SAND2011-5070C

Okay, Now What?

Challenges in Large Data Analysis

July 26, 2011

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Scalable Analysis and Visualization
Sandia National Laboratories

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Analysis Is…

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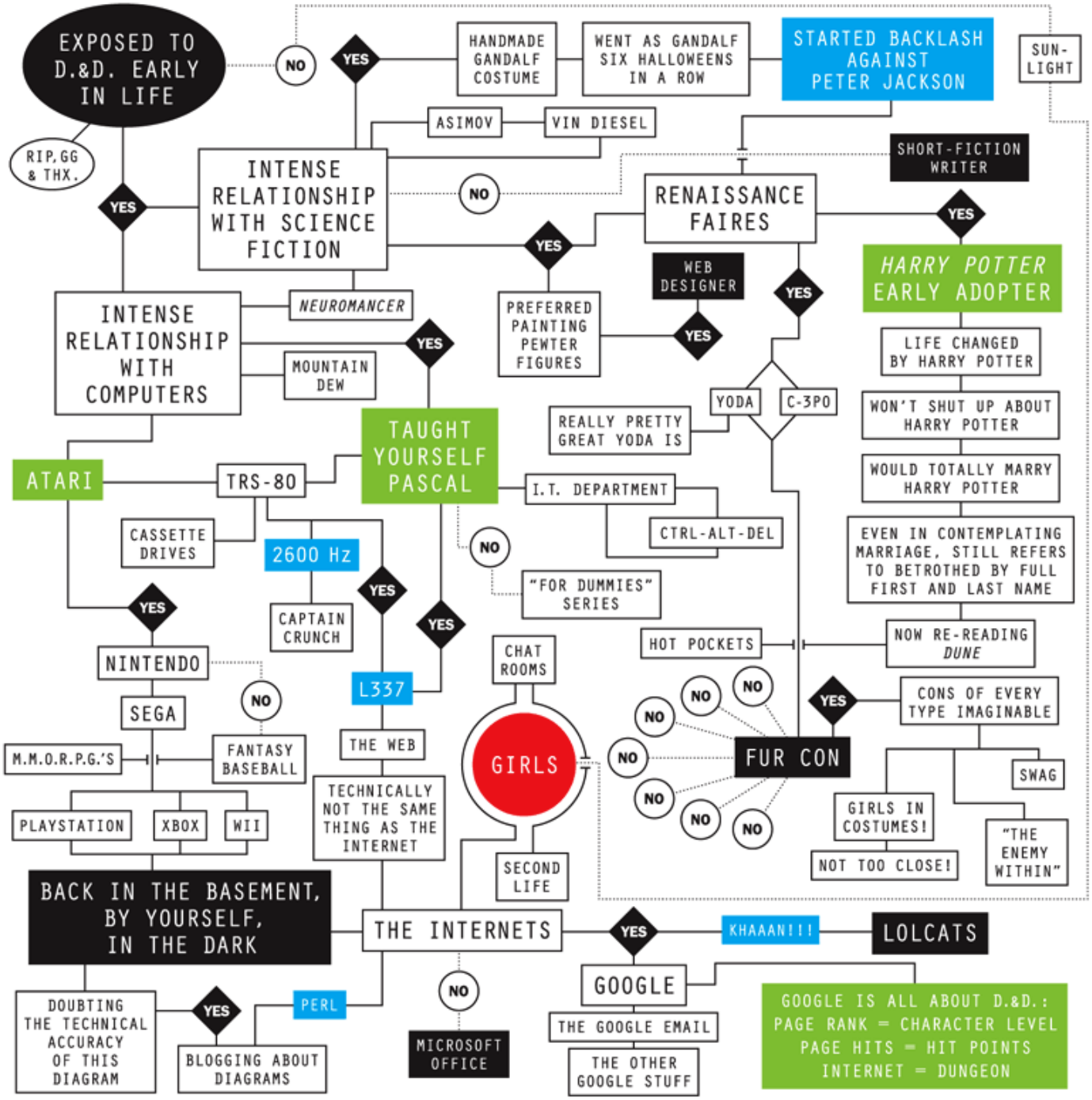

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Problem #2: The Semantic Gap

