

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.



Visual Analytics Tools

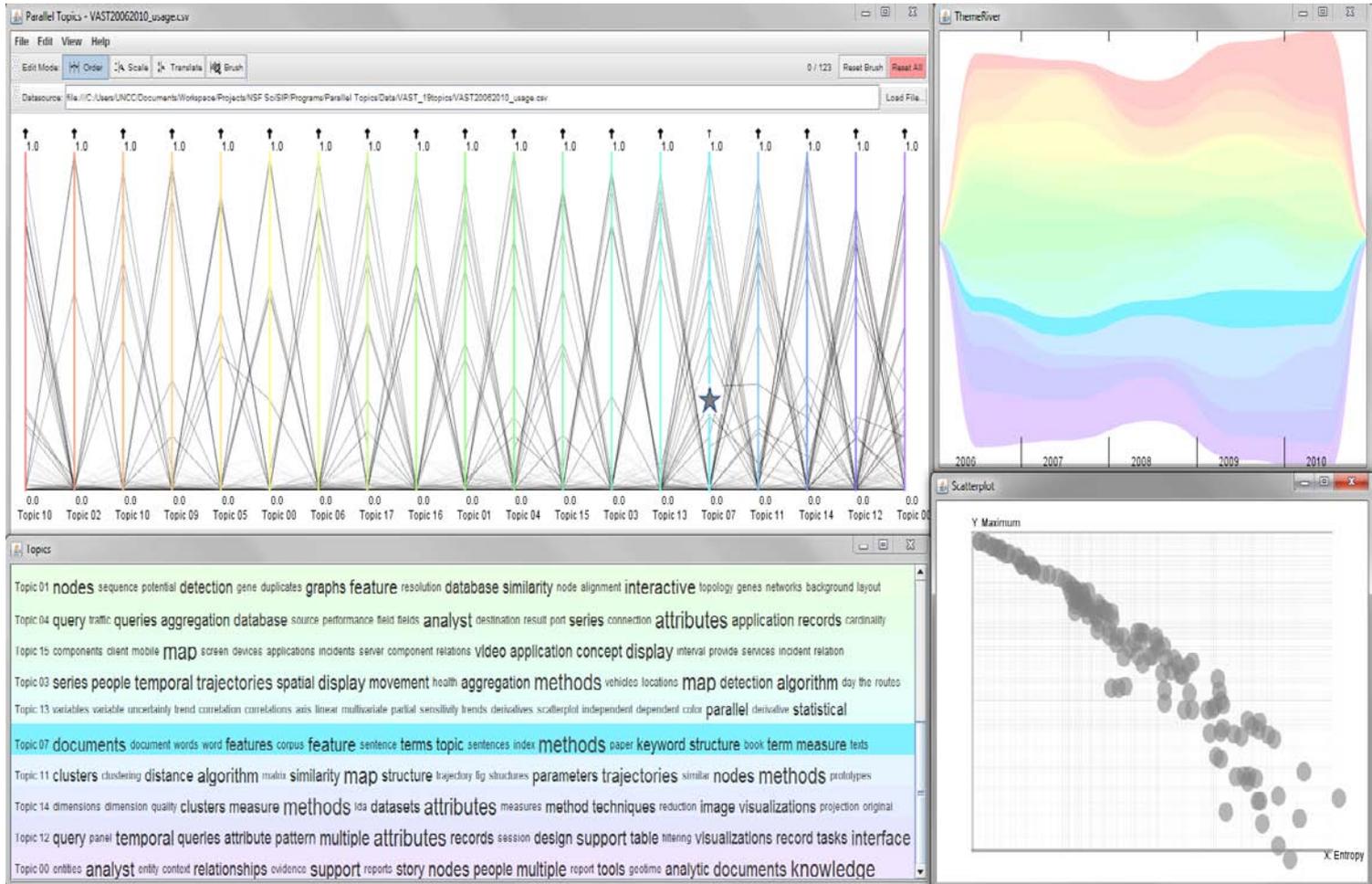
Tools embodying general methods for comprehensive analysis:

- 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)



