

Funding vs. Research: Chicken and Egg problem?

<http://snap.stanford.edu/proj/nsf-isi>

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Q: How do funding and science relate?

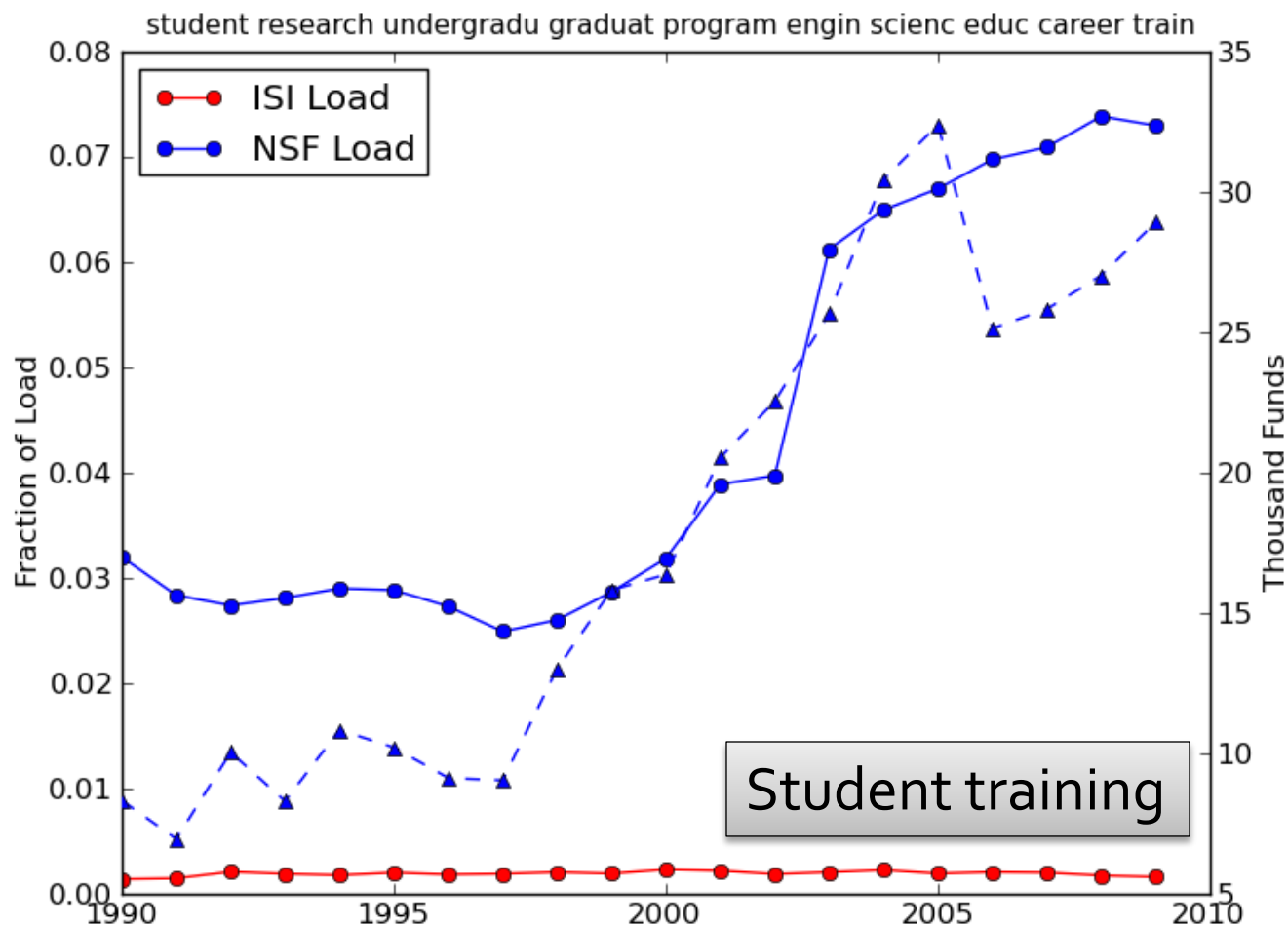
- Does funding lead/lag science?
 - Is funding leading (published) science?
 - 1:write a grant, 2:get funds, 3:do research, 4:publish
 - Is science leading funding?
 - 1:do research, 2:publish, 3:write grant, 4:get funds
- Has consequences for:
 - Career trajectories
 - Amount of “preliminary” work needed before getting funded