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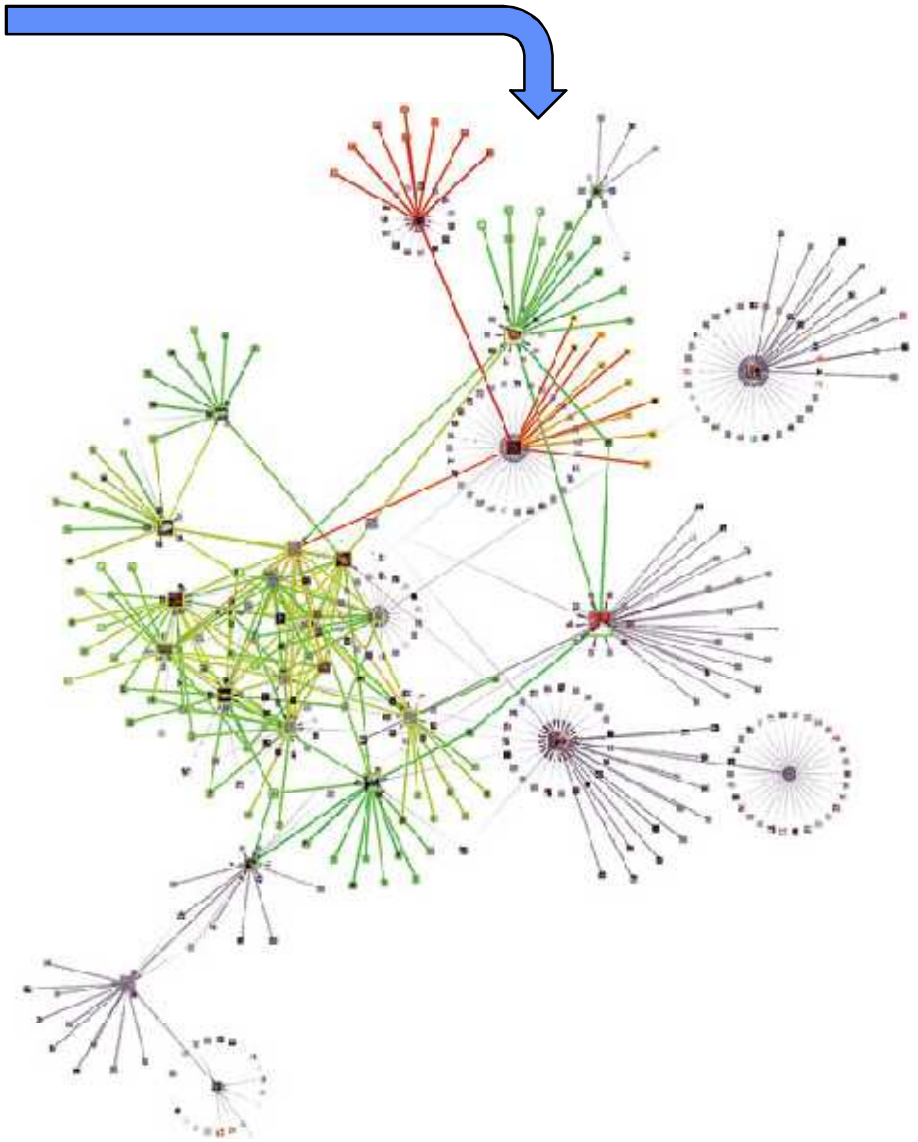
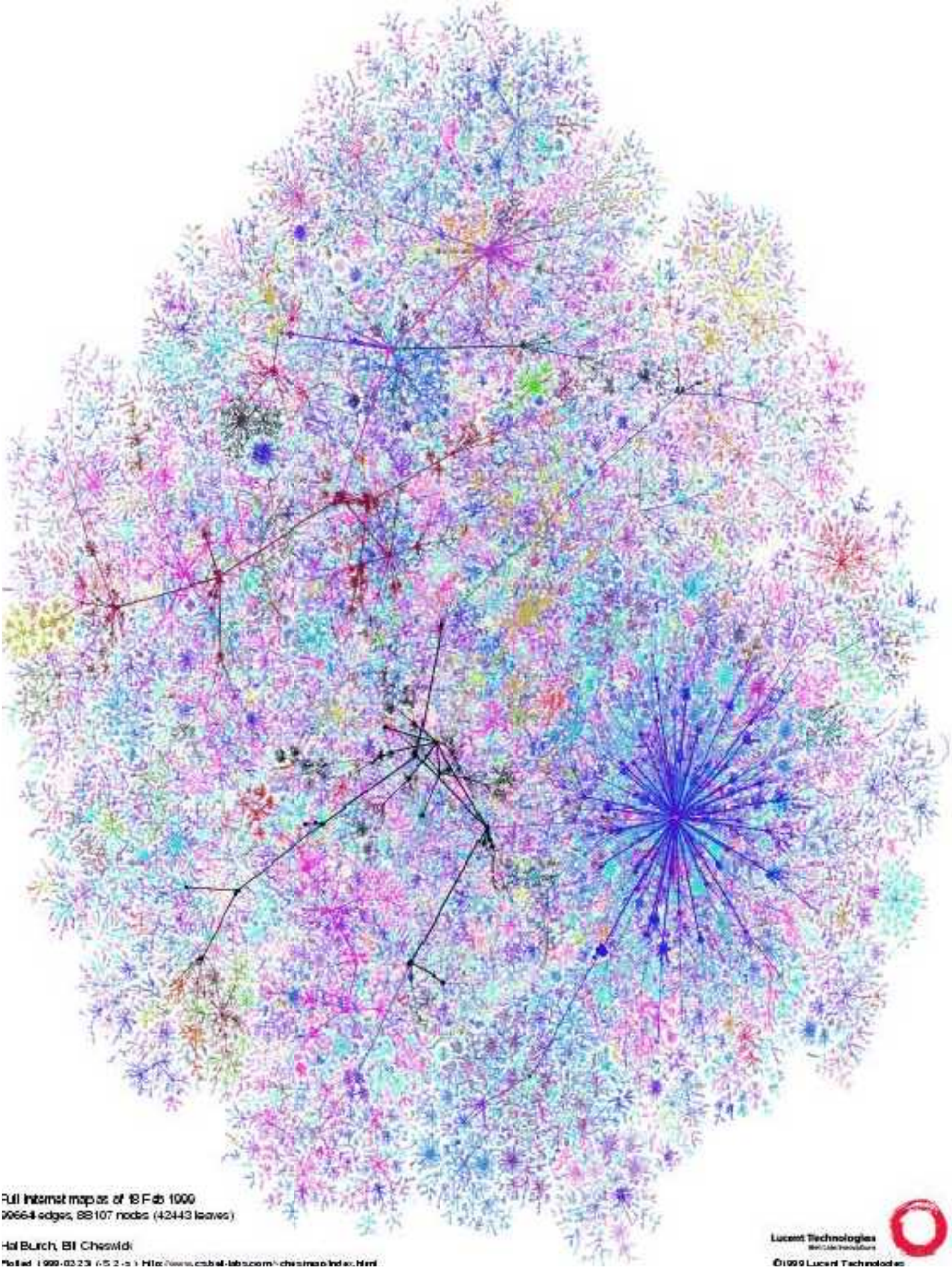


So here's what we do…

- If there are two things that computers are good at, it's
  - Handling large amounts of data and
  - Converting data from one representation to another
- Use computers to create a (hopefully manageable) amount of information in usable form. Abstract away the minute detail.
- Except…