ParallelTopics

Topic streams over time



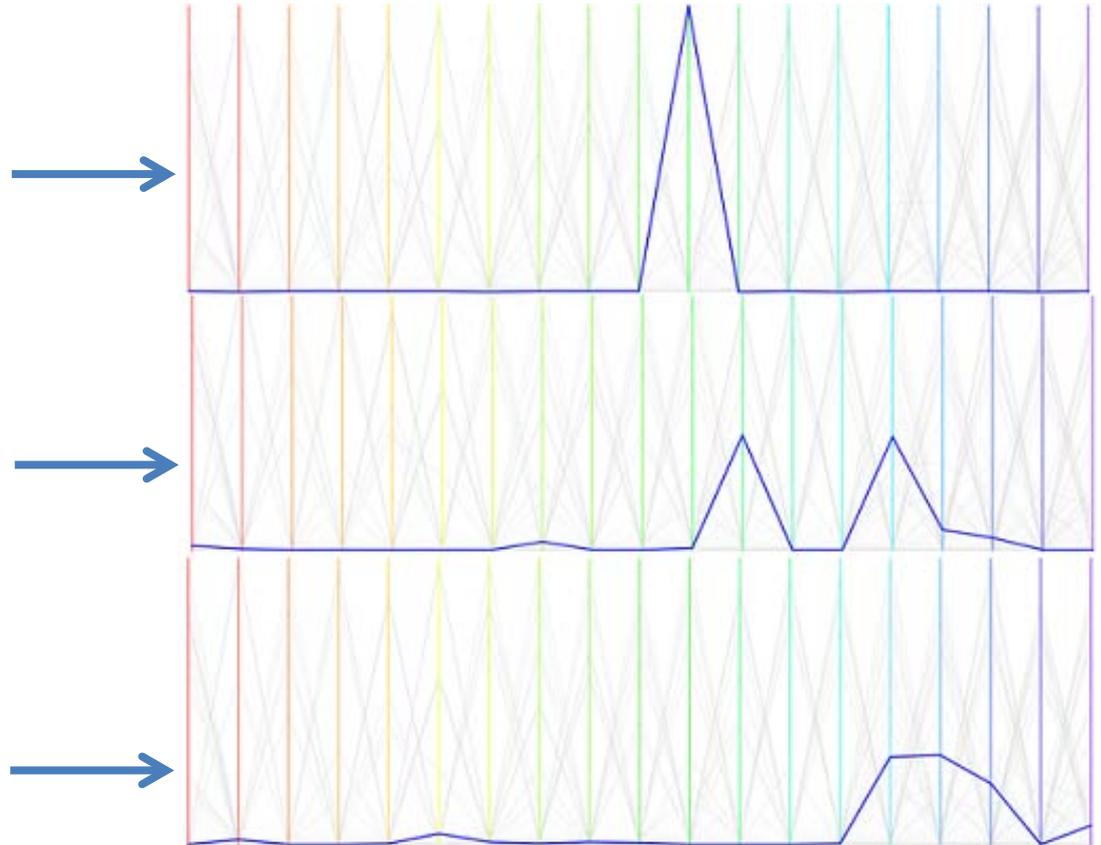
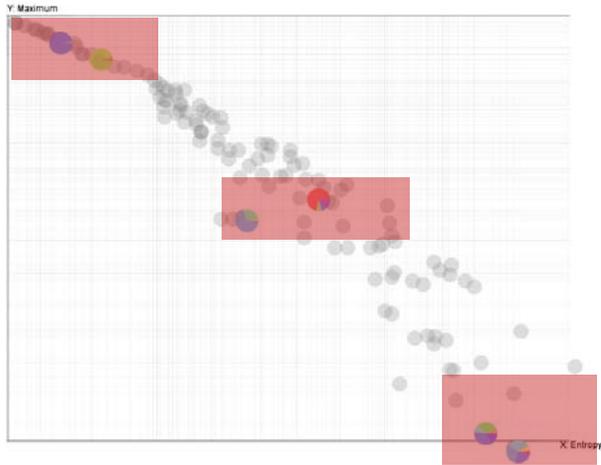
Distribution of proposals from single topic to multiple topic

Distribution of proposals over topics

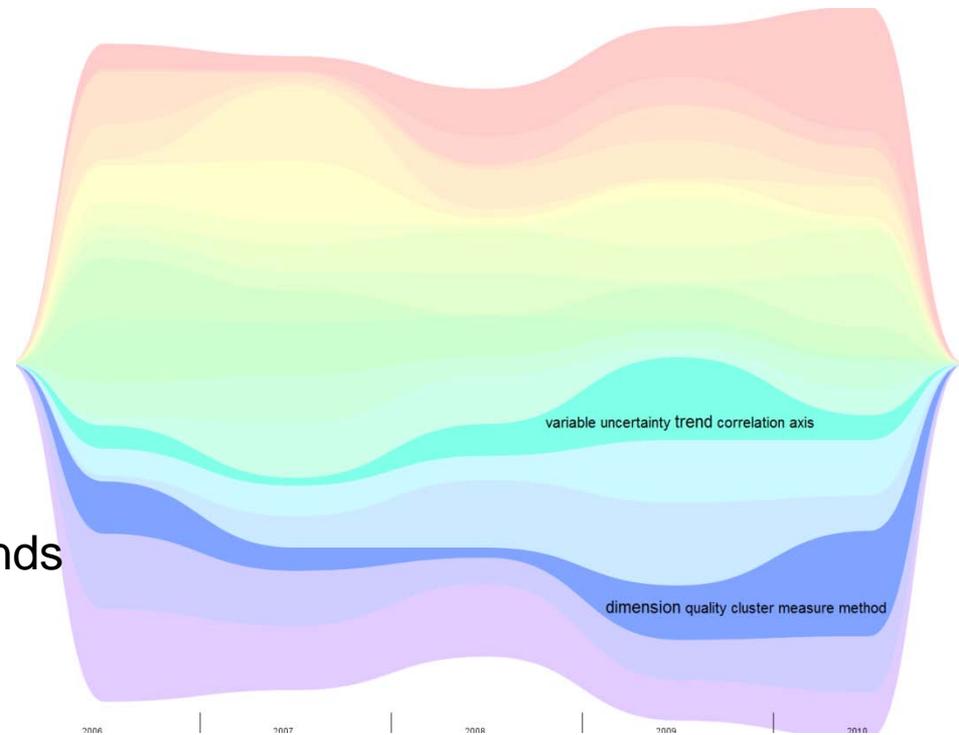
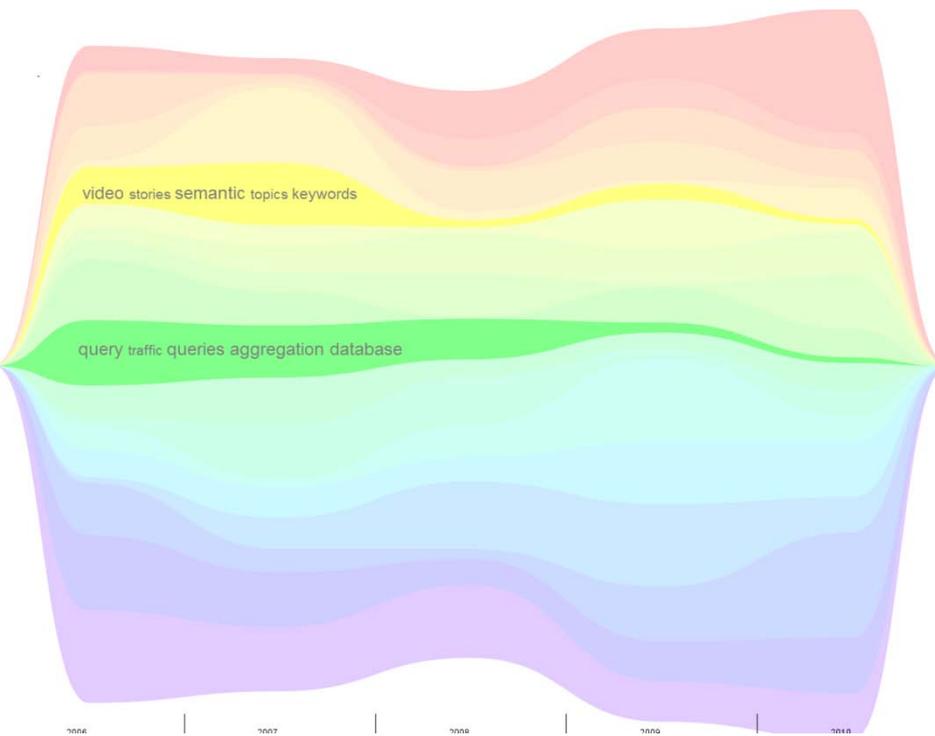
Key word lists for each topic