Methodology

- Compare
 - NSF funded grant abstracts
 - 200k grant abstracts between 1990-2010
 - Abstract of papers in ISI Web of Knowledge
 - 250 million documents (133k journals, 256 fields)
- Perform topic analysis on the combined corpora to identify scientific subareas
- Topic dynamics in ISI vs. NSF over time
 - For each topic find the optimal alignment
- Correlate them with funding

Results: Preliminaries (1)

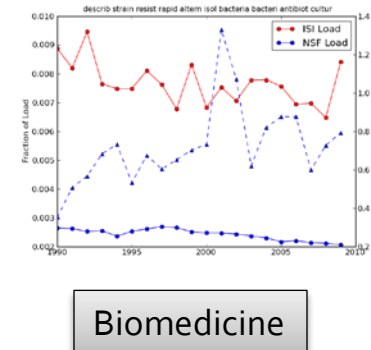
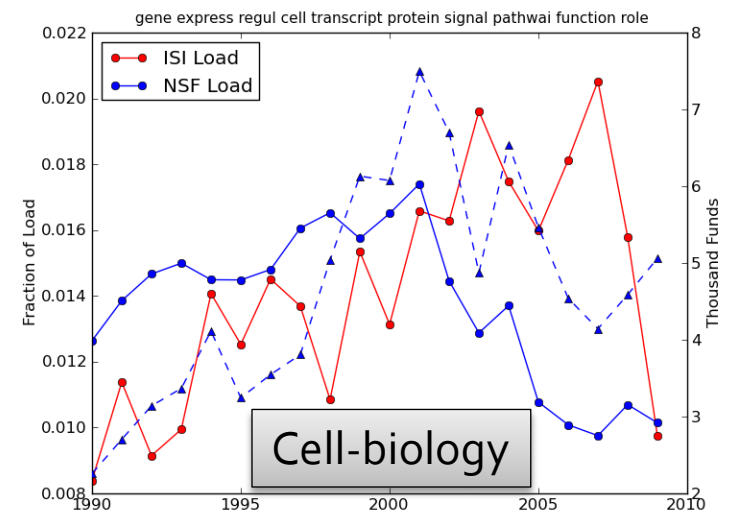
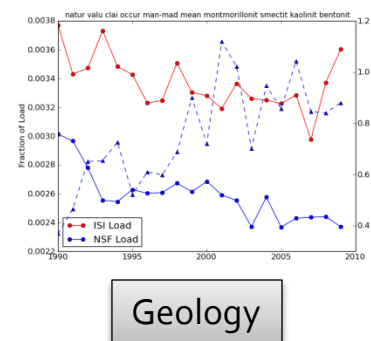
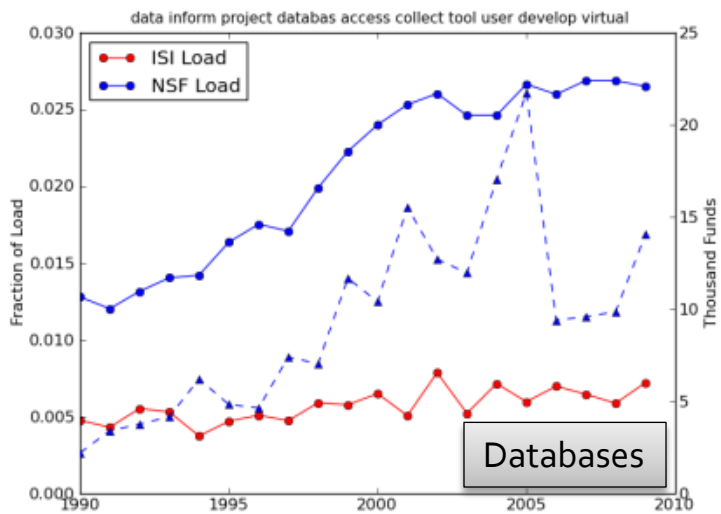
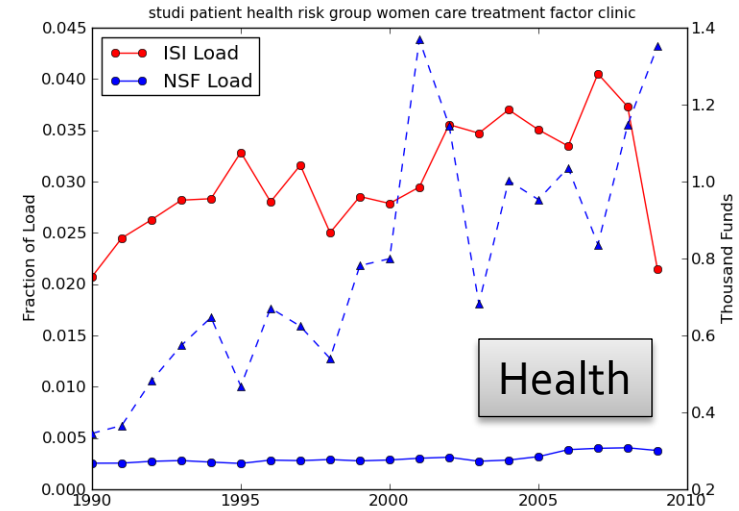
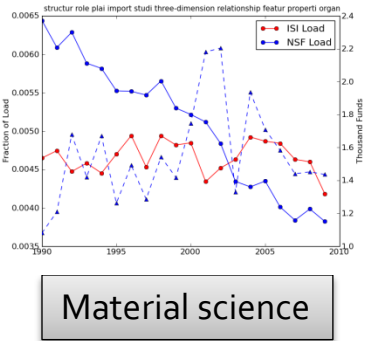
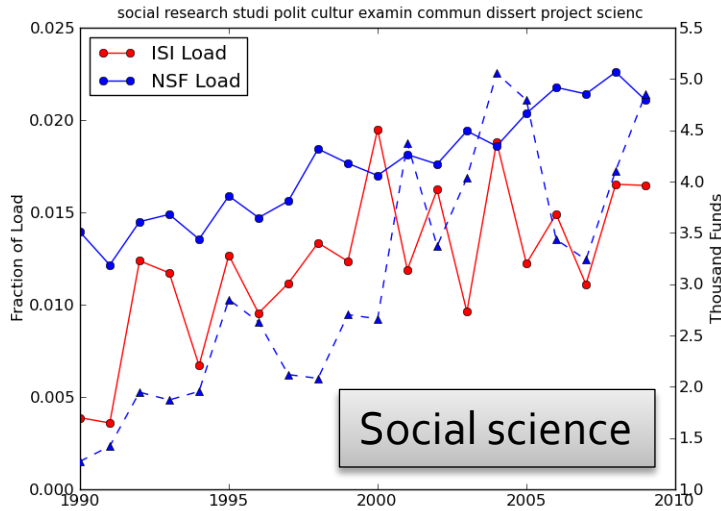
100 topics on the full combined NSF+ISI corpus (all disciplines)