Full Internet map as of 18 Feb 1999
99664 edges, 88107 nodes (42443 leaves)
Hal Burch, Bill Cheswick
Mapped 1999-02-23 (-5 2 -1) http://www.cs.bell-labs.com/~ches/map/index.html
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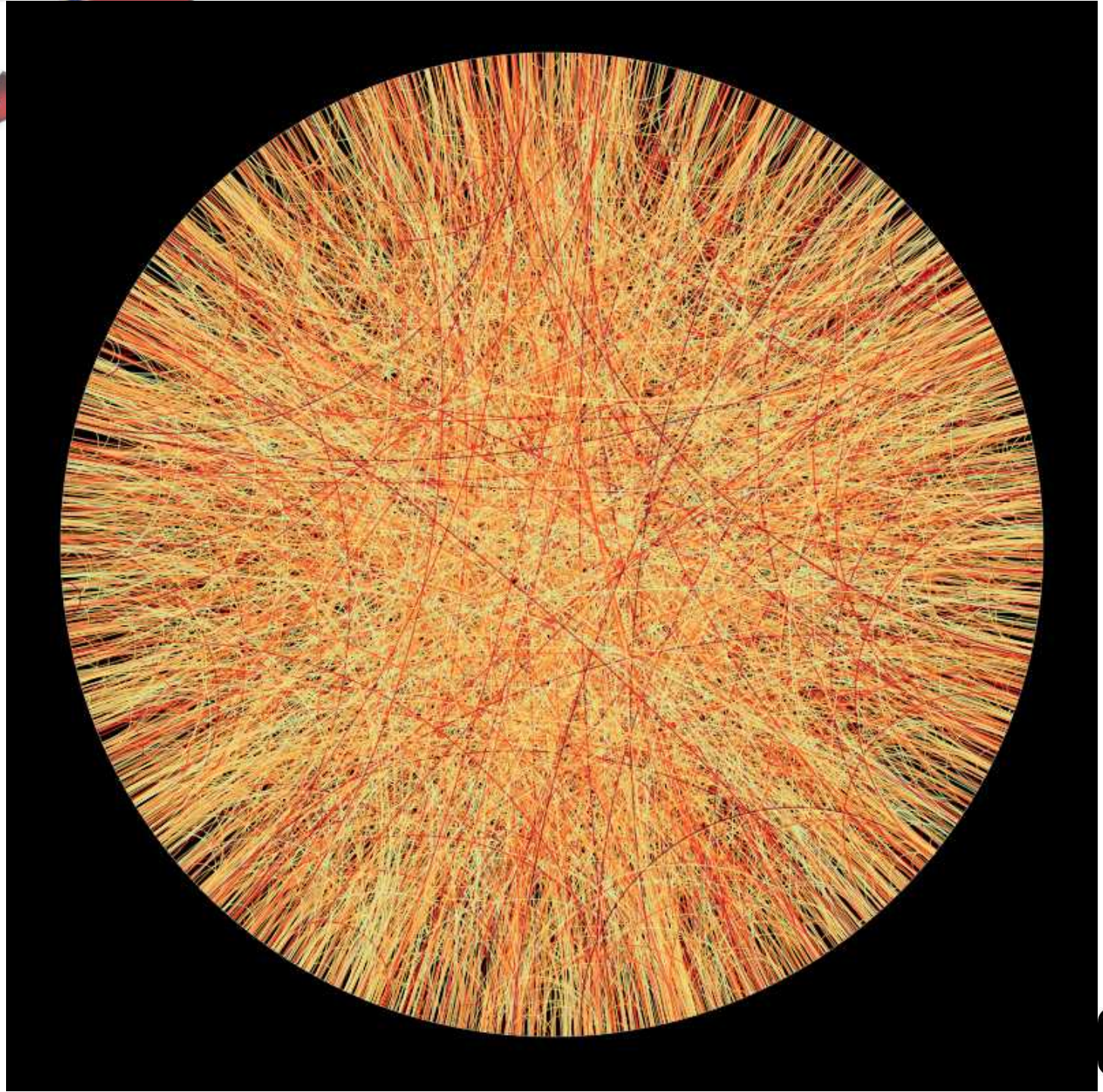

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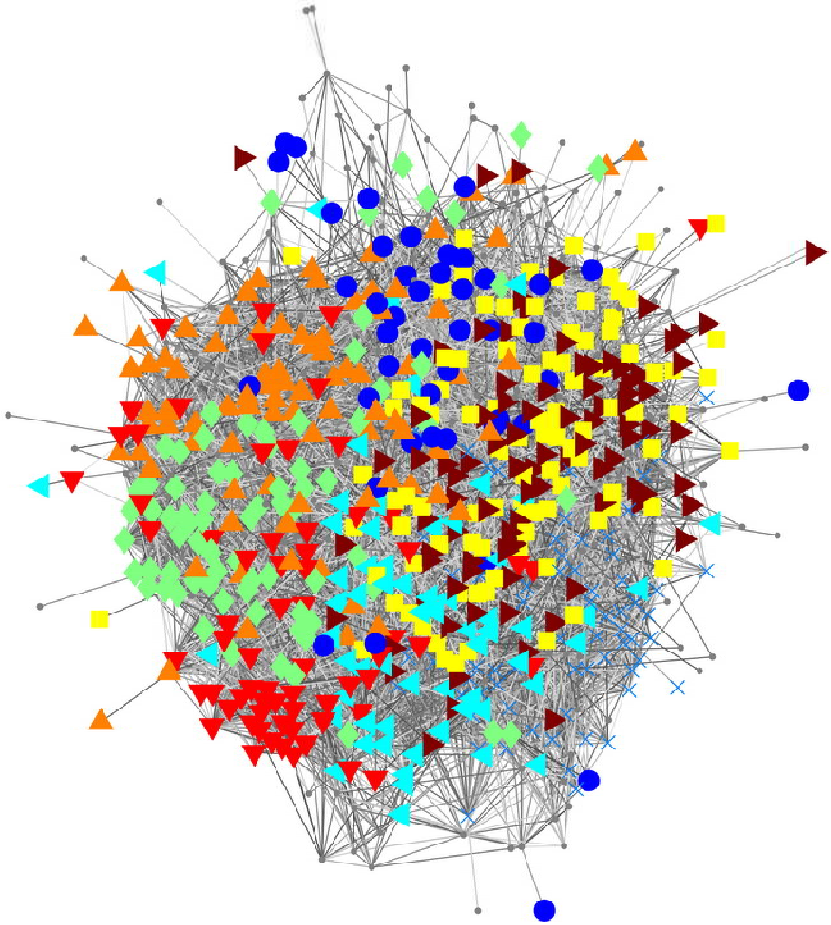