ParallelTopics



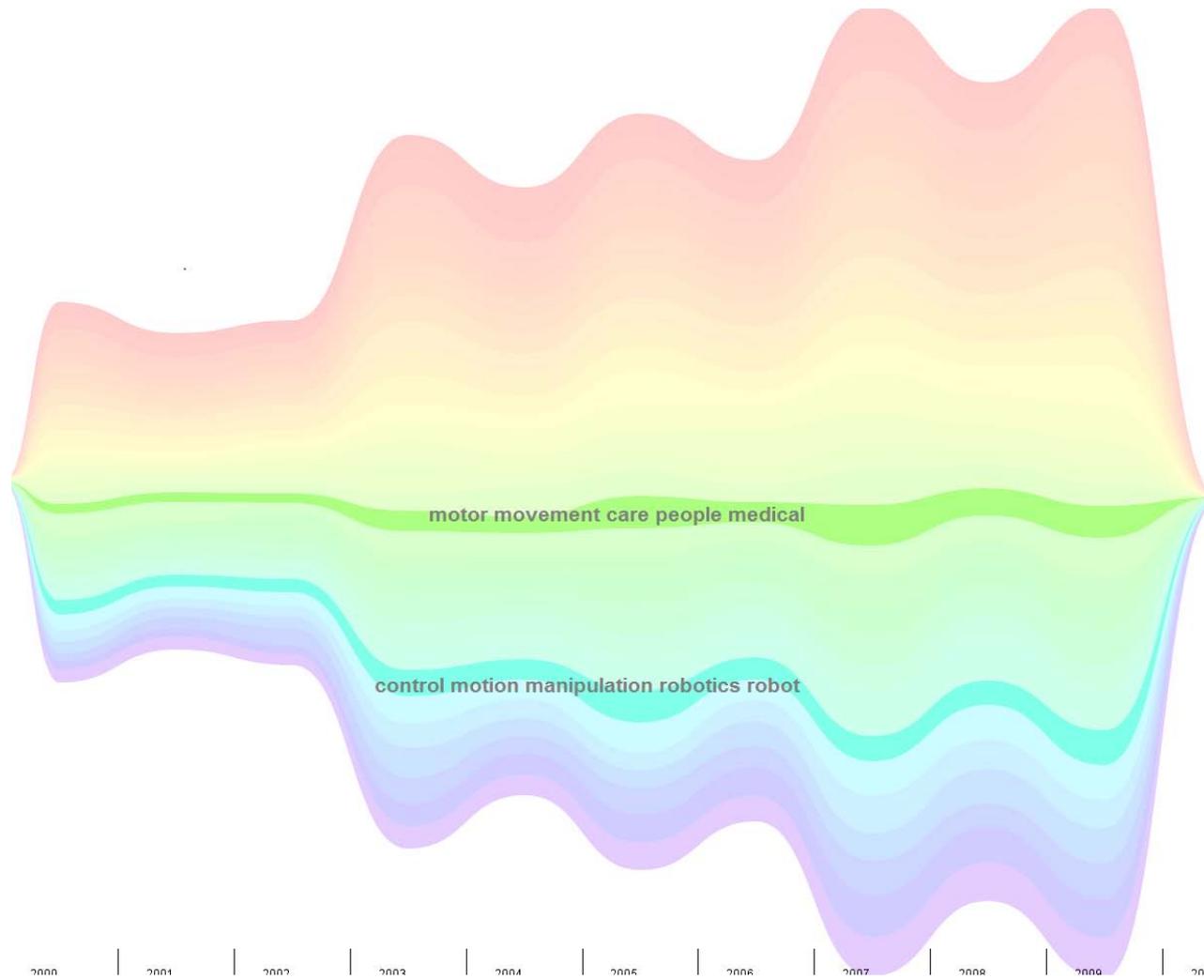
Topic Trends in ParallelTopics



Visual Analytics research paper trends
(2006-2010)



