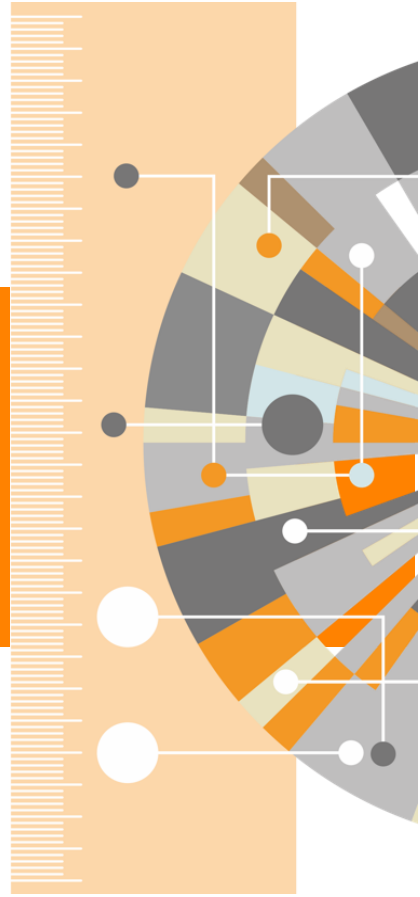
ELSEVIER

Research Intelligence

Using Advanced Metrics to Identify Unique Institutional Research Strengths, Recruit and Retain Talent, and Drive More Productive University-Industry Partnerships



University-Industry Partnership Workshop

25 September 2017

Detroit

Daniel Calto
Global Director of Solution Services
Research Intelligence

Empowering Knowledge

Agenda

- Data Sources and Technologies: Scopus, SciVal, Elsevier Fingerprint Engine
- Advances in SciVal Metrics – Topics of Prominence (TOP)
  - What are TOP, how do they work?
  - Why are they different and better than previous methods?
  - Broadening SciVal use cases
- Research Strengths and SWOT Analysis
  - How can TOP be used to identify specific strengths at a national level?
- Driving University-Industry Partnerships
- Q&A

Elsevier – A Unique Vantage Point on the Global World of Research

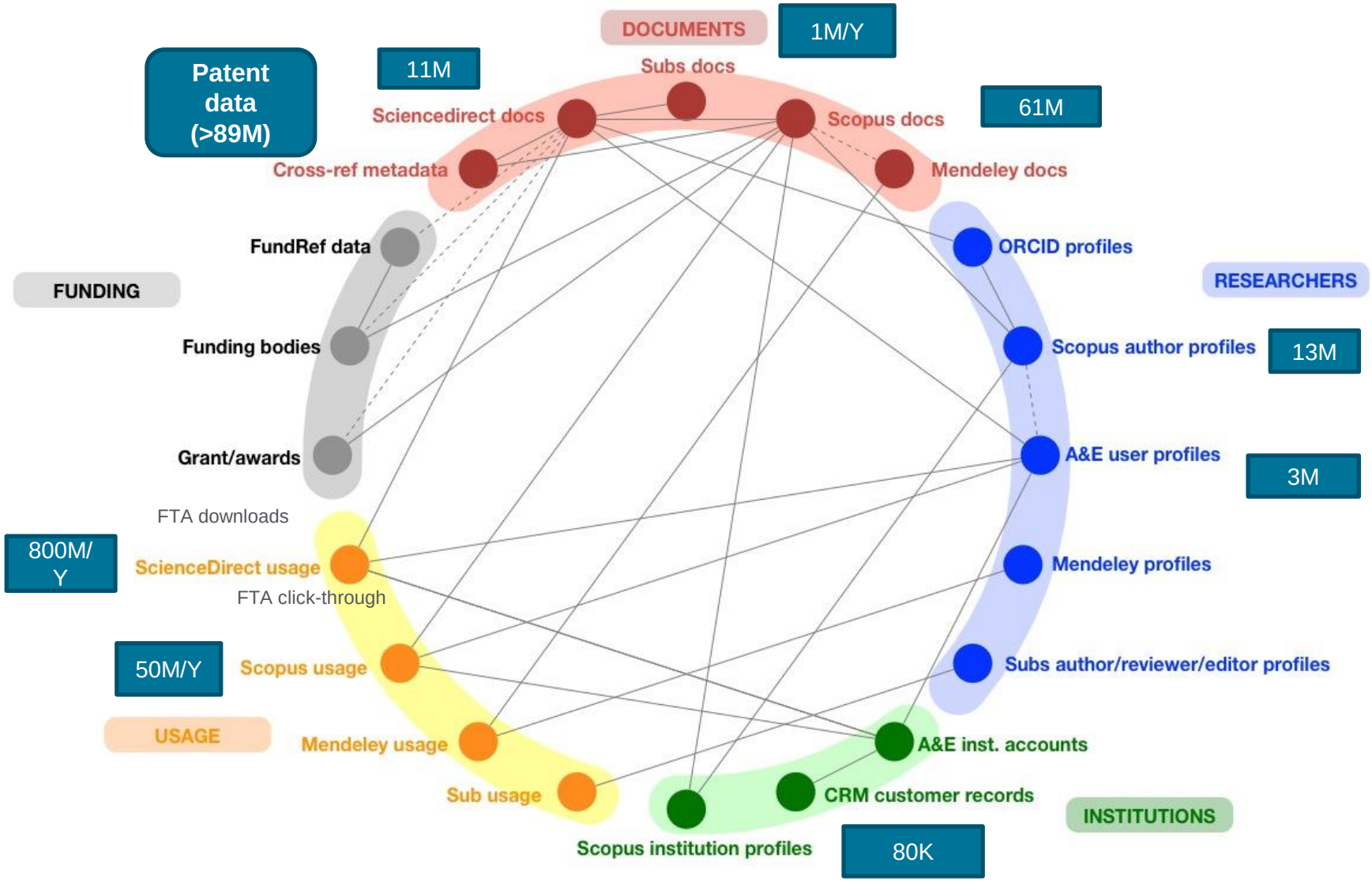
Elsevier – From publisher to solution provider

- Founded 130+ years ago
- Serving 30 million+ scientists, students, health and information professionals in 180+ countries
- 2,500 E-journals, 2,000 E-books published each year, dozens of research-oriented databases
- RELX (Reed Elsevier), the largest digital company in Europe

Each year

- 1.3 million manuscripts submitted to 2,500+ Elsevier journals
- 350,000+ articles published
- 900 million digital article downloads delivered
- 22,000+ journals from 5000+ publishers, >2 million articles per year tracked by Scopus (>69M articles in total)
- Terabytes of data in the Elsevier Research Intelligence suite
- Interactions with every university and government

What Data Do We Bring to the Table?