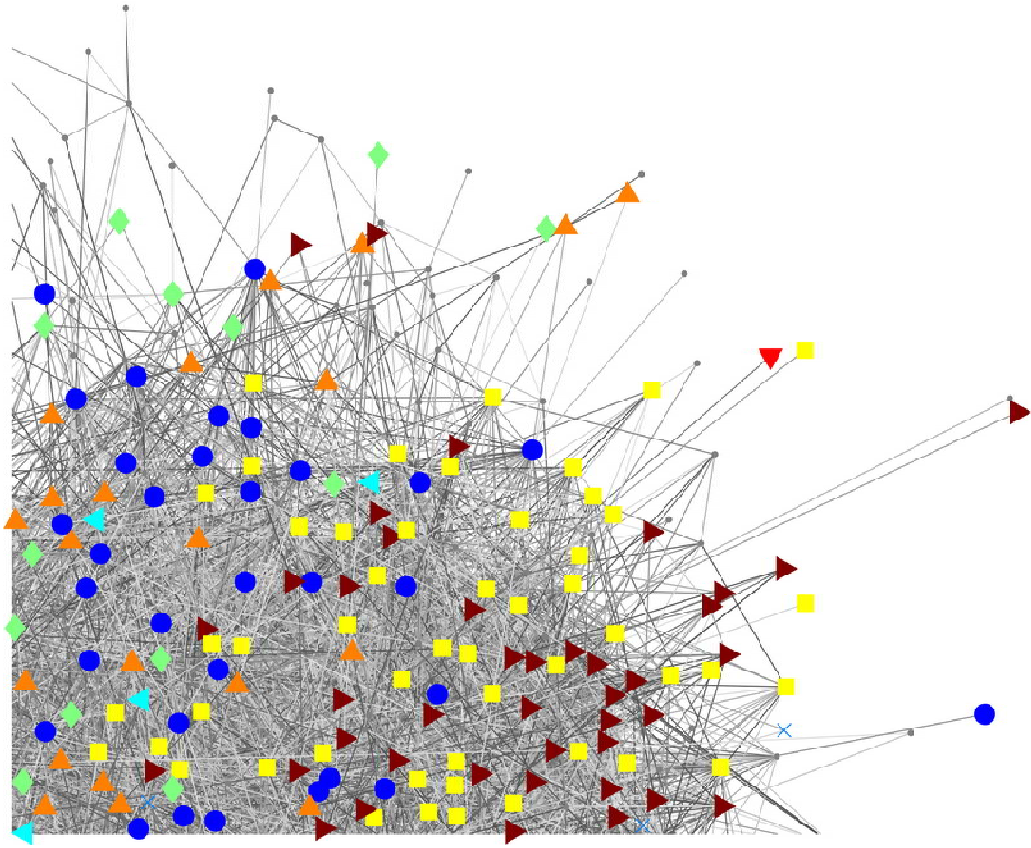

"Comparing Community Structure to Characteristics in Online Collegiate Networks", Traud et al.

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MY THESIS

Sensemaking and narrative formation are best aided by tools that provide multiscale summaries, familiar metaphors and expose more detail on request.

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Principle 1: Analyze While Computing

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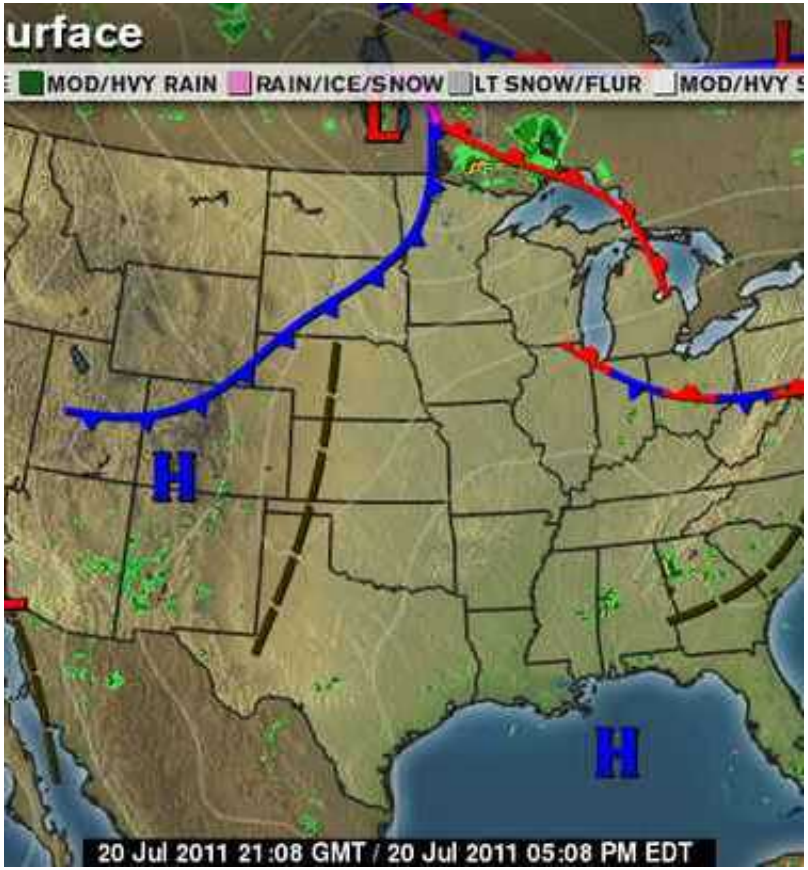
Connect analysis code to the running simulation to extract exactly the structures you want with maximum fidelity or even guide the computation.