More at: <http://snap.stanford.edu/proj/nsf-isi/all>

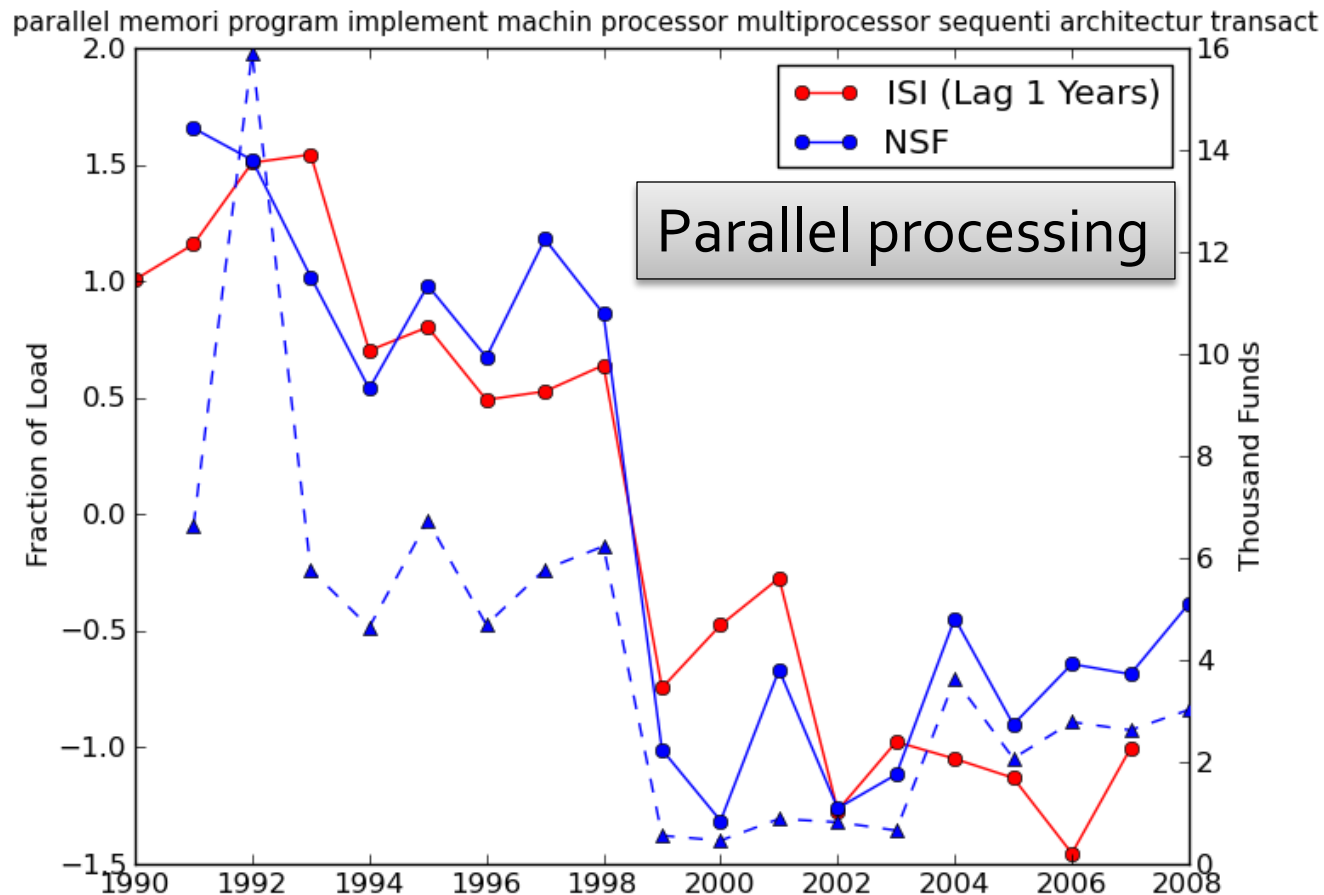
Results: Preliminaries (2)

100 topics on the full combined NSF+ISI corpus (all disciplines)