Scopus Coverage Summary

World's largest Abstract and Citations Database

69M records from **22K** serials, **100K** conferences and **150K** books

from more than **5000** publishers and **105** countries

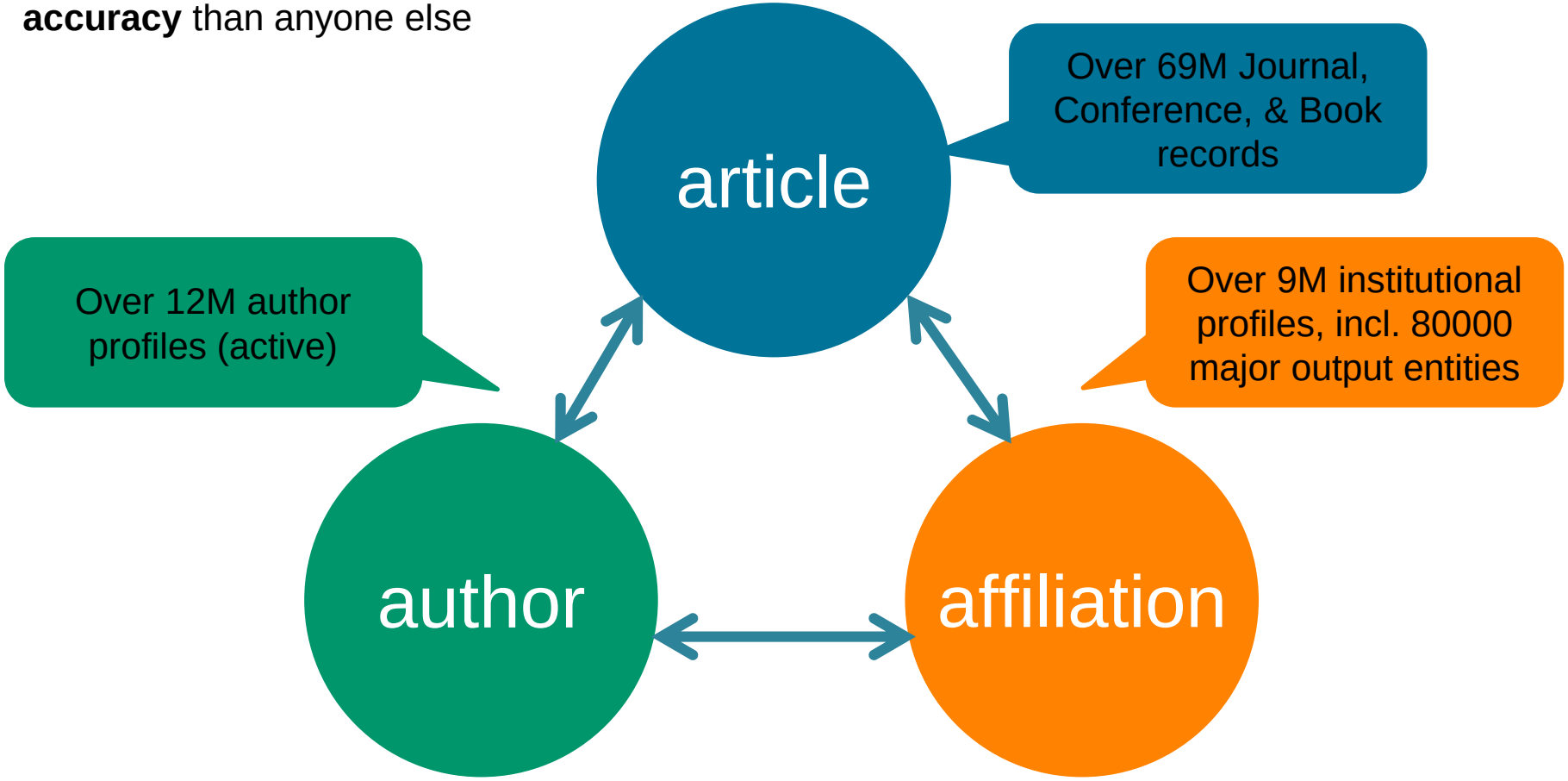
- Updated daily
- Records back to 1823
- "Articles in Press" from > 8,075 titles
- 40 different languages covered
- 3,643 active Gold Open Access journals indexed

	JOURNALS	CONFERENCES	BOOKS	PATENTS*
Physical Sciences 7,441 **Health Sciences** 7,133 **Social Sciences** 8,698 **Life Sciences** 4,601	**21,951** peer-reviewed journals **280** trade journals • Full metadata, abstracts and cited references (refs post-1970 only) • Funding data from acknowledgements • Citations back to 1970	**100K** conference events **8M** conference papers Mainly Engineering and Computer Sciences	**562** book series **150K** stand-alone books **1.2M** items Focus on Social Sciences and A&H	**27M** patents From 5 major patent offices - WIPO - EPO - USPTO - JPO - UK IPO

Scopus Data Model

The Scopus data model is designed around the notion that ***articles*** are written by ***authors*** that are ***affiliated*** *with institutions*. Visually and rather simplistically, this relational model is represented below.

What is the value of this structured data? This relational data model means that Scopus can tell you **who is doing what** in global literature and **where they are doing it** with **higher accuracy** than anyone else



Scopus Data Model Simplified

SciVal in a nutshell

SciVal offers quick, easy access to the research performance of 220 nations and 8,500 research institutions worldwide, and groups of institutions

Visualize research performance

Ready-made-at a glance snapshots of any selected entity

Benchmark your progress

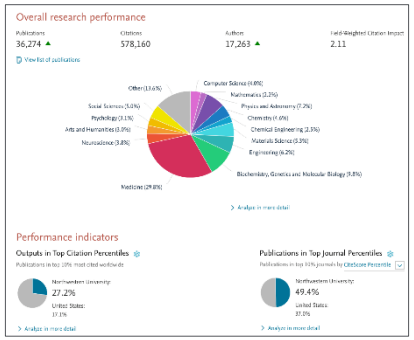
Flexibility to create and compare any research groups

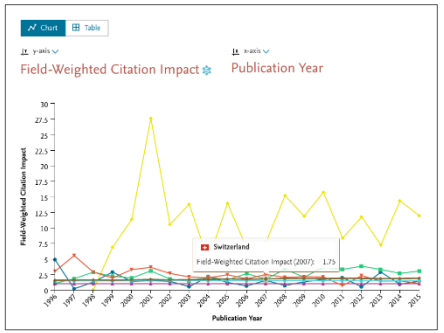
Develop collaborative partnerships

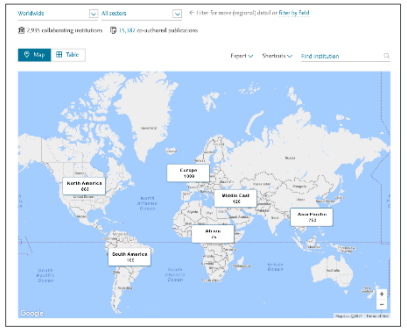
Identify and analyze existing and potential collaboration opportunities