Principle 2: Summarize at Multiple Scales



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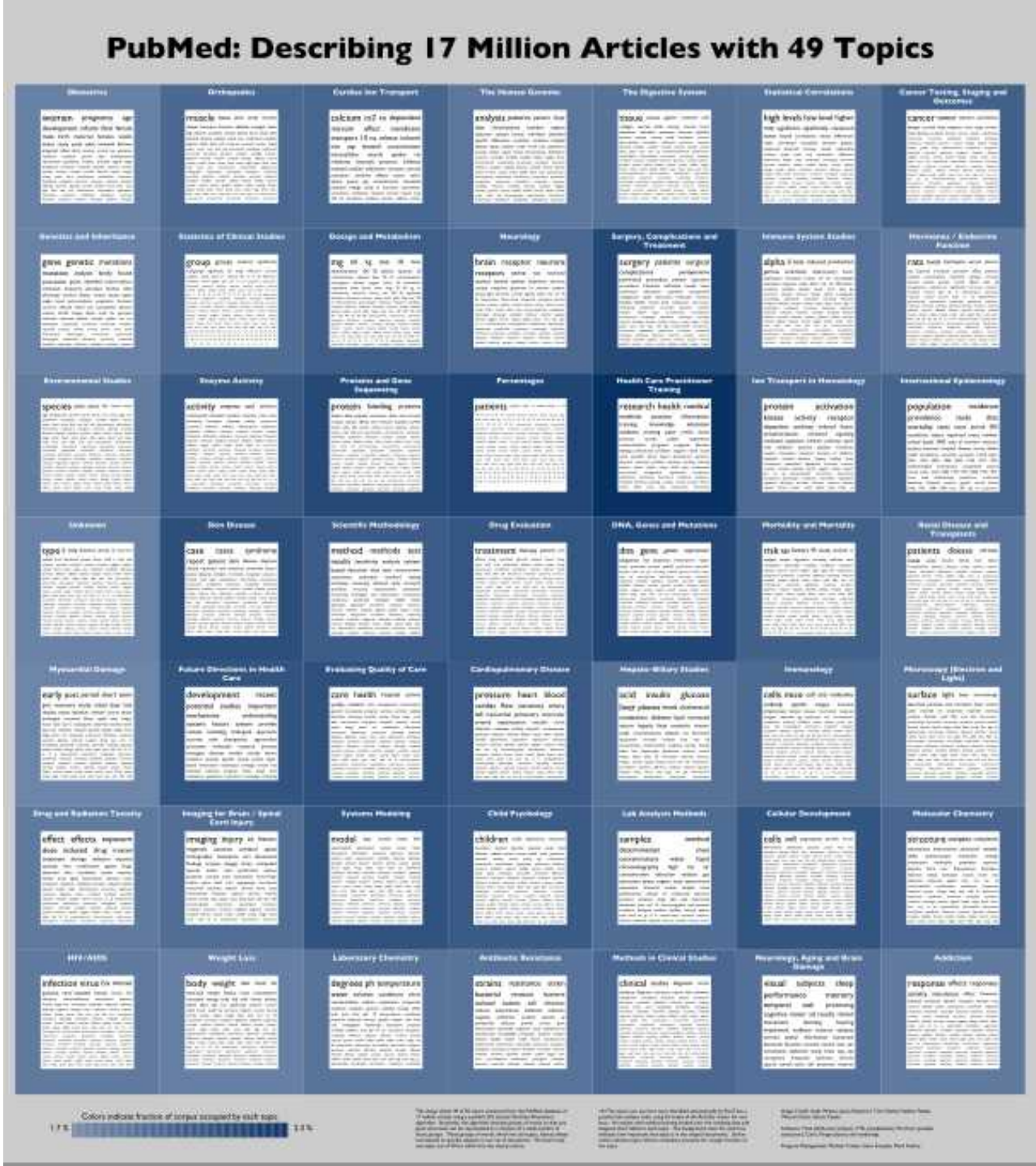
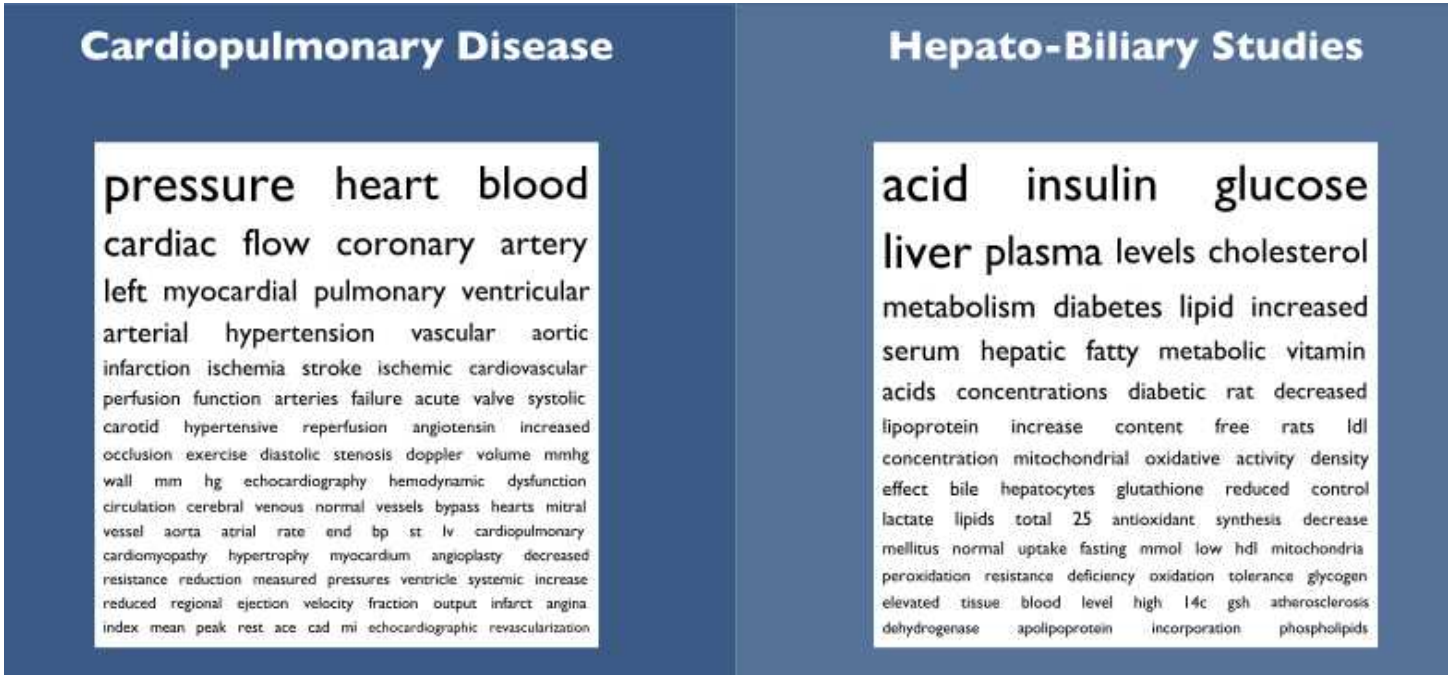
- Summarize large collections of documents by talking about the topics