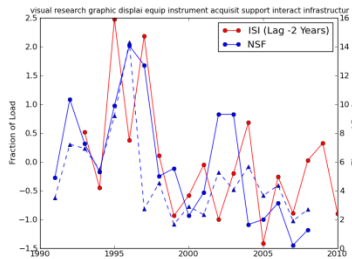
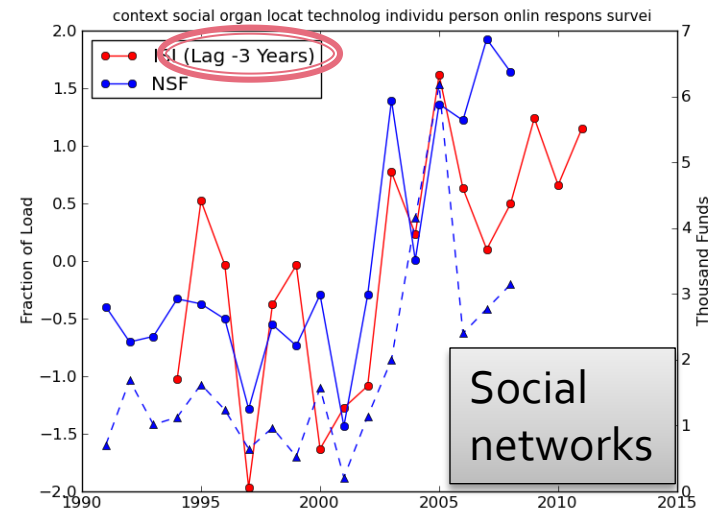
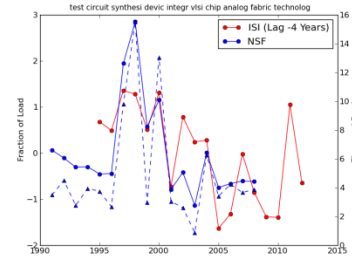
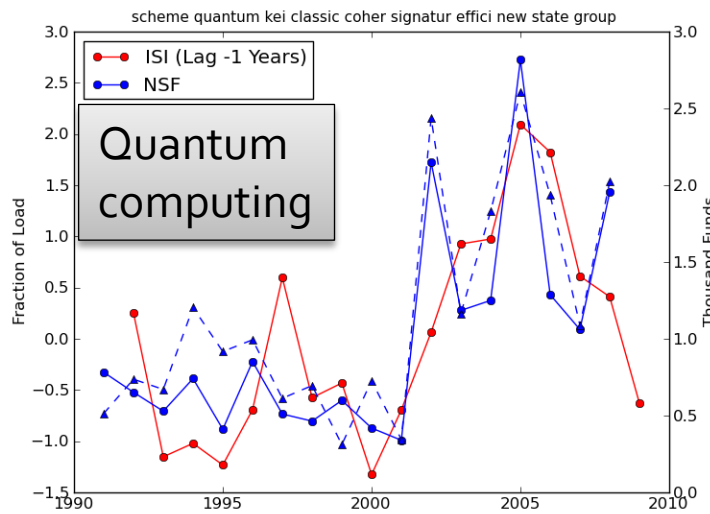
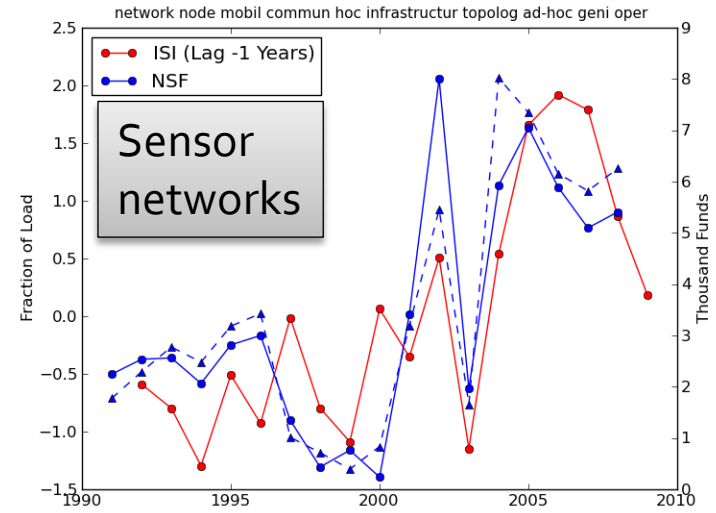
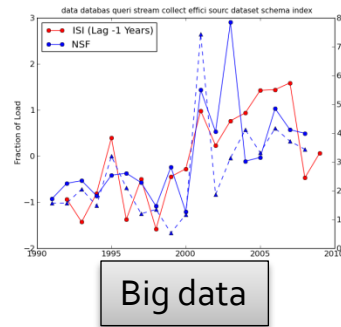
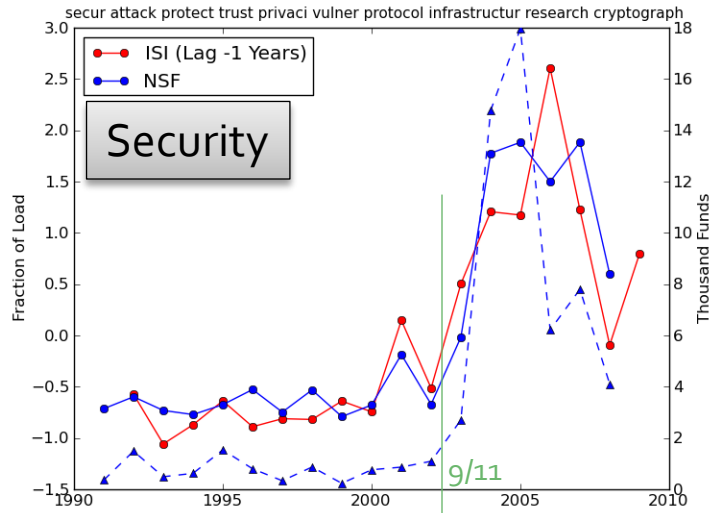
Results: Lead-Lag in CS