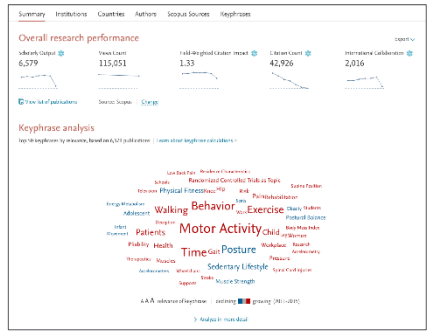
Analyze research trends

Analyze research trends to discover the top performers and rising stars



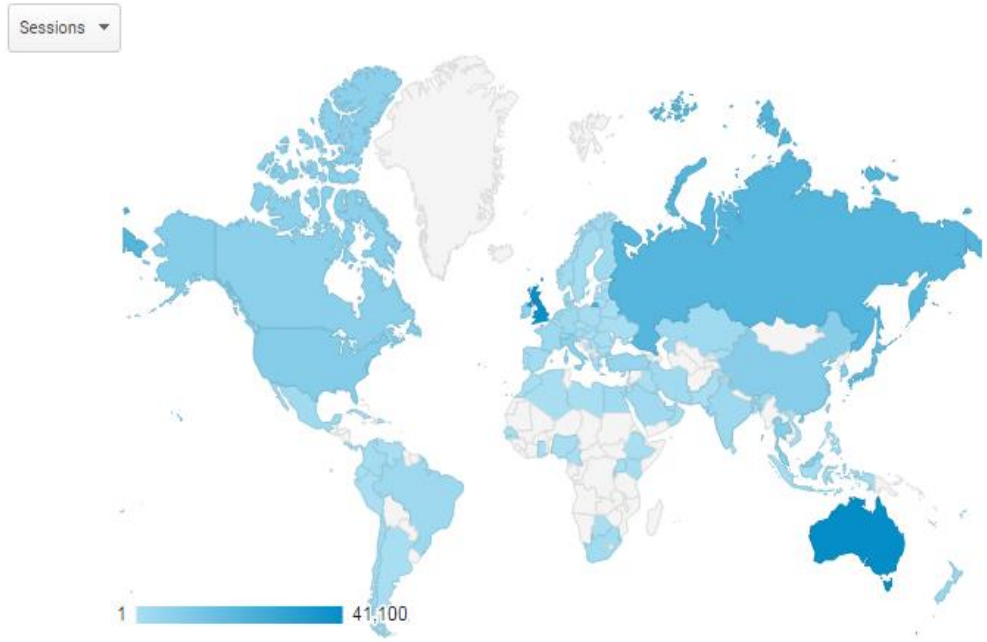




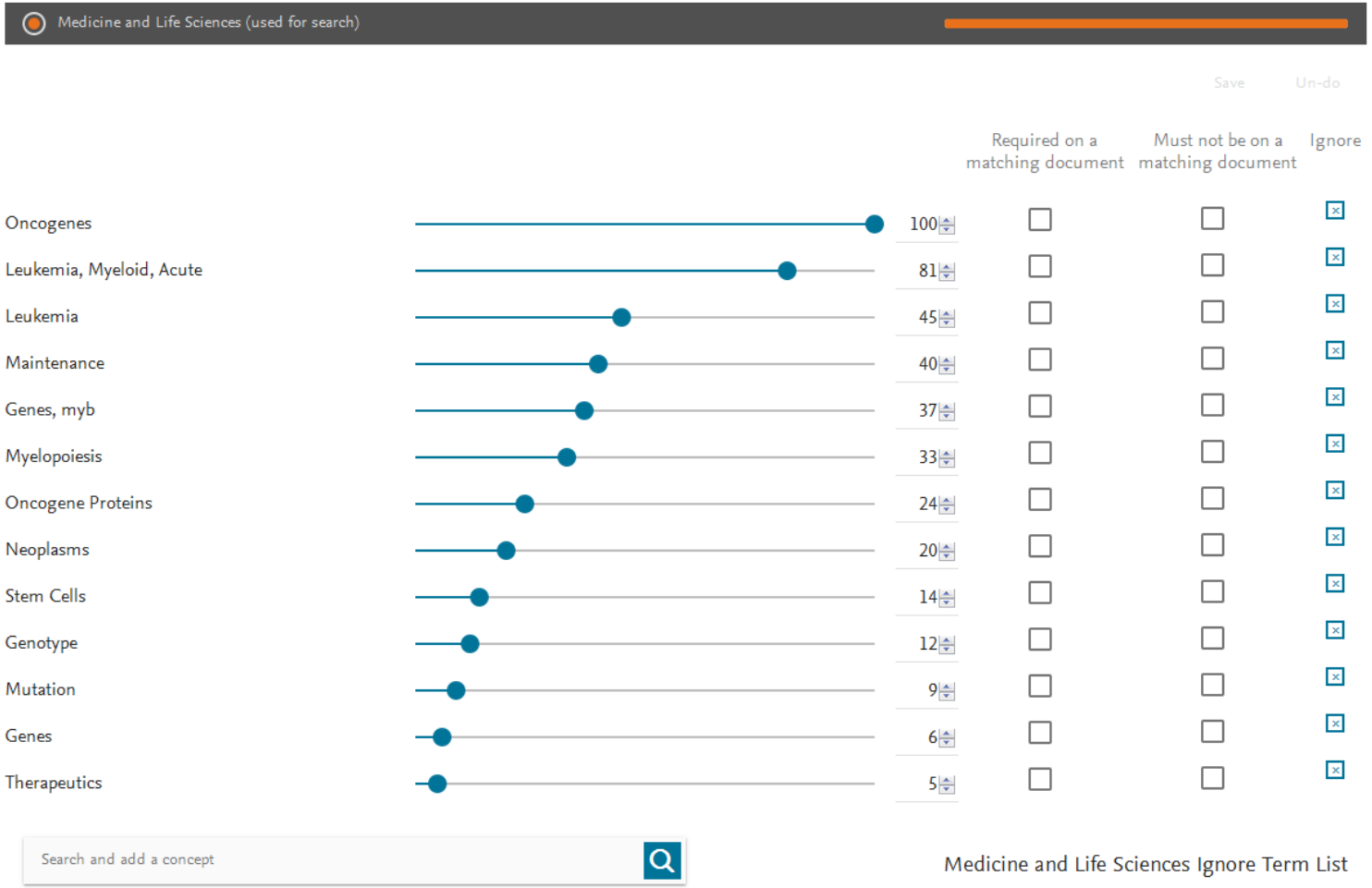


SciVal at this Moment

- **To evaluate and demonstrate performance** of research teams, institutions, cities, provinces and countries all around the world
- Launched in 2014. More than **500 customers,** predominantly academic institutions.
- **Corporate customers** include: Unilever, Siemens, Boeing, Mercedes
- **Several funding organizations and national government bodies** also use SciVal for both internal and external analysis