- Darker squares = more “important” topics

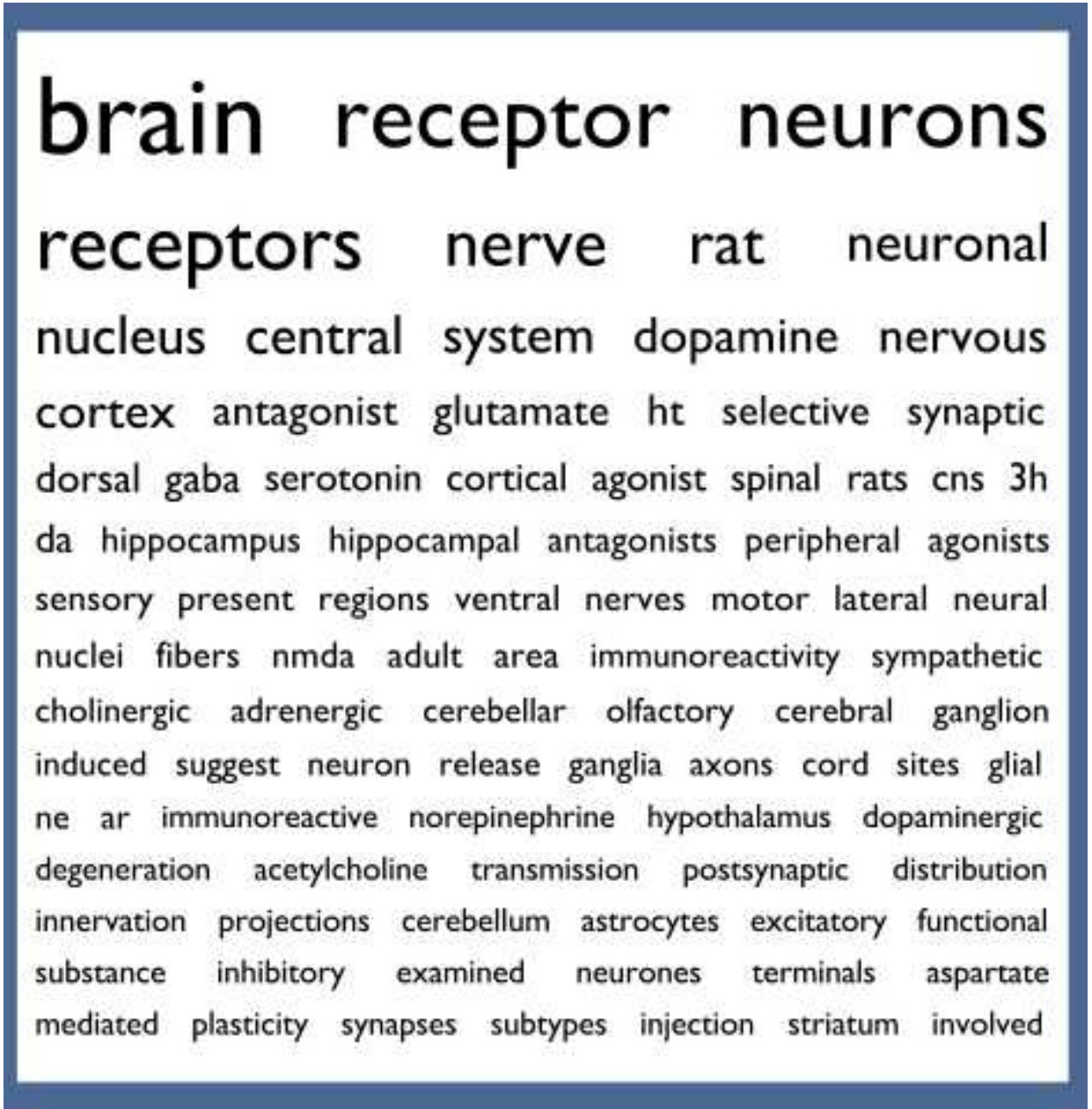


Topical Clustering: Example Topics



- Topic labels come from a subject-matter expert
- Words in each cloud sized by importance in topic

Neurology



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Principle 3: “Compared to what?”

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Principle 4: Familiar Metaphors

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Summary

- Abstraction and metaphor are necessary for large data but carry cognitive load

- Principles for Sensemaking Tools
  - Analyze While Computing
  - Summarize at Multiple Scales
  - Use Familiar Metaphors
  - “Compared To What?”

- Tie together Analyst, Toolsmith and Researcher

Backup Slides

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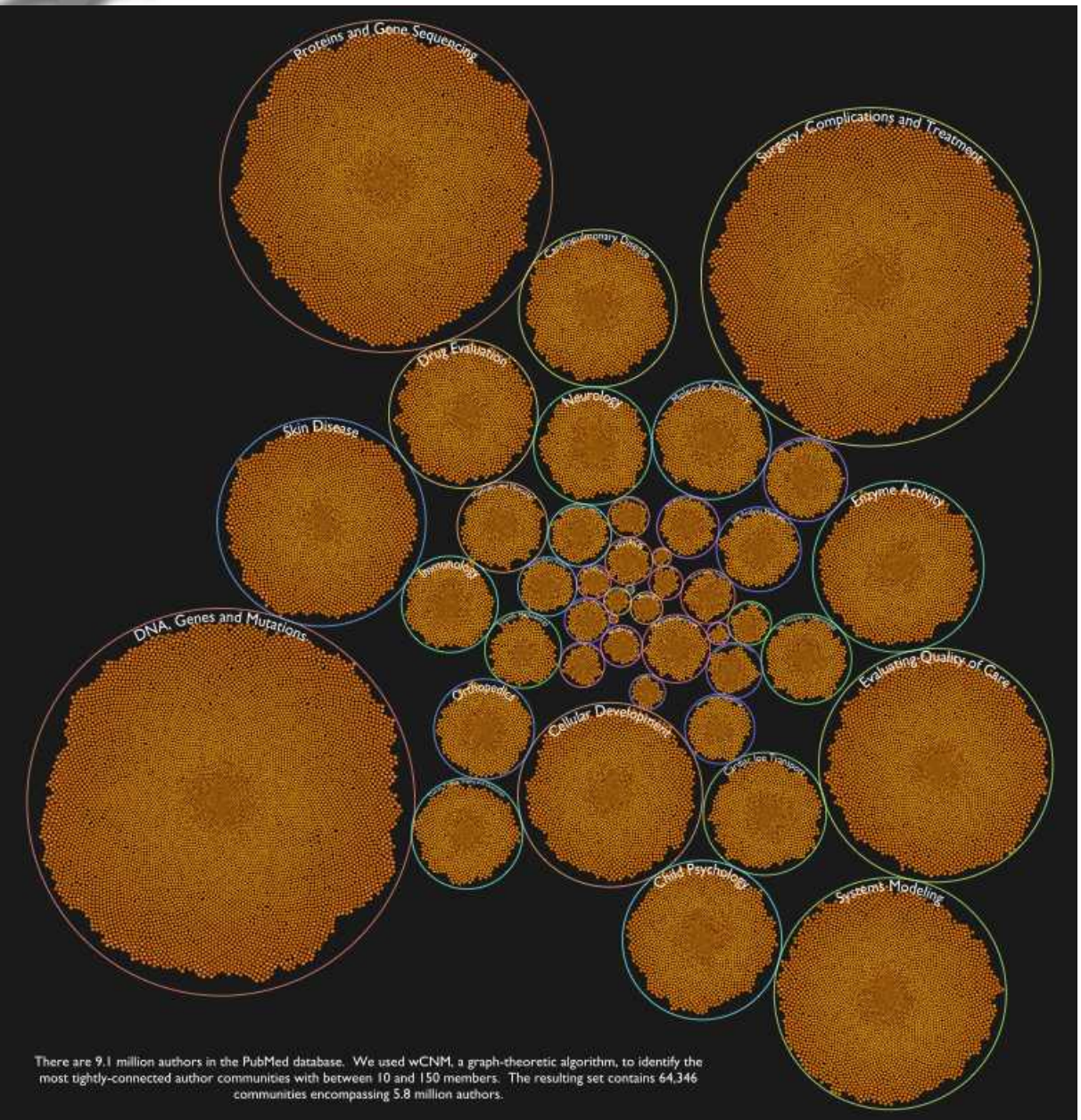