100 Computer science topics (NSF+ISI corpus)

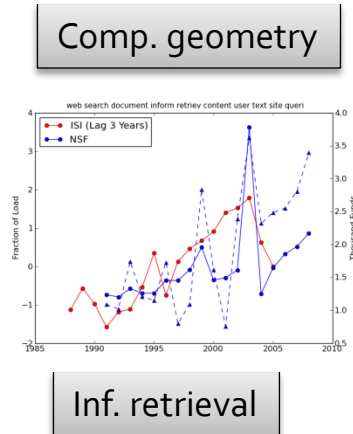
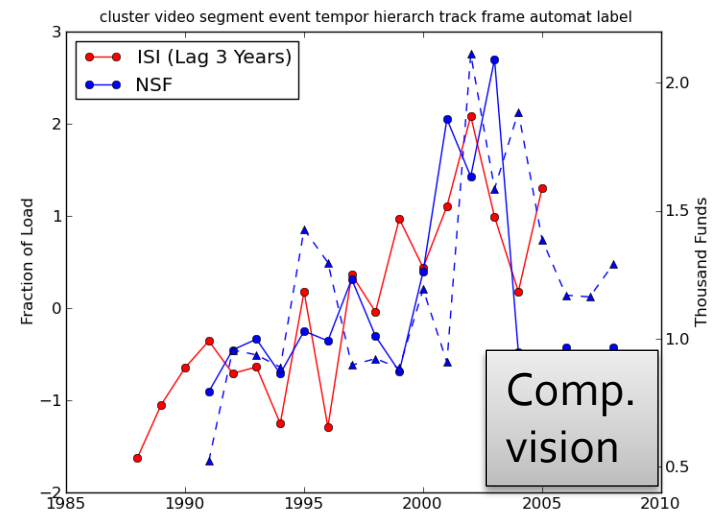
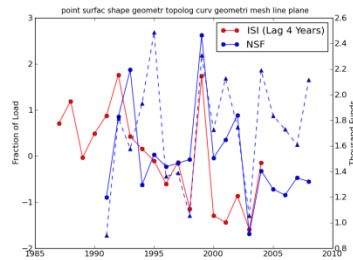
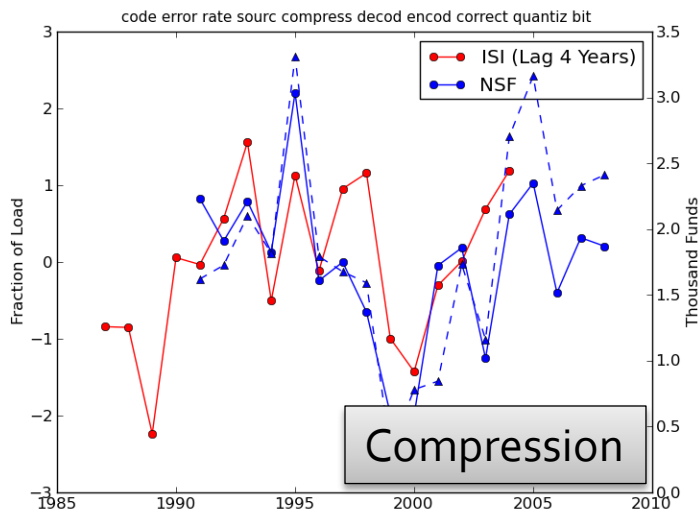
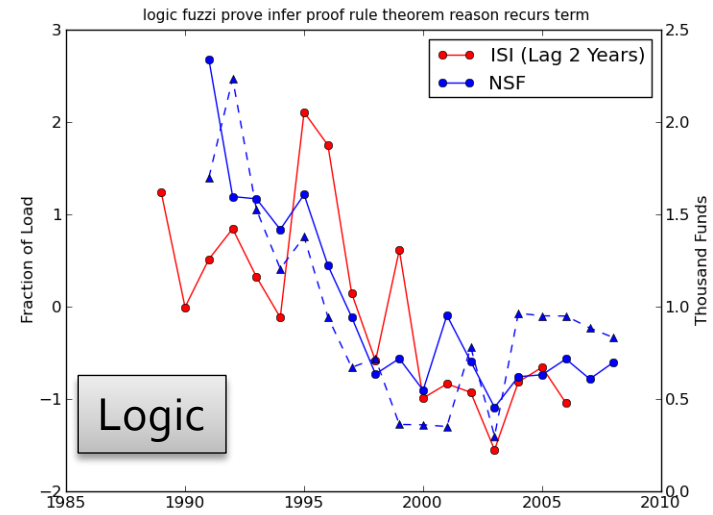
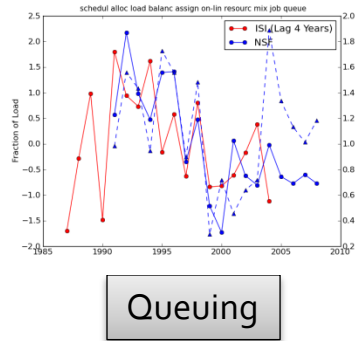
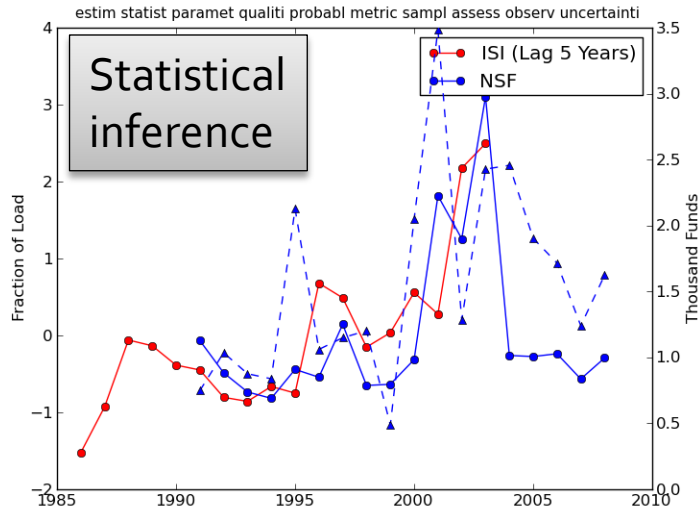