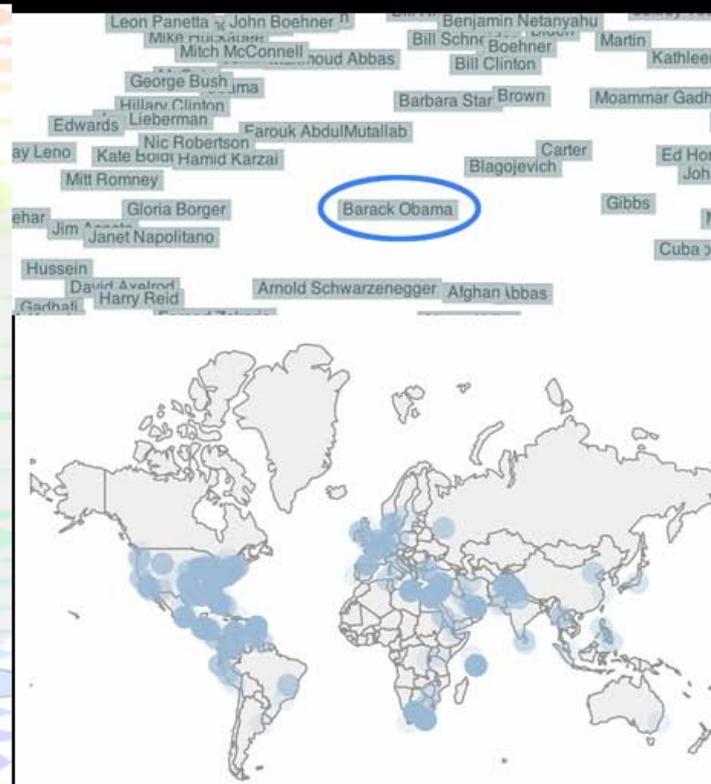
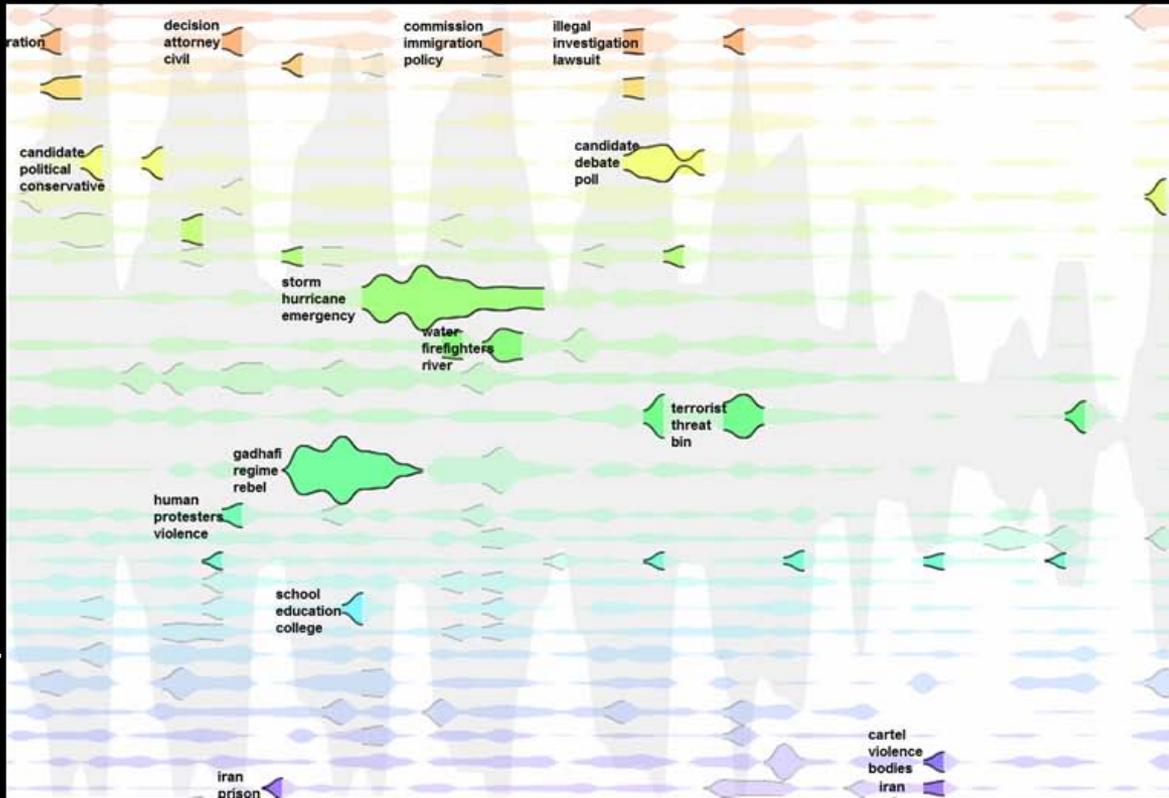
Topic Trends in ParallelTopics



