

Citation Map: Visualizing the Spread of Scientific Ideas through Space and Time

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Outline

- **Motivation**
- **Design principles**
- **Data sources and system architecture**
- **Demo**
- **Conclusions and future work**

Motivation

- **Publication citations have great meanings**
 - Quality of the research
 - Recognition among the research community
 - Influence of a research
 - ...

Motivation

- **Web of Science**

The screenshot displays the Web of Science interface within a Mozilla Firefox browser window. The address bar shows the URL: `apps.webofknowledge.com/summary.do?product=WOS&search_mode=GeneralSearch&qid=1&SID=2D20c43Kdbi8G61eEgK&page=1&ac`. The page title is "Web of Knowledge [v.5.9] - Web of Science Results".

The interface includes a navigation menu with "All Databases", "Select a Database", "Web of Science", and "Additional Resources". Below this is a search bar and a "Search" button. The main content area shows the "Web of Science®" logo and search results for the topic "GIS". The search parameters are: "Topic=(GIS)", "Timespan=All Years", "Databases=SCH-EXPANDED, SSCI, A&HCI". There are buttons for "Create Alert" and "RSS".

The results section shows "Results: 24,358" and "Page 1 of 2,436". The sorting is set to "Times Cited -- highest to lowest". A "Refine Results" sidebar is visible on the left, with sections for "Web of Science Categories" and "Document Types".

The main list of results includes:

- Title: **Predictive habitat distribution models in ecology**
Author(s): Guisan, A; Zimmermann, NE
Source: ECOLOGICAL MODELLING Volume: 135 Issue: 2-3 Pages: 147-186 DOI: 10.1016/S0304-3800(00)00354-9
Published: DEC 5 2000
Times Cited: 1,967 (from Web of Science)
UC-eLinks [View abstract]
- Title: **Very high resolution interpolated climate surfaces for global land areas**
Author(s): Hijmans, RJ; Cameron, SE; Parra, JL; et al.
Source: INTERNATIONAL JOURNAL OF CLIMATOLOGY Volume: 25 Issue: 15 Pages: 1965-1978 DOI: 10.1002/joc.1276
Published: DEC 2005
Times Cited: 1,908 (from Web of Science)
UC-eLinks [View abstract]
- Title: **LOCAL INDICATORS OF SPATIAL ASSOCIATION - LISA**
Author(s): ANSELIN, L
Source: GEOGRAPHICAL ANALYSIS Volume: 27 Issue: 2 Pages: 93-115 Published: APR 1995
Times Cited: 1,118 (from Web of Science)
UC-eLinks [View abstract]
- Title: **Large area hydrologic modeling and assessment - Part 1: Model development**
Author(s): Arnold, JG; Srinivasan, R; Muttiah, PS; et al.

Motivation

- **Google Scholar**

The screenshot shows a Mozilla Firefox browser window with the address bar containing the URL: `scholar.google.com/scholar?q=geographical+information+science+michael&btnG=&hl=en&as_sdt=0%2C5`. The search results page displays the following information:

- Search Results:** About 890,000 results (0.14 sec)
- Articles:**
 - Geographical information science** [PDF] from univie.ac.at

MF Goodchild - *International Journal of Geographical Information ...*, 1992 - Taylor & Francis

Abstract. Research papers at conferences such as EGIS and the International Symposia on Spatial Data Handling address a set of intellectual and scientific questions which go well beyond the limited technical capabilities of current technology in **geographical information ...**

[Cited by 632](#) [Related articles](#) [All 21 versions](#) [Cite](#) [More](#)
 - Geographic information systems and science** [PDF] from tu-darmstadt.de

PA Longley, MF Goodchild, DJ Maguire, DW Rhind - 2005 - books.google.com

The first edition of **Geographic Information Systems and Science** has taken the GIS textbook market by storm, selling over 22,000 copies since publication. It is the most current, authoritative and comprehensive treatment of the field, that goes from fundamental ...