Fingerprints Can Be Created from Any Text, or Group of Texts



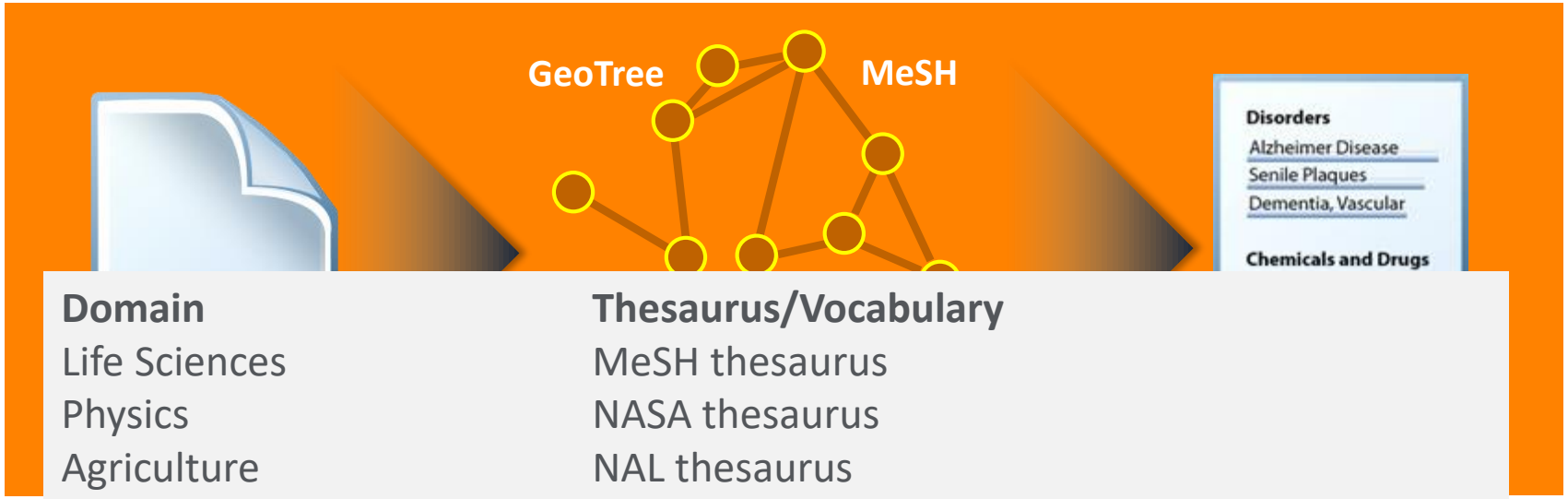
2

Concepts are derived from the text. Each concept is found in an underlying thesaurus suitable for the scientific area of the text. Concepts are weighted to create a precise summary of the text's meaning.

1

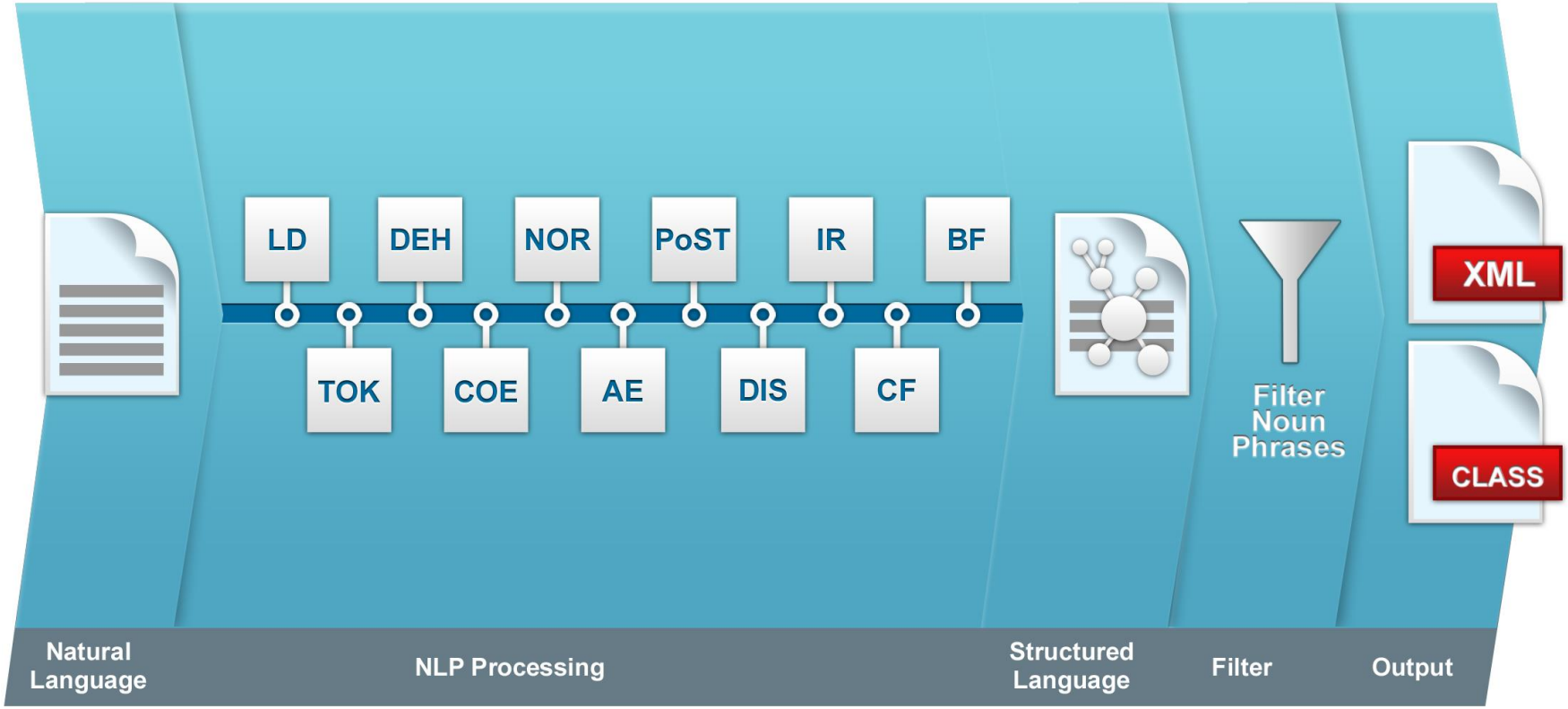
- Any text can be Fingerprinted, from grant applications to publications
- Fingerprints are generated from the title and abstract
- Natural Language Processing techniques are applied

How Does the Elsevier Fingerprint Engine Work?



