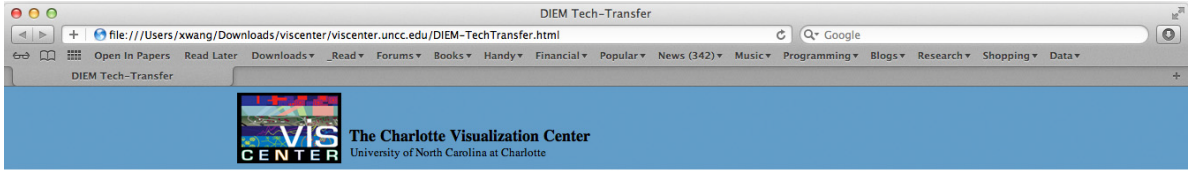


Document alignment between NSF and paper on the topic from 2000 to 2009.

Questions?

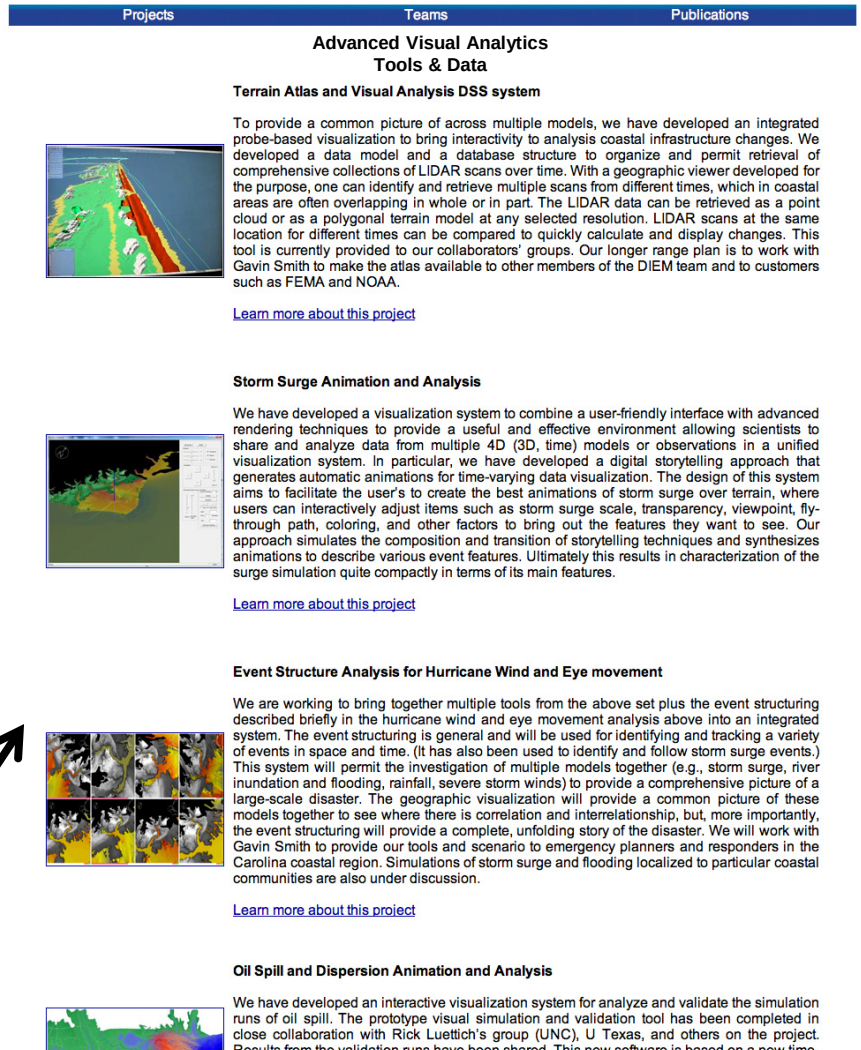
www.viscenter.uncc.edu

Products --- Tools & Data Website

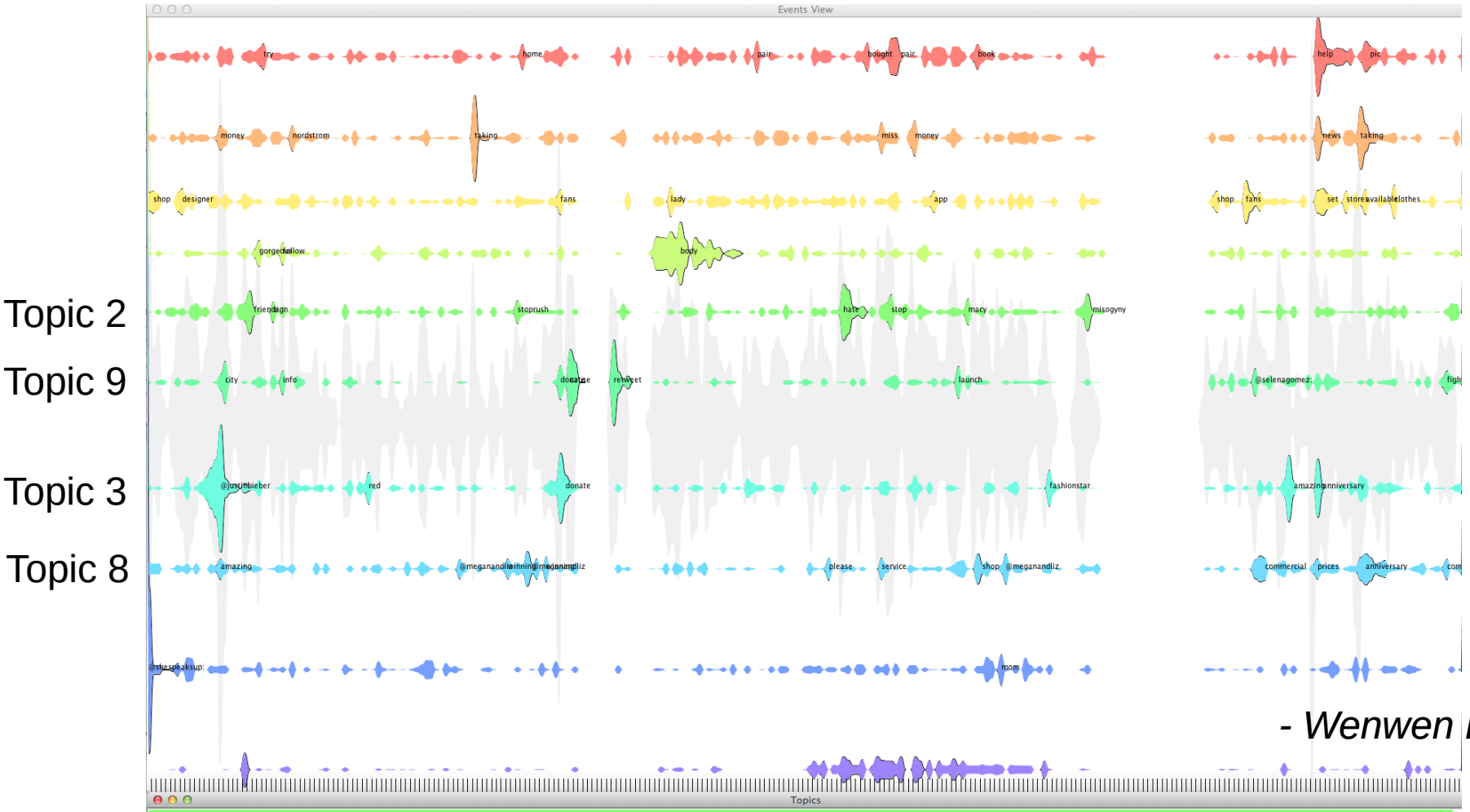


- We are developing and will soon launch a Tools + Data Website via www.viscenter.uncc.edu
- This site will contain downloads of the above tools plus others with descriptions of their capabilities and how to use them.
- Some publicly available data will also be available.
- Downloads will be by permission.