[Cited by 1962](#) [Related articles](#) [All 23 versions](#) [Cite](#) [More](#)
 - Geographical information systems: principles and applications. Volume 2: applications.**

DJ Maguire, MF Goodchild, DW Rhind - 1991 - cabdirect.org

... Document details. Title Remove from marked Records **Geographical information systems: principles and applications. Volume 2: applications. ...** DJ;Goodchild, MF;Rhind, DW Book **Geographical information systems: principles and applications. Volume 2: applications. 1991 ...**

[Cited by 633](#) [Related articles](#) [All 5 versions](#) [Cite](#) [More](#)
 - GIS: A computing perspective**

M Worboys, M Duckham - 2004 - books.google.com

... **Mike** Worboys, 1995 Page 17. Authors **Mike** Worboys is a professor in the Department of Spatial Information **Science** and Engineering, and at the ... He holds a PhD in pure mathematics, and has worked for many years on com- putational aspects of **geographic information. ...**

On the left side of the page, there are filters and options:

- Any time:** Since 2013, Since 2012, Since 2009, Custom range...
- Sort by:** relevance (selected), Sort by date
- include patents
- include citations
- Create alert

Motivation

- Microsoft Academic Search

The screenshot shows a web browser window displaying search results for "citizens as sensors" on Microsoft Academic Search. The browser's address bar shows the URL: `academic.research.microsoft.com/Search?query=citizens as sensors`. The search results page includes a sidebar with various academic fields and their respective result counts, such as Computer Science (221) and Engineering (55). The main content area lists several publications, with the first one being "Citizens as Sensors: the World of Volunteered Geography" by Michael F. Goodchild, which has 179 citations. The second result is "Spatio-Temporal-Thematic Analysis of Citizen Sensor Data: Challenges and Experiences" with 11 citations. The third result is "CITIZENS AS SENSORS: WEB 2.0 AND THE VOLUNTEERING OF GEOGRAPHIC INFORMATION" with 9 citations. The page also features a "Subscribe" button and a "Share this on" button at the bottom right.

Motivation

- **The number of citations has often been used to measure the influence of scientific publications.**
- **Can we know the influence of a paper by just looking at a number?**

Motivation

- **An interesting case:**
 - Two papers, each has 100 citations.
 - The citations of one paper are restricted in one country, while the citations of the other are spread throughout the world.
 - Can we say they have the same or even just similar influence?

Motivation

- Therefore, a citation map, which shows the geographical distribution of citations, can help us learn more about the influence of a paper.
- Such a map can also visualize the process in which a scientific idea was first generated at a particular location, and then spread to different places all around the world.

Design principle

- **Publication geolocating:** the first author's institution has been selected to locate papers.
- **Geospatial scale:** a world map has been employed as the base map.

Design principle

- **Temporal representation:** graduated colors have been used to visualize citations in different years.
- **Most frequent citations:** curves in different colors are used to link scholars who have cited a paper most frequently with the author.

Data sources

- **Publication, citation, and author's information are from Microsoft Academic Search.**
- **Base map data is from OpenStreetMap, and rendered by CloudMade.**