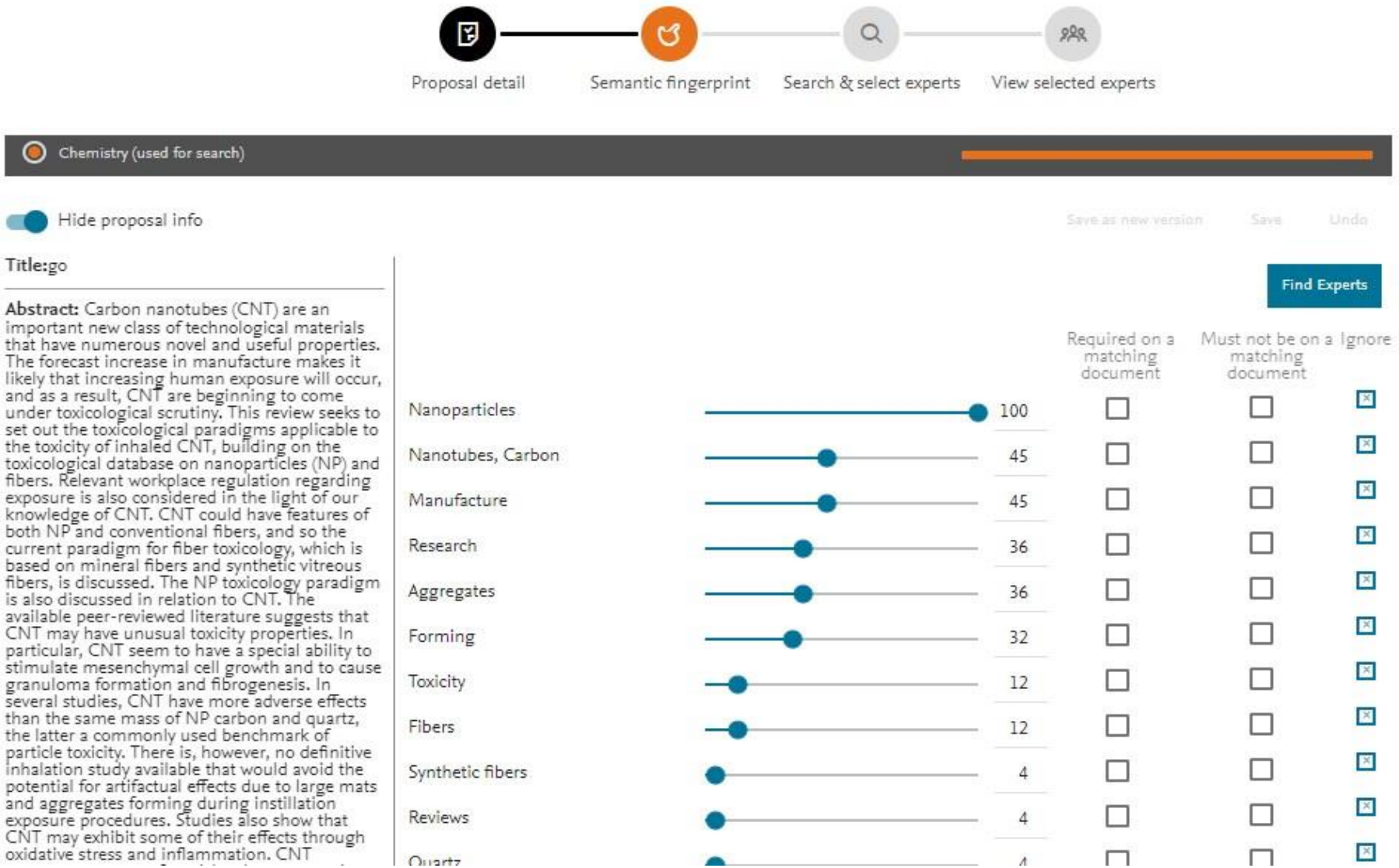
Domain	Thesaurus/Vocabulary
Life Sciences	MeSH thesaurus
Physics	NASA thesaurus
Agriculture	NAL thesaurus
Economics	STW thesaurus, Eco Humanities vocabulary
Social Sciences	Gesis thesaurus
Mathematics	Cambridge Math thesaurus, Math vocabulary
Geosciences	Geobase thesaurus
Engineering	Compendex thesaurus
Humanities	Humanities vocabulary
Compounds (Chemistry)	Compendex thesaurus, MeSH thesaurus

Natural Language Processing Modules Applied to Text



Natural Language via NLP Processing to Structured Semantic Machine-Readable Text

FPE In Action--Expert Lookup—Global Expertise Search



Expert Lookup—Global Expertise Search—Top Scholars

go

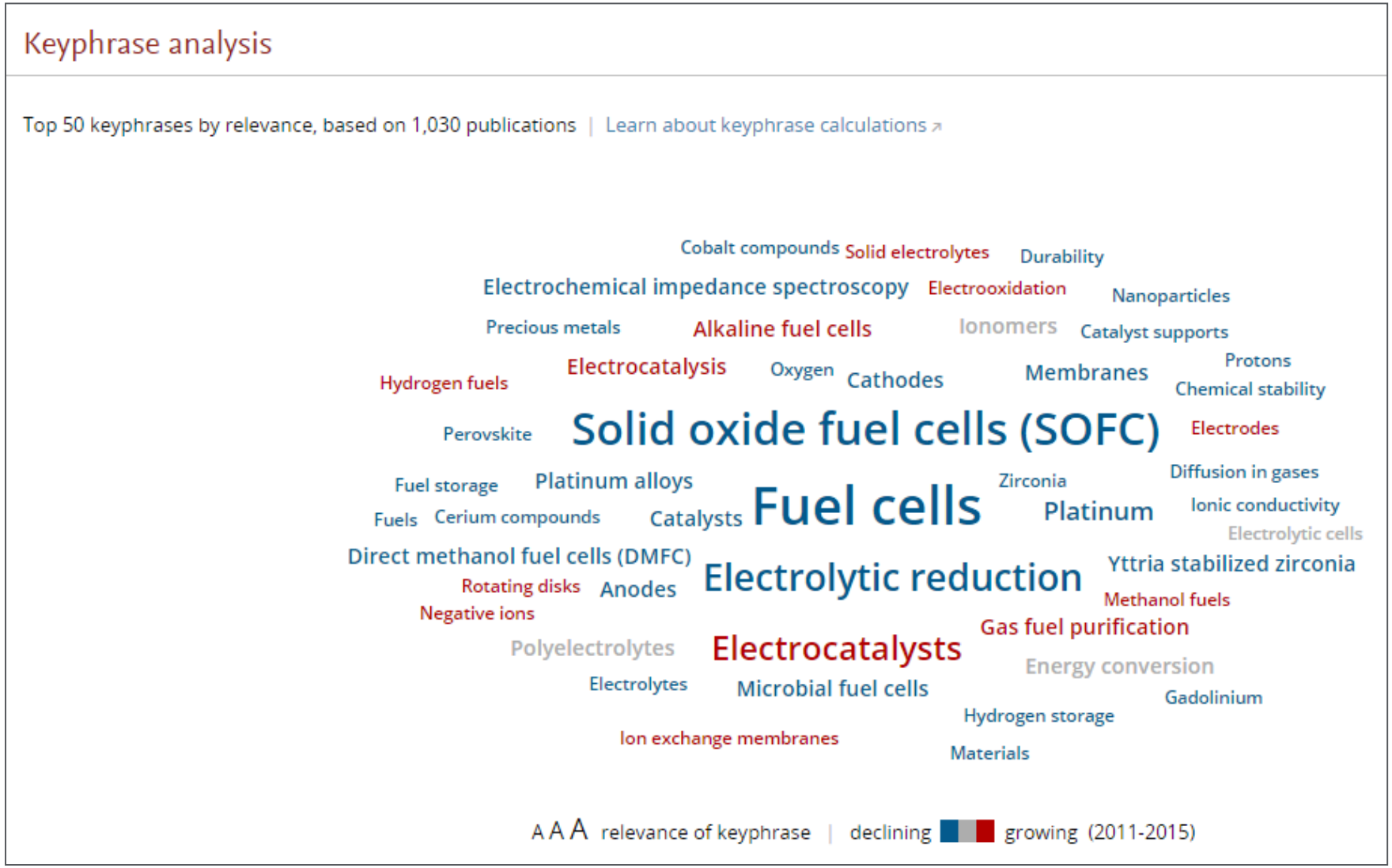
Fingerprints Nanoparticles, Manufacture, Nanotubes, Carbon, Research, Aggregates, show all

