

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

Web of Knowledge [v.5.9] - Web of Science Results - Mozilla Firefox

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Web of Knowledge [v.5.9] - Web of S...

apps.webofknowledge.com/summary.do?product=WOS&search_mode=GeneralSearch&qid=1&SID=2D20c43Kdbi8G61eEgK&page=1&ac

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Web of Science®

Results Topic=(GIS)
Timespan=All Years. Databases=SCH-EXPANDED, SSCI, A&HCI.

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Scientific WebPlus BETA View Web Results >>

Results: 24,358 Page 1 of 2,436 Go Sort by: Times Cited -- highest to lowest

Refine Results

Search within results for

Web of Science Categories Refine

- ENVIRONMENTAL SCIENCES (4,870)
- GEOSCIENCES MULTIDISCIPLINARY (4,209)
- GEOGRAPHY PHYSICAL (2,721)
- WATER RESOURCES (2,690)
- GEOGRAPHY (2,622)

Document Types Refine

- ARTICLE (22,687)
- PROCEEDING'S PAPER (2,277)
- REVIEW (513)
- BOOK REVIEW (346)
- MEETING ABSTRACT (330)

Research Areas

Authors

Save to: ENDNOTE® WEB ENDNOTE® I Wrote These Publications R Analyze Results

more options

- 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; Mutiiah, PS; et al.

Motivation

- **Google Scholar**

The screenshot shows a Mozilla Firefox browser window displaying a Google Scholar search for "geographical information science". The search results page shows approximately 890,000 results found in 0.14 seconds. The left sidebar contains filters for "Articles", "Legal documents", "Any time" (with options for "Since 2013", "Since 2012", "Since 2009", and "Custom range..."), "Sort by relevance" (with "Sort by date" as an option), and checkboxes for "include patents" and "include citations". There is also a "Create alert" option. The main content area lists several results:

- 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](#)
- Legal documents**
- Any time**
 - Since 2013
 - Since 2012
 - Since 2009
 - Custom range...
- Sort by relevance**
 - Sort by date
- include patents
- include citations
- Create alert

Additional results shown include:

- book** **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](#)
- book** **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](#)
- book** **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. ...**

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 category filters, a main list of publications, and a "Share this on" button at the bottom right.

Search Results:

- Computer Science (221)**
- Engineering (55)**
- Medicine (14)**
- Geosciences (13)**
- Social Science (7)**
- Chemistry (5)**
- Environmental Sciences (4)**
- Biology (4)**
- Mathematics (1)**
- Economics & Business (1)**
- Multidisciplinary (88)**

Publications (407)

Citizens as Sensors: the World of Volunteered Geography (Citations: 179) [View...](#)

Michael F. Goodchild
 ...voluntarily by individuals. sites such as wikimapia and openstreetmap are empowering **citizens** to create a global patchwork...new phenomenon to more traditional **citizen** science and the role of...
 Journal: *Geojournal*, vol. 69, no. 4, pp. 211-221, 2007

Spatio-Temporal-Thematic Analysis of Citizen Sensor Data: Challenges and Experiences (Citations: 11)

Meenakshi Nagarajan, Karthik Gomadam, Amit P. Sheth, Ajith Ranabahu, Raghava Mutharaju, Ashutosh Jadhav
 ...spatio-temporal-thematic analysis of **citizen-sensor** observations pertaining to real-world events. using twitter as a platform for obtaining crowd...
 Conference: *Web Information Systems Engineering - WISE*, pp. 539-553, 2009

CITIZENS AS SENSORS: WEB 2.0 AND THE VOLUNTEERING OF GEOGRAPHIC INFORMATION (Citations: 9)

MICHAEL F. GOODCHILD

Crowdsourcing, citizen sensing and Sensor Web technologies for public and environmental health surveillance and crisis management: trends, OGC standards and application examples

Maged Kamel Boulos, Bernd Resch, David N. Crowley, John G. Breslin, Gunho Sohn, Edwin R. Burtner, William A. Pike, Eduardo Jezierski, Kuo Yu Slayer Chuang
 methodology involved in the application as well as some of its capabilities. wikification. geospatial consortium (ogc) standards.