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

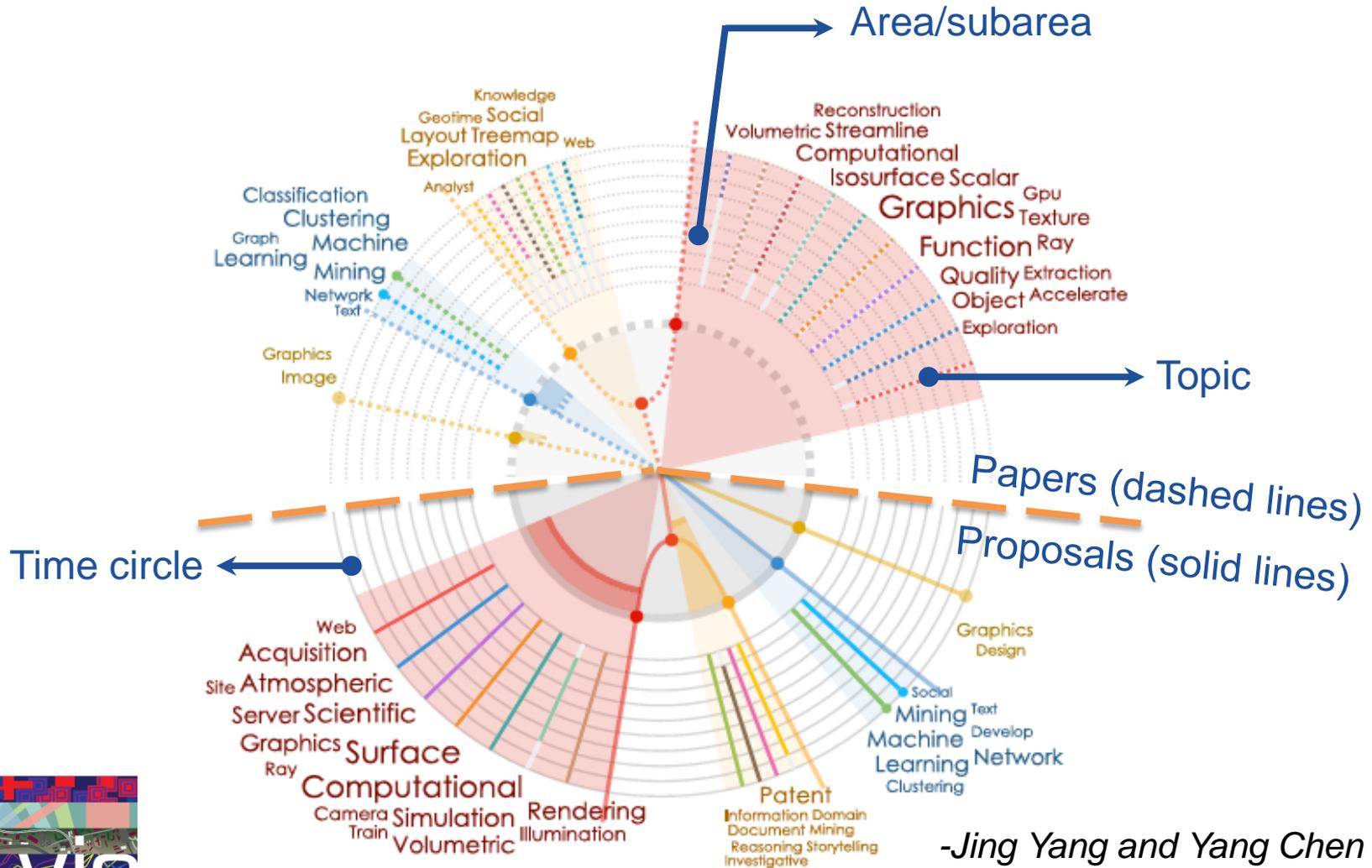
Methodology

- 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

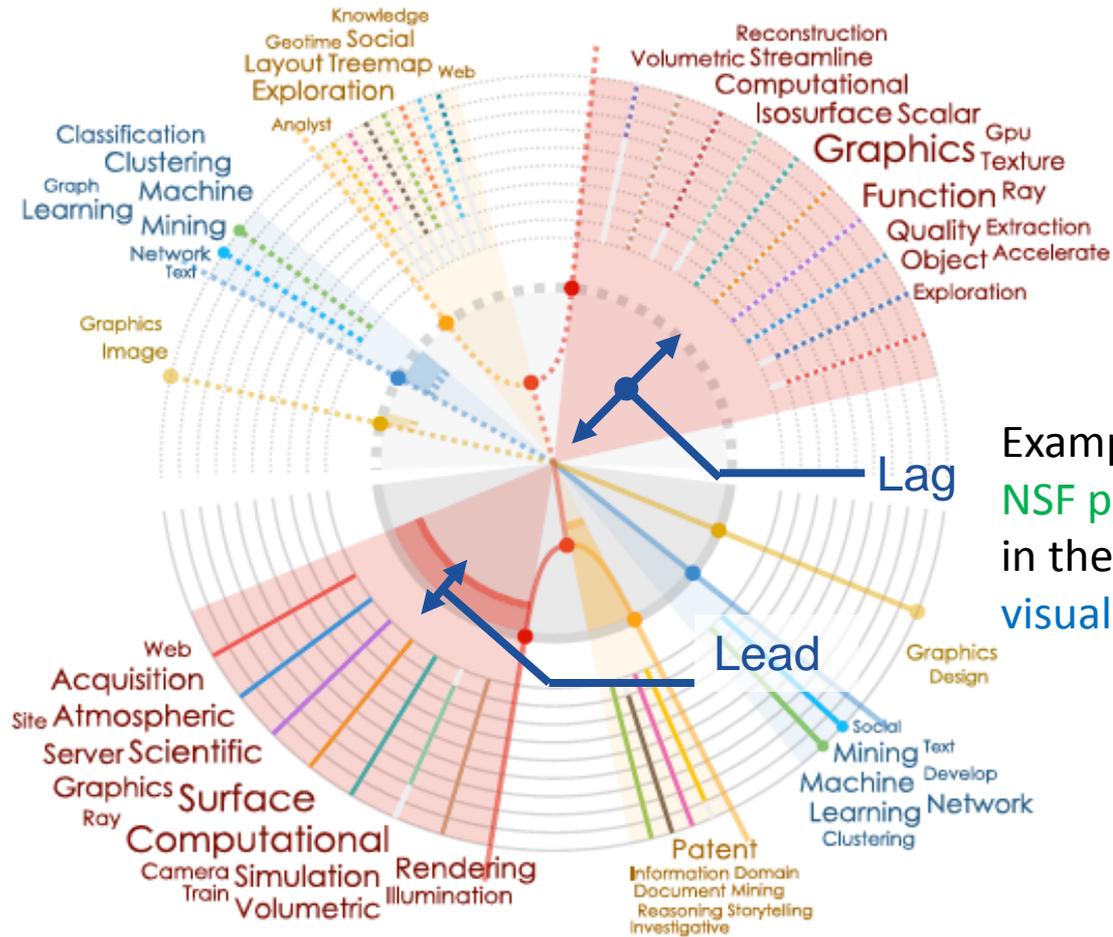
NSF vs. Papers: Overall leads



-Jing Yang and Yang Chen



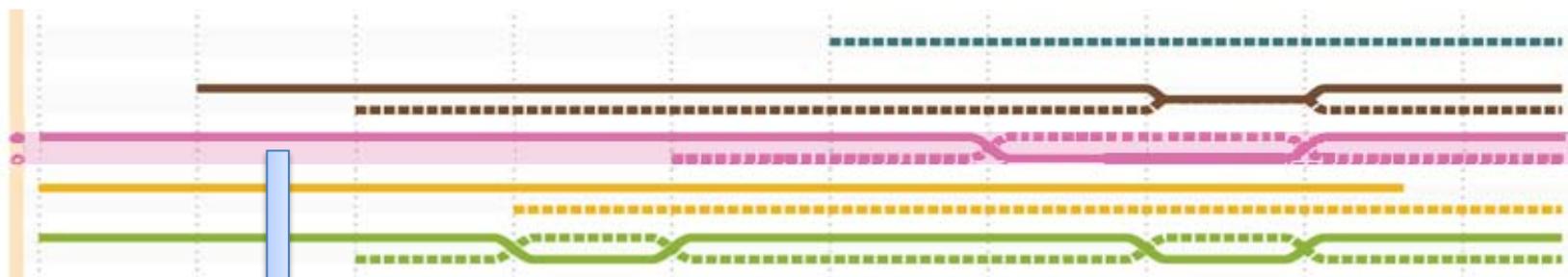
NSF proposals vs. Papers: Overall leads