200 experts based on Chemistry thesaurus

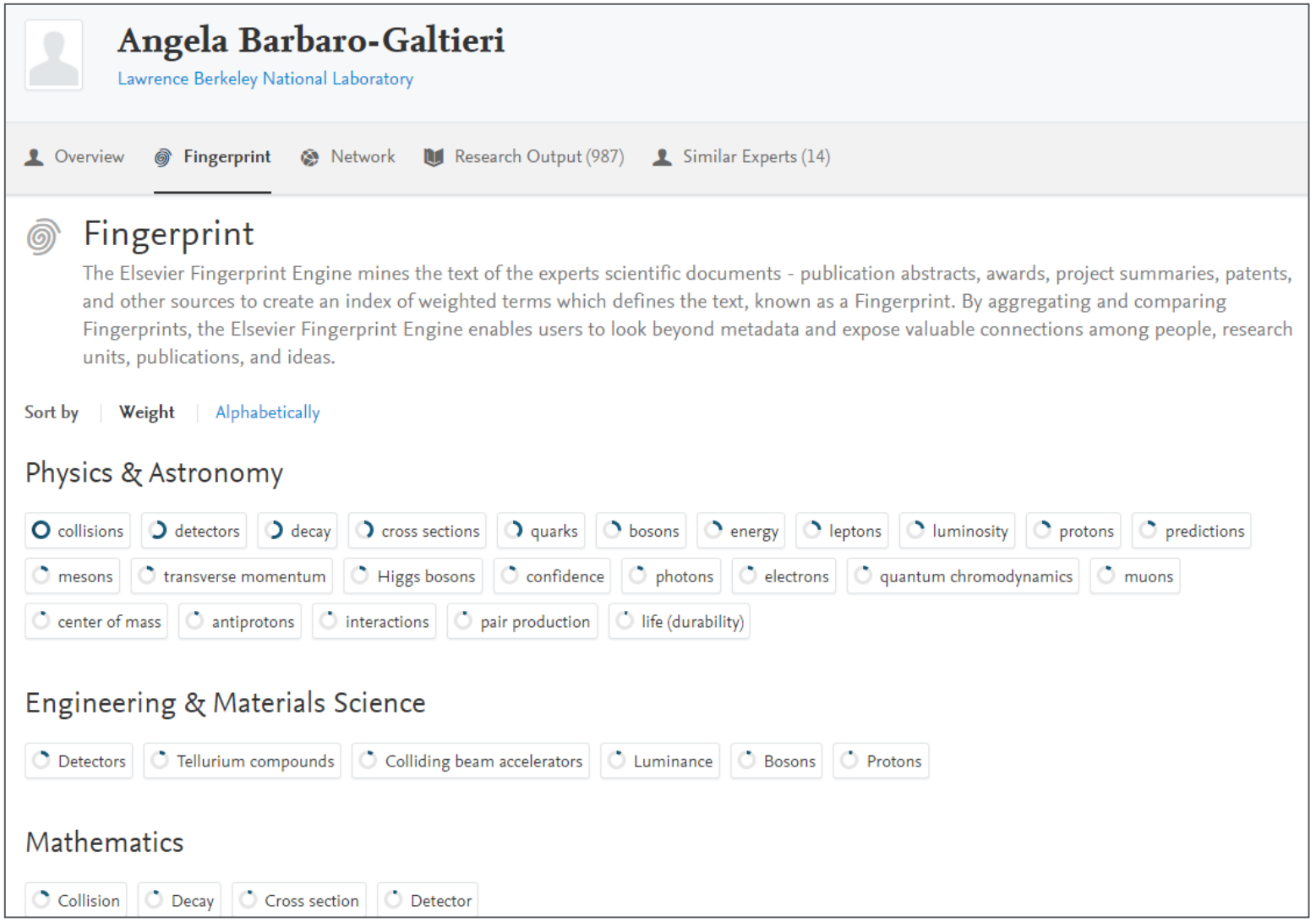
Search within resultset

Rank	Name	Institution	Matching pub.	First author	Last author	Total pub.	h-Index	Potential COI	Assign Expert
	Thomas D. Pollard	Yale University	2	1	1	146	97	No	
	Michael P. Sheetz	Mechanobiology Ins...	3	0	2	183	96	No	
	James A. Spudich	Stanford University ...	2	0	0	107	72	No	
	Fei Wei	Tsinghua University	2	0	1	478	66	No	
	H. Lee Sweeney	University of Florida...	3	0	1	162	64	No	
	Jean François Joanny	Universite Paris Sor...	2	0	0	157	61	No	
	James R. Sellers	National Heart, Lun...	4	0	2	111	60	No	
	Shouzhuo Yao	Hunan Normal Uni...	3	0	2	566	60	No	