Share this on [f](#) [t](#)

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

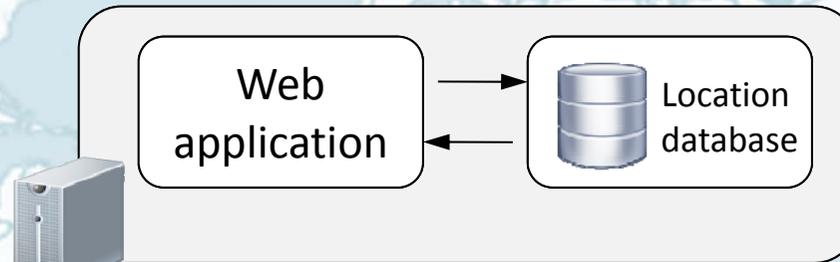


Data request ↑

Map data ↓

Publication, citation data ↓

Authors, keywords ↑



Ajax request ↑

Ajax response ↓



Demo

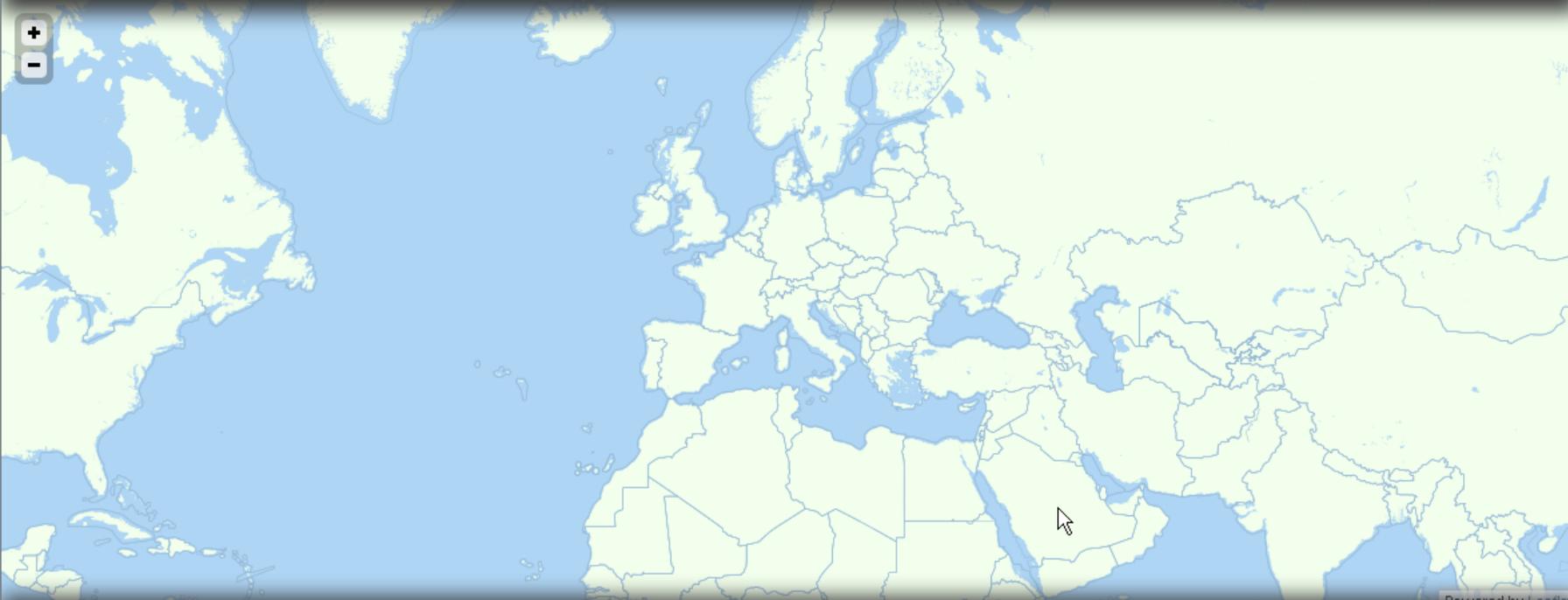
Citation Map: Visualizing the spread of scientific ideas through space and time - Mozilla Firefox

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

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

 **CITATION MAP**



Map showing the spread of scientific ideas through space and time. The map displays the world with a color gradient from blue (low density) to red (high density), indicating the concentration of scientific publications. The map is 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.

Powered by 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.