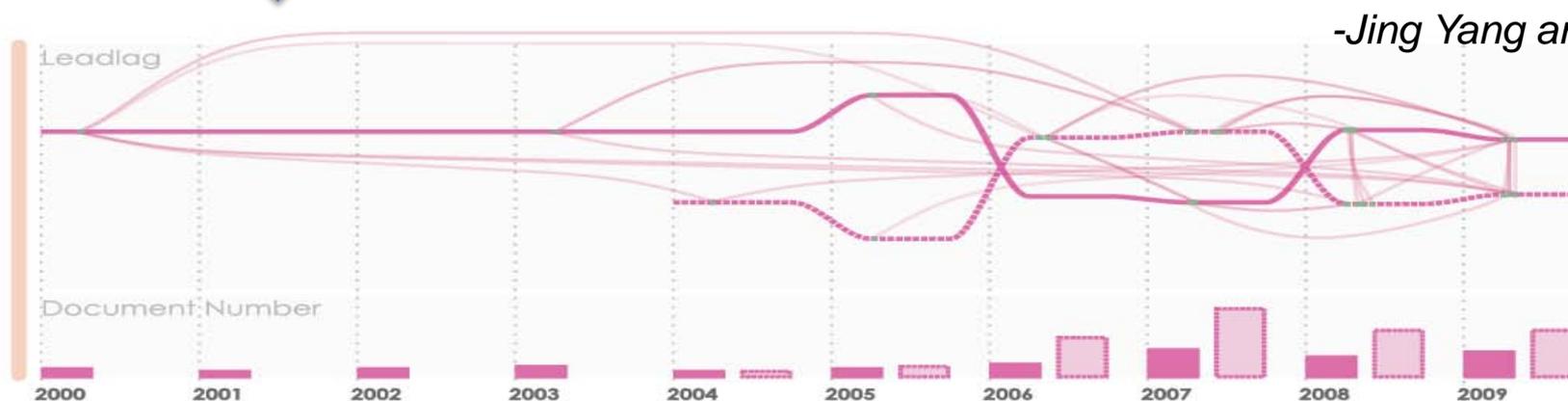
Example:
NSF proposals lead papers
in the subarea of scientific
visualization

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.



-Jing Yang and Yang Chen

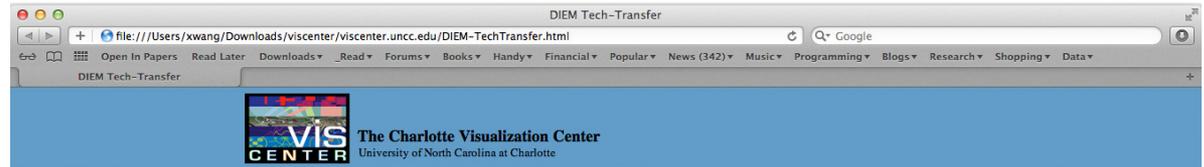
Document alignment between NSF and paper on the topic from 2000 to 2009.