FPE in Action: SciVal



FPE in Action: Pure



Agenda

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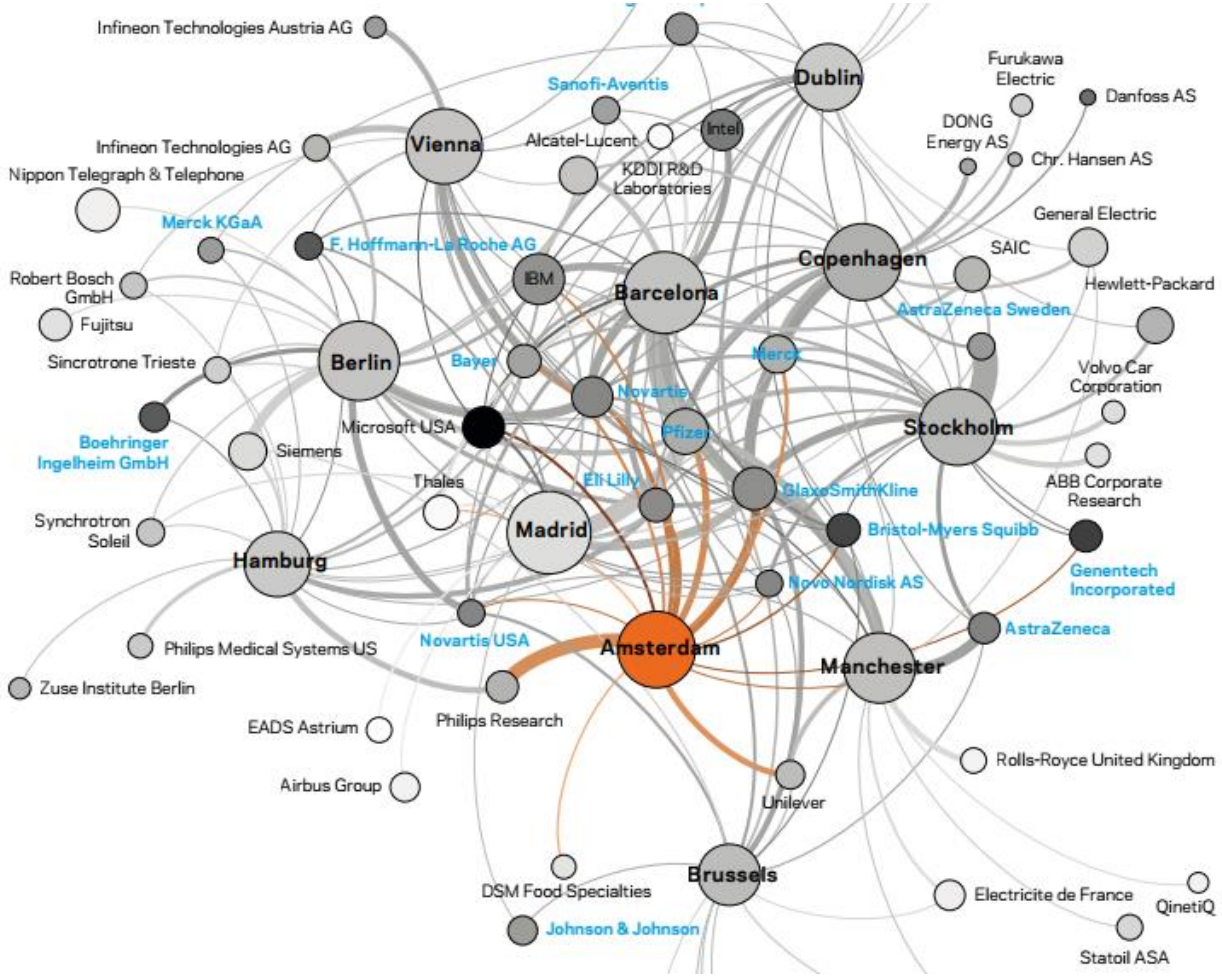
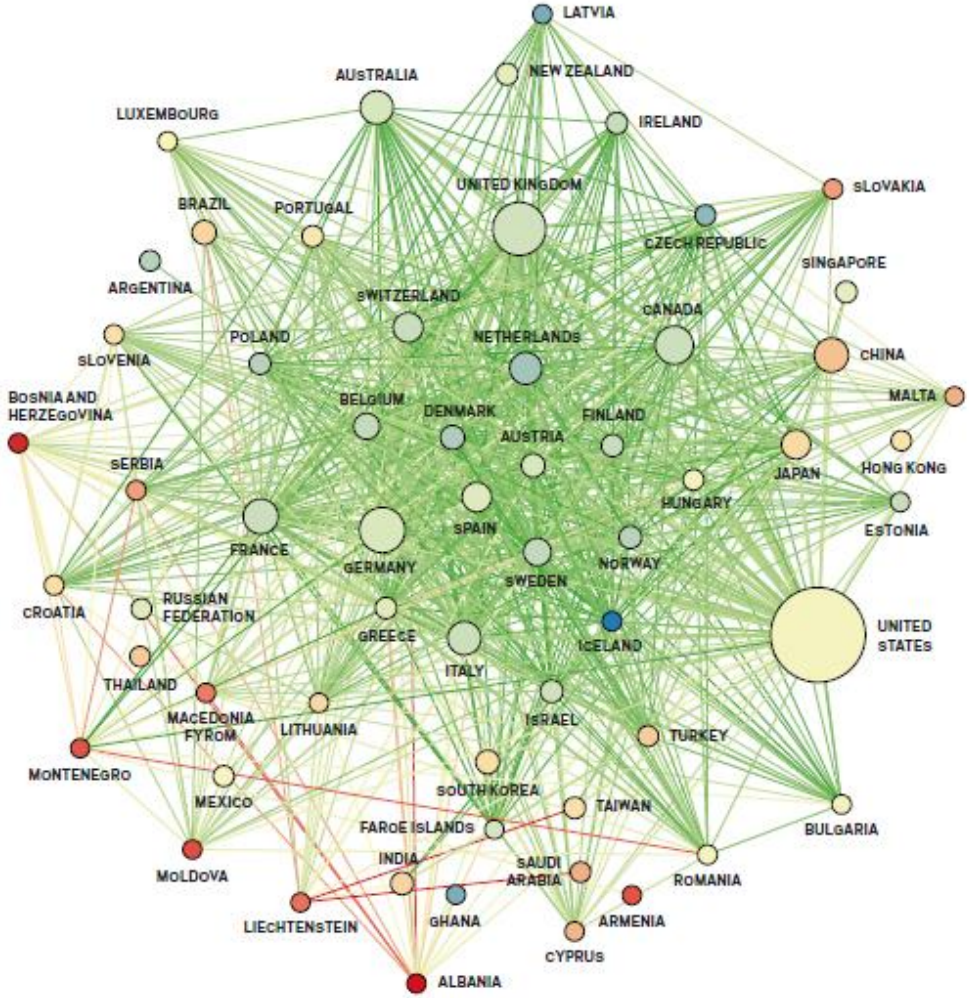
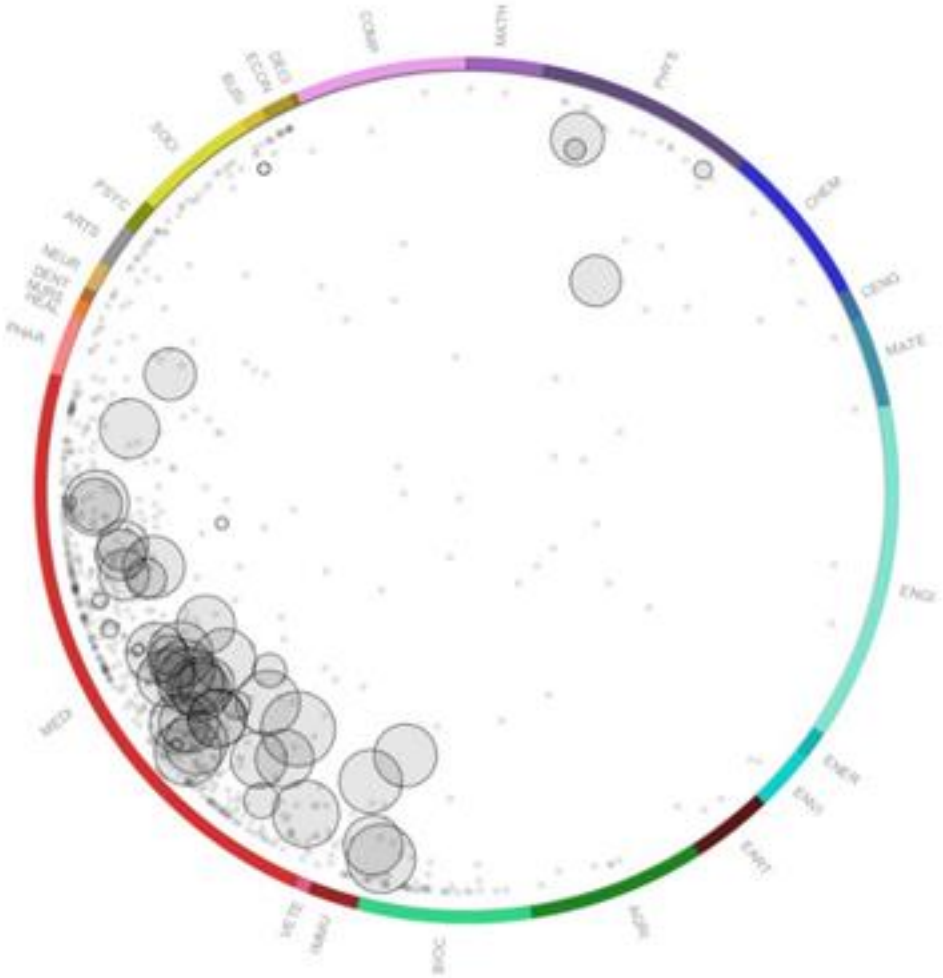
Network Graphs – Production, Collaboration, Impact, Visualization..