More at: <http://snap.stanford.edu/proj/nsf-isi/leadlag-cs>

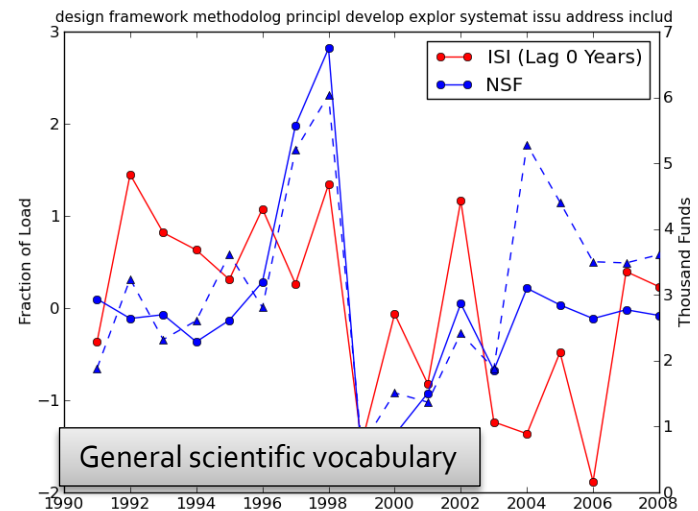
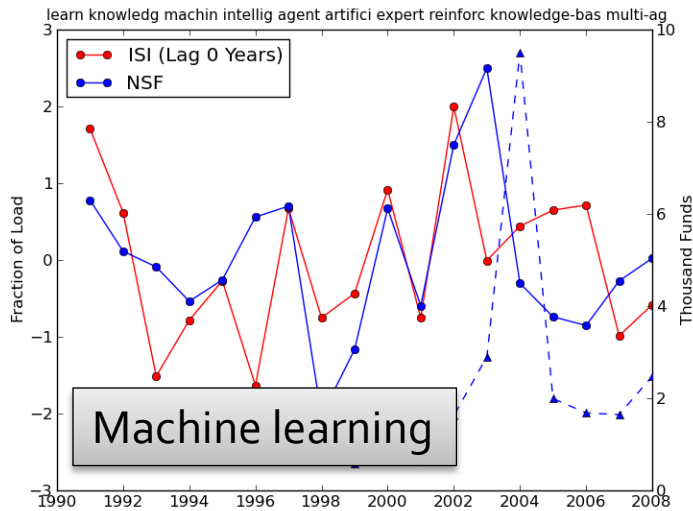
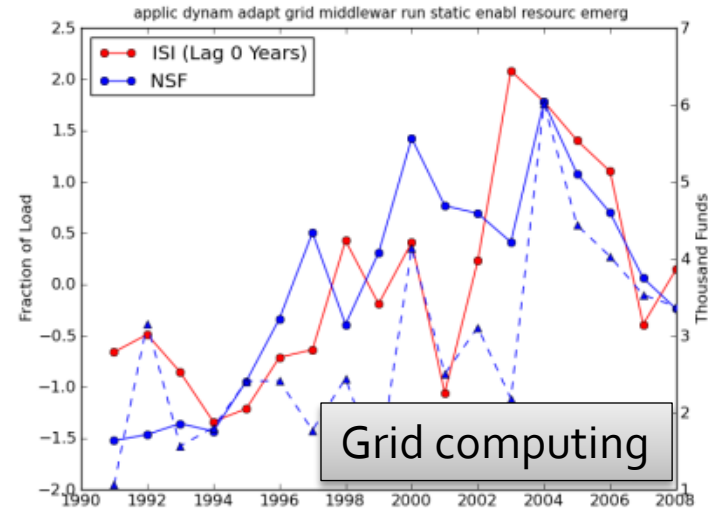
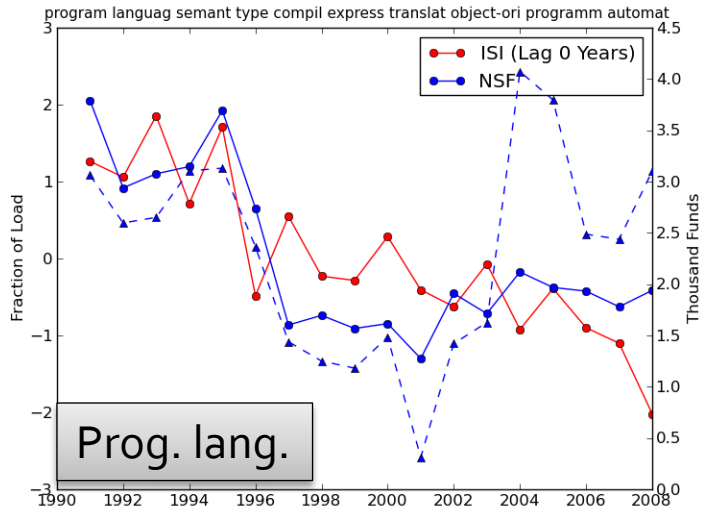
Results: NSF Lags Science