Example from another project

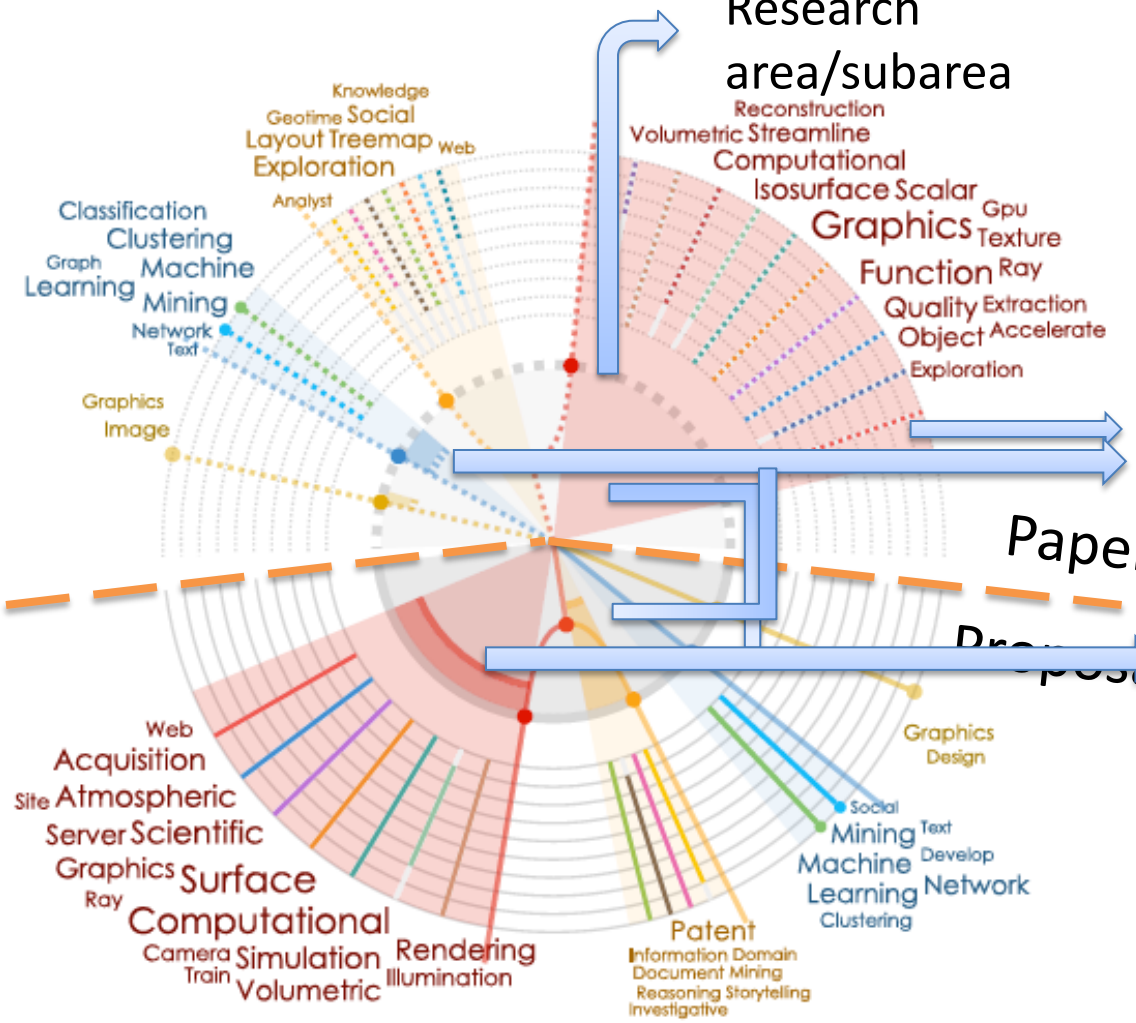


Know Your Customers (Know Their Customers)



- Wenwen Dou

Lead-Lag
NSF vs. Papers: Overall leads



Paper leads NSF proposal in the area of Research topic data mining

NSF proposal leads paper in the subarea of scientific visualization

-Jing Yang and Yang Chen