Topics of Prominence

Recent advances in clustering and modelling science allow us to partition science into Topics

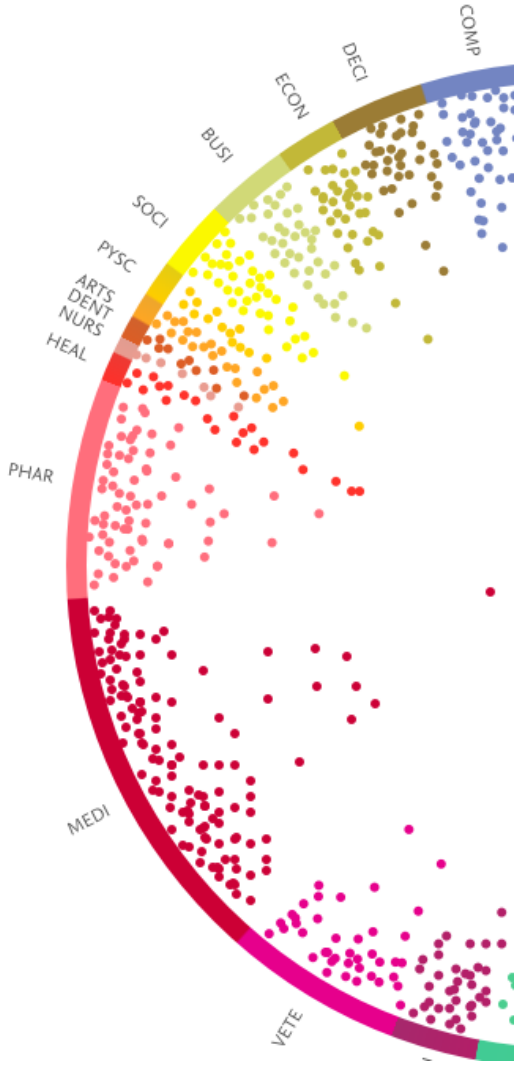


Looking at a specific institution to collaborate with..

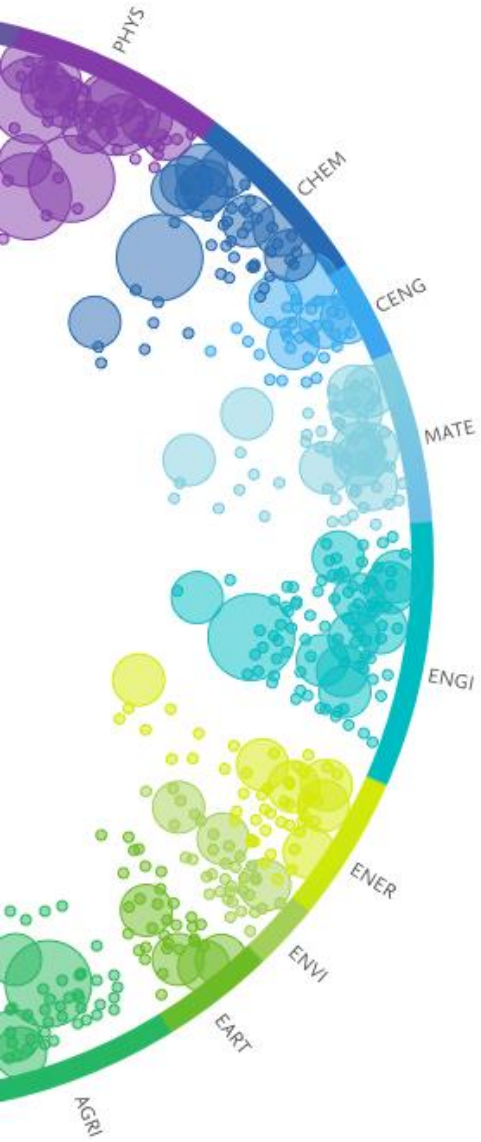
- What are the most prominent topics this institution is active in ?
- What is this institution's presence in topics of prominence across the subject fields ?
- Show me the dynamics within this topic, the top performers and rising stars ?
- Are there any other topics I should keep an eye on ?

Topics of Prominence—A Planning Solution

- We have identified **~100.000 global research topics** and ranked them by **Prominence.**
- **Prominence is a new indicator** that shows the **current momentum** of a topic by looking at **citations**, **views** and **CiteScore** values.
- **Prominence highly correlated with funding** – helps researchers and research managers identify topics in which funding will increase.
- Going **way beyond** what the competition can do…



First Solution of its Kind

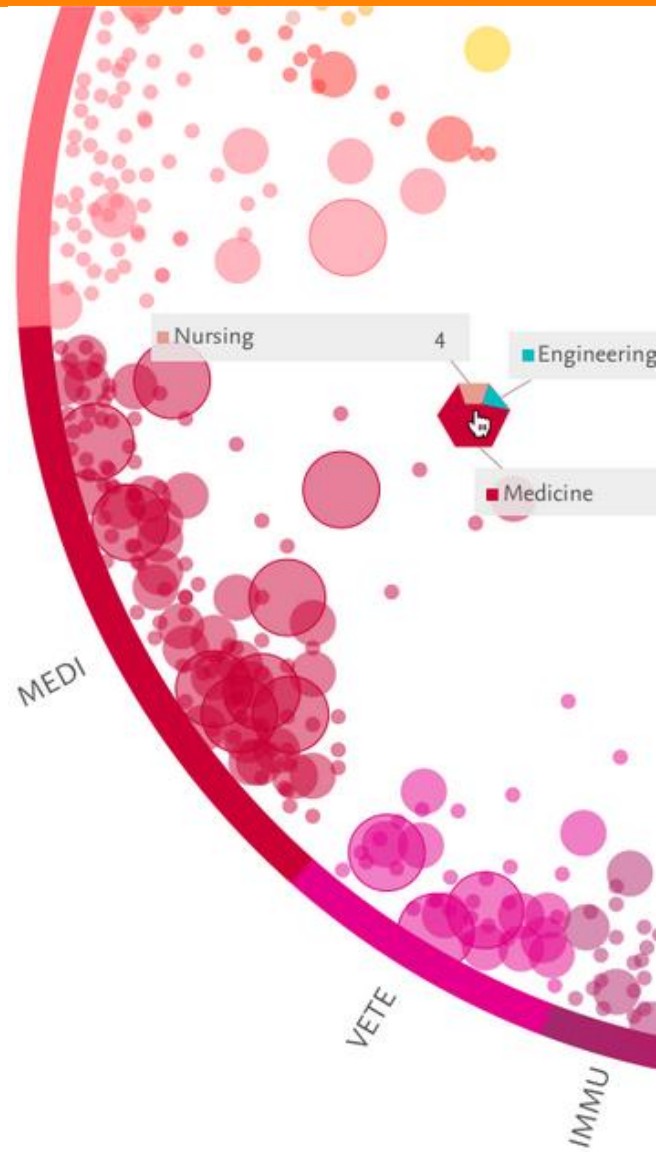


The first truly global detailed research portfolio analysis – this has never been done before – we use all of Scopus to form topics.

- **Who's leading the way** – we can identify emergent topics with high momentum to understand who is currently leading the way.
- **What's related** – We can tell you how the topics are related to your research portfolio.
- **A better reflection of reality** – topics are an excellent reflection of reality since they are based on citation patterns and not journal categories and therefore truly multidisciplinary.

A groundbreaking concept

- **Researchers in topics with high prominence receive more funding on average** – We have evidence that researchers in prominent topics receive more