Questions?

www.viscenter.uncc.edu

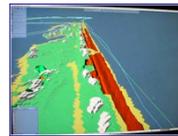


Products --- Tools & Data Website



Advanced Visual Analytics Tools & Data

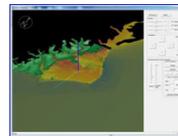
Terrain Atlas and Visual Analysis DSS system



To provide a common picture of across multiple models, we have developed an integrated probe-based visualization to bring interactivity to analysis coastal infrastructure changes. We developed a data model and a database structure to organize and permit retrieval of comprehensive collections of LIDAR scans over time. With a geographic viewer developed for the purpose, one can identify and retrieve multiple scans from different times, which in coastal areas are often overlapping in whole or in part. The LIDAR data can be retrieved as a point cloud or as a polygonal terrain model at any selected resolution. LIDAR scans at the same location for different times can be compared to quickly calculate and display changes. This tool is currently provided to our collaborators' groups. Our longer range plan is to work with Gavin Smith to make the atlas available to other members of the DIEM team and to customers such as FEMA and NOAA.

[Learn more about this project](#)

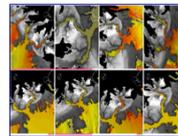
Storm Surge Animation and Analysis



We have developed a visualization system to combine a user-friendly interface with advanced rendering techniques to provide a useful and effective environment allowing scientists to share and analyze data from multiple 4D (3D, time) models or observations in a unified visualization system. In particular, we have developed a digital storytelling approach that generates automatic animations for time-varying data visualization. The design of this system aims to facilitate the user's to create the best animations of storm surge over terrain, where users can interactively adjust items such as storm surge scale, transparency, viewpoint, fly-through path, coloring, and other factors to bring out the features they want to see. Our approach simulates the composition and transition of storytelling techniques and synthesizes animations to describe various event features. Ultimately this results in characterization of the surge simulation quite compactly in terms of its main features.

[Learn more about this project](#)

Event Structure Analysis for Hurricane Wind and Eye movement



We are working to bring together multiple tools from the above set plus the event structuring described briefly in the hurricane wind and eye movement analysis above into an integrated system. The event structuring is general and will be used for identifying and tracking a variety of events in space and time. (It has also been used to identify and follow storm surge events.) This system will permit the investigation of multiple models together (e.g., storm surge, river inundation and flooding, rainfall, severe storm winds) to provide a comprehensive picture of a large-scale disaster. The geographic visualization will provide a common picture of these models together to see where there is correlation and interrelationship, but, more importantly, the event structuring will provide a complete, unfolding story of the disaster. We will work with Gavin Smith to provide our tools and scenario to emergency planners and responders in the Carolina coastal region. Simulations of storm surge and flooding localized to particular coastal communities are also under discussion.

[Learn more about this project](#)

Oil Spill and Dispersion Animation and Analysis



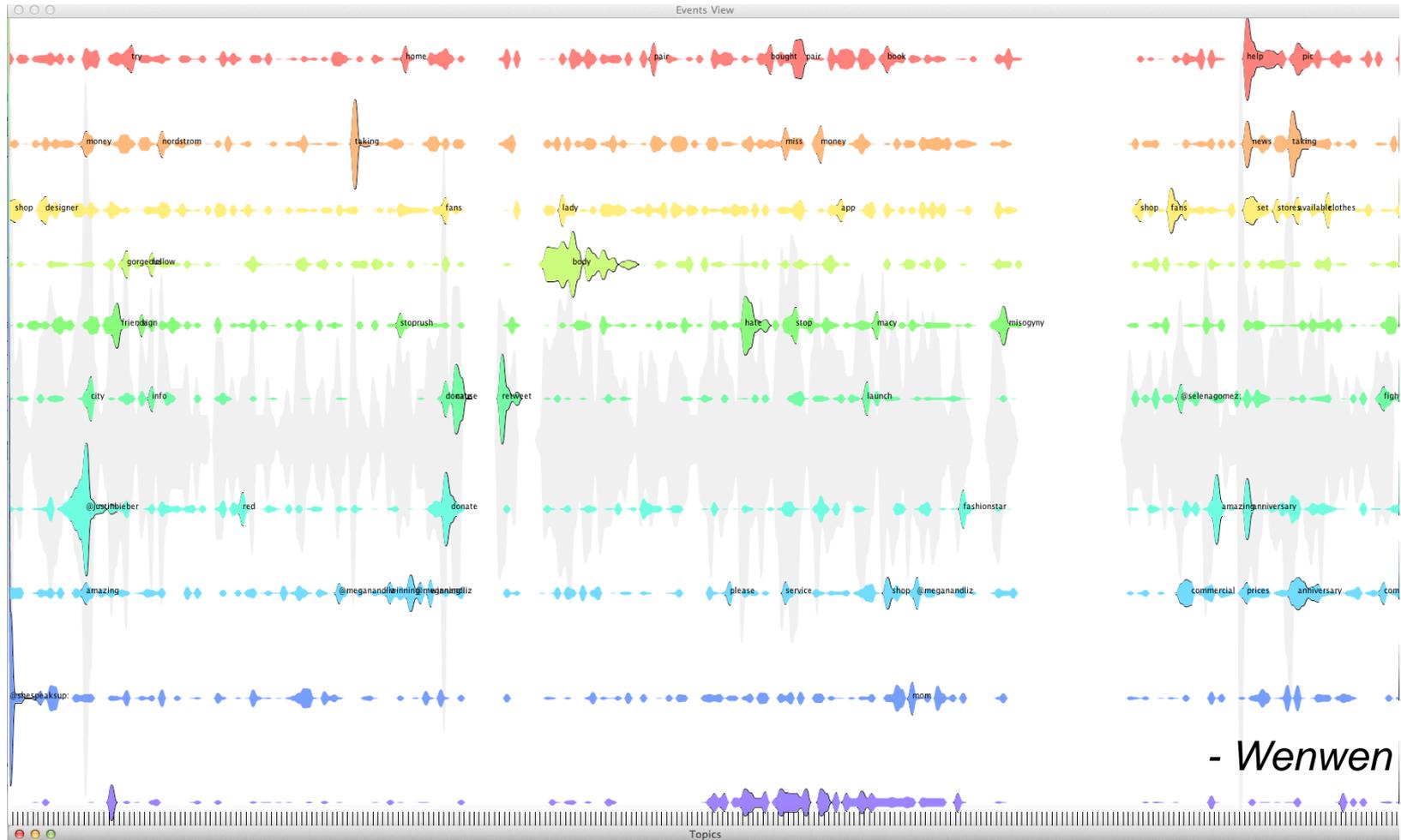
We have developed an interactive visualization system for analyze and validate the simulation runs of oil spill. The prototype visual simulation and validation tool has been completed in close collaboration with Rick Luetich's group (UNC), U Texas, and others on the project. Results from the validation have been shared. The visualization is based on the