- Each blob is a topic area
- Each tiny orange dot is a single community
- 44 topics, 64,314 communities
  - 10-150 authors in each community

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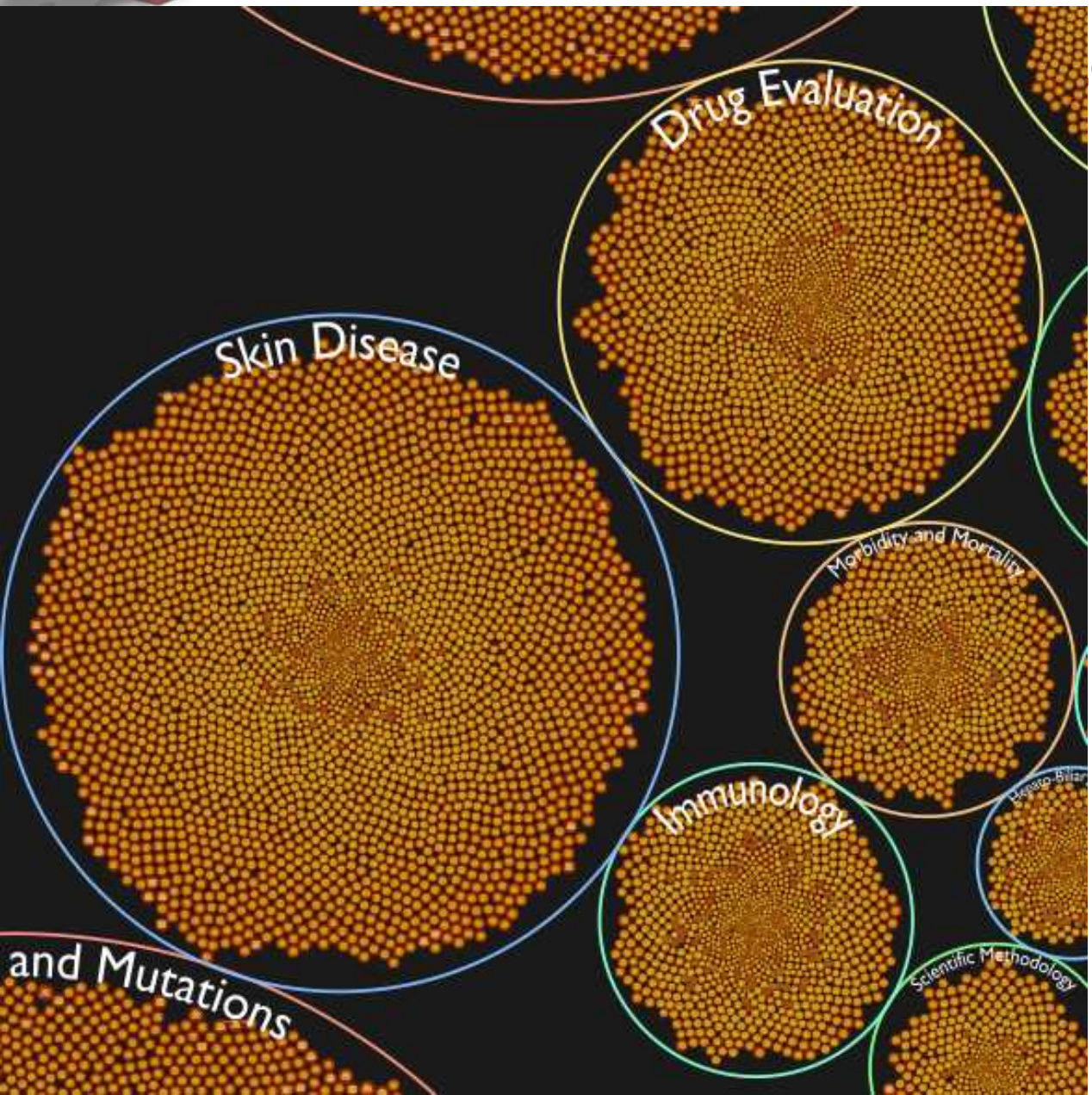

oom 1

- Topic areas contain between 5 and 9800 communities
- Each community is sized according to its author/article count