System architecture

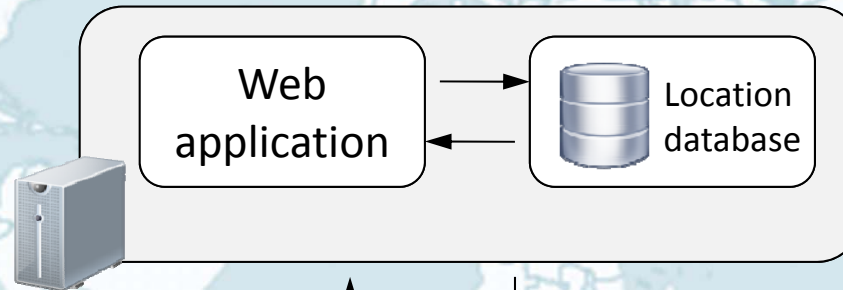


Data request

Map data

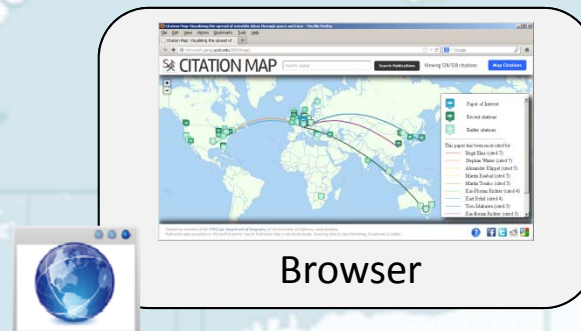
Publication, citation data

Authors, keywords

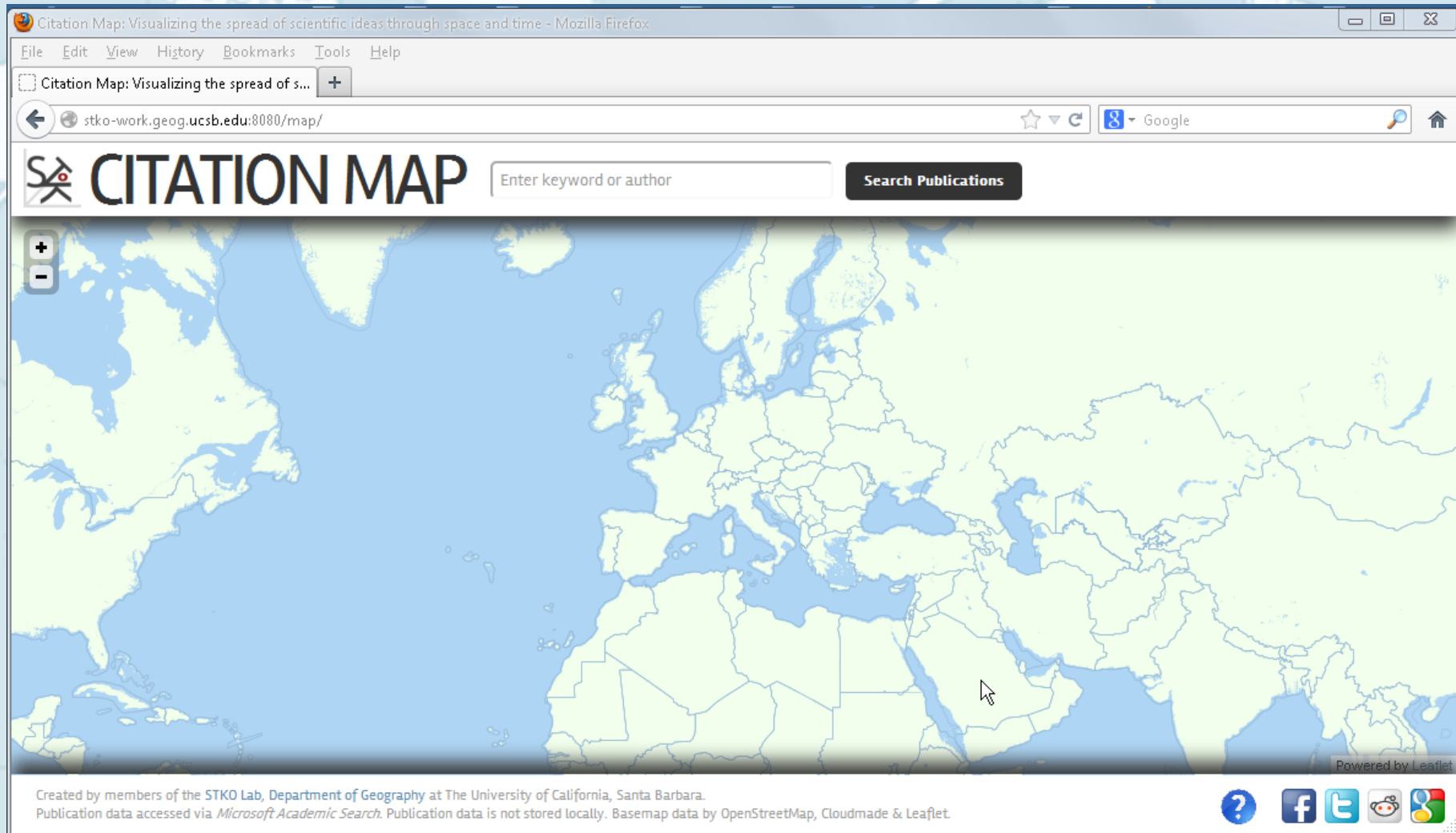


Ajax request

Ajax response



Demo




Citation Map: Visualizing the spread of scientific ideas through space and time - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Citation Map: Visualizing the spread of s... +


stko-work.geog.ucsb.edu:8080/map/ Google

 **CITATION MAP**

Map interface showing a world map with a search bar and navigation controls.

Powered by Leaflet

Created by members of the STKO Lab, Department of Geography at The University of California, Santa Barbara.
Publication data accessed via *Microsoft Academic Search*. Publication data is not stored locally. Basemap data by OpenStreetMap, Cloudmade & Leaflet.



Conclusions

- The citation map can visualize the spread of scientific ideas through space and time
- Provide an alternative way to evaluate the spatial influence of publications and researchers
- Help researchers find potential collaborators

Future work

- A “geospatial-index” to measure a publication’s influence on the geographical scale?
- Including other co-authors in the citation frequency analysis.