Example from
another project



- 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.

Know Your Customers (Know Their Customers)



- Wenwen Dou

Topic 02 macy online **stoprush** extra perfect favorite stop friends **hate** code list buy **limbaugh** ads size guys

Topic 09 **heart** launch fragrance **donate** fight @selenagomez: @goredforwomen: meet dise @goredforwomen wo

Topic 03 thanksgiving parade red christmas wear july buy fashionstar fireworks celebrate **ready** nyc anniversary

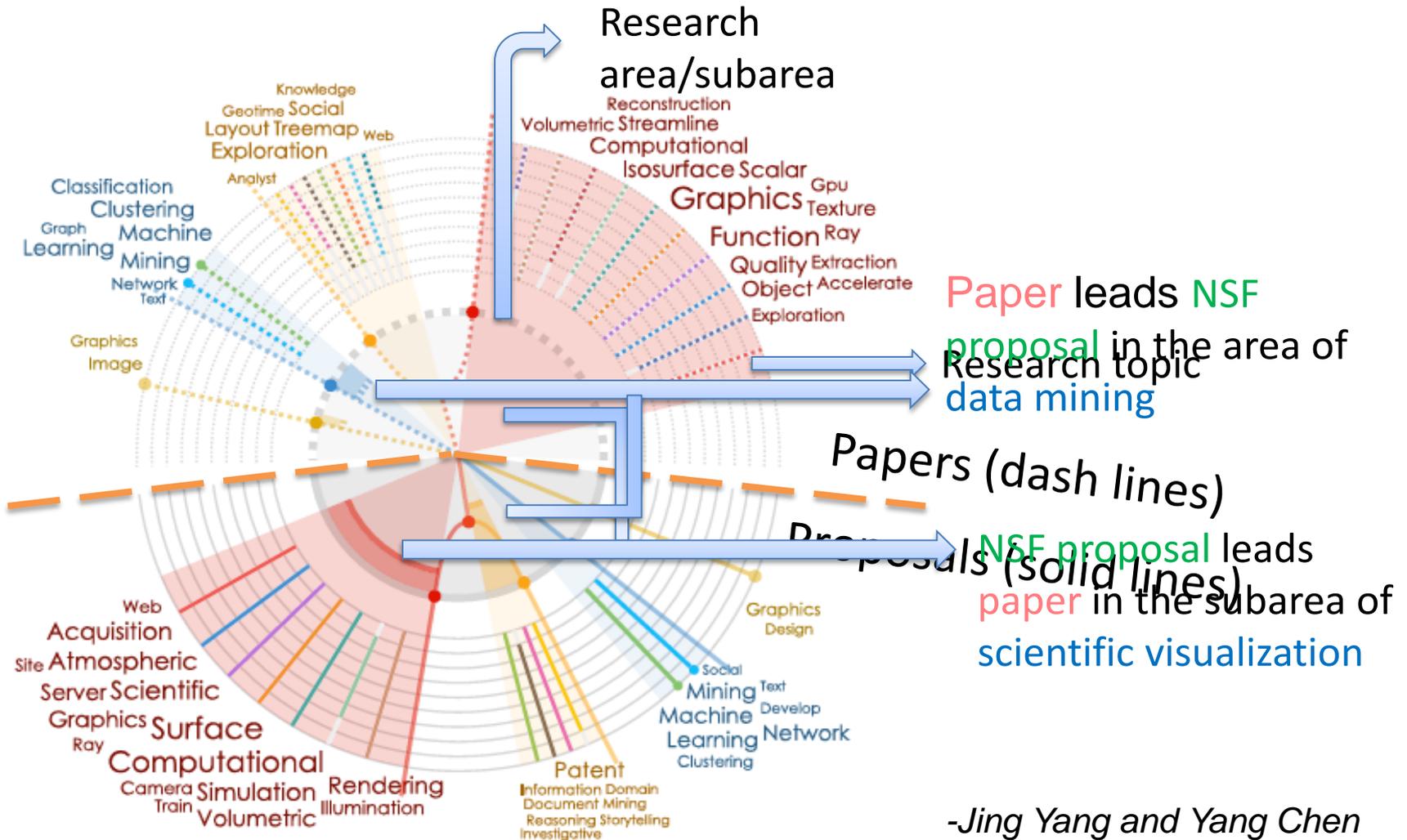
Topic 08 @meganandliz **contest** please @iheartradio customer service risingstar **amazing** commercial produc

Topic 04 week hope recipeshare party top mom congrats twitter won rsvp join congratulations **tonight** worth hills @

Topic 06 enter chance hotel giuliana follow **contest** giveaway guidemetosave dance **http** bag @dongtown cou

Lead-Lag

NSF vs. Papers: Overall leads



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