Results: NSF Leads Science



Results: NSF aligned with Science



Observations

- Based on our preliminary analysis:
 - Older & more established Computer Science topics seem to lead by NSF
 - New emerging fields are led by ISI and slowly being caught up by NSF
 - More NSF funds does not necessarily lead to shortening the lag of NSF
 - However, more NSF funds leads to higher topic load

Analysis by NSF programs

- **Methodology:**
 - For each NSF abstract find the most similar research abstract
 - Time lag between the NSF abstract and the corresponding paper
- **NSF directorates/programs are mostly leading:**
 - **Lead:**
 - Information & Data Management: Leads 1.5 years
 - Network Infrastructure: Leads 4 years
 - Digital Society & Technologies: Leads 3 years
 - Robotics and Human Augmentation: Leads 2.4 years
 - **However, some are lagging:**
 - Robust Intelligence: Lags 1.2 years
 - Human-centered Computing: Lags 1.2 years
 - Trustworthy Computing: Lags 1.8 years
 - Broadening Participation in Computing: Lags 1.6 years
 - Computational Physics: Lags 1 year
 - Sensors and Sensing Systems: Lags 1.2 years

Future work (1)

- Analysis on the non-funded proposal:
 - Do they lead science even more?
 - Is rejected too novel?
 - Rejected ideas that later had big impact
 - Science that never was
 - Or do they lag science?
- Analysis of other scientific fields:
 - Experiments suggest that NSF leads science in its core areas but lags in non-core areas (Biology, Medicine, ...)
- Can compare different databases:
 - NSF—NIH, NSF—UMI (dissertations), NSF—JSTOR,...

Future work (2)

- What kinds of science gets funded?
 - Scientific impact per dollar spent?
 - Should science go for high-risk high-reward?
- Career trajectories + networks:
 - How do scientific-collaboration and grant-collaboration networks shape career trajectories/success of starting faculty
 - What are network structures of fields that lead/lag funding?

Reflections

- Very interesting and unique data
 - Lots of interesting questions
- NORC data enclave:
 - Sooooo tedious to work with
 - Machines are too weak for any serious data analysis/processing
 - We can setup a secure data room at Stanford?
- Funding?
 - So far: Stanford Mimir Project (NSF funded) and our unrestricted (gift) funds
 - Would be nice if NSF could support our efforts