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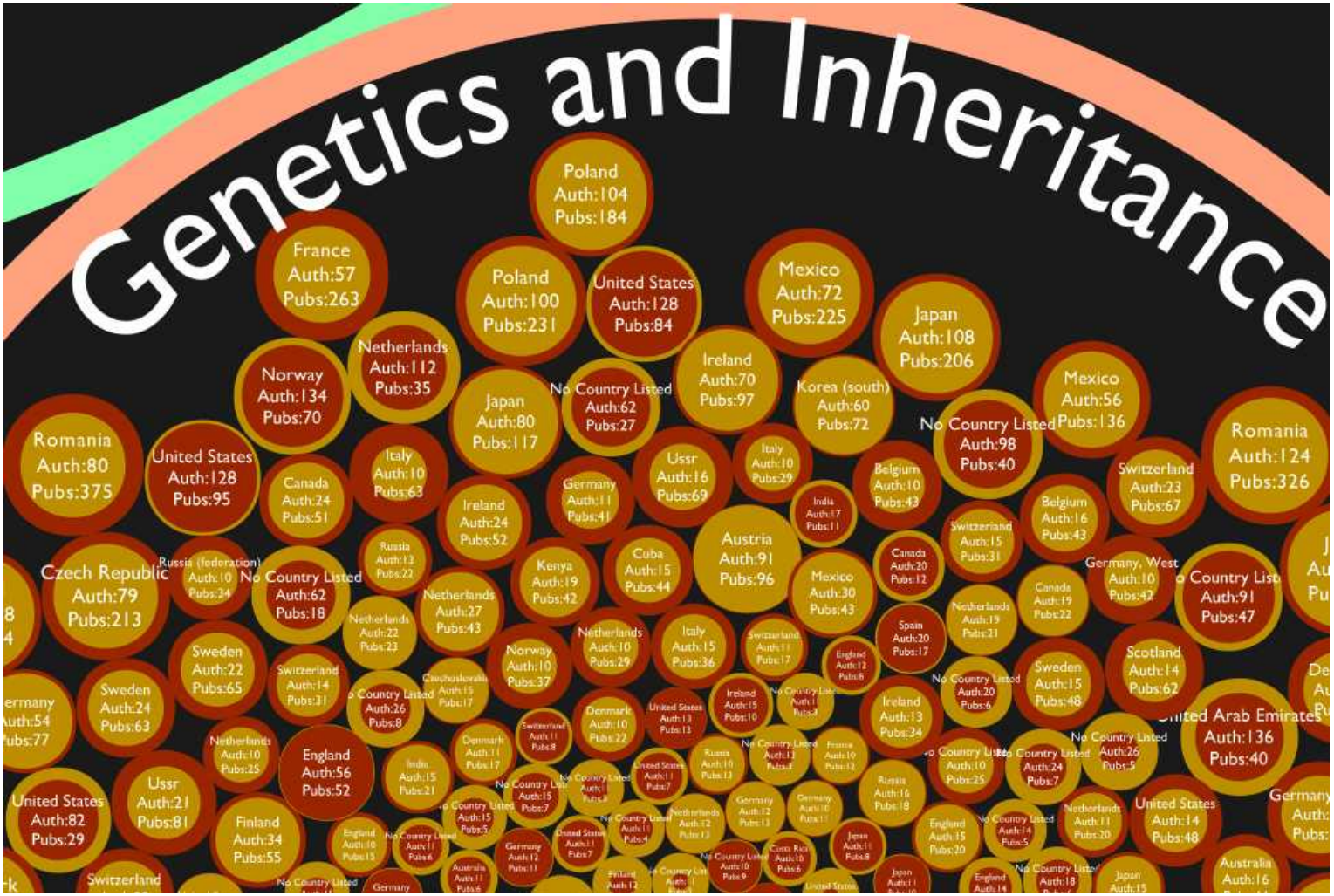
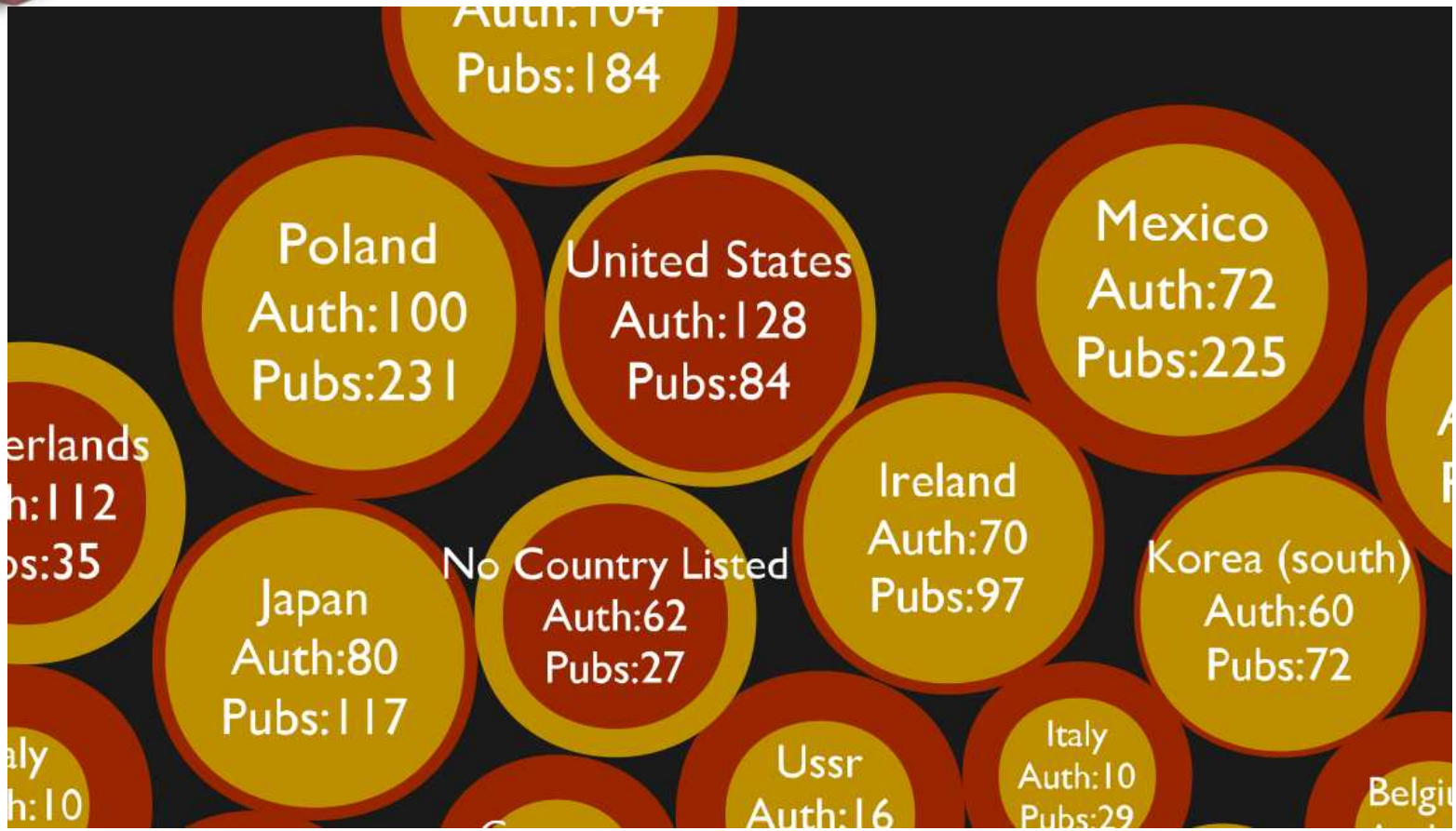


- Finer-grained topics (and diagrams) are possible
- Hierarchical layout possible with advanced clustering algorithms



- Community glyphs indicate relative proportion of authors to articles
- Red = articles, yellow = authors
- Red outside yellow means more articles than authors (and vice versa)
- Labels show country where most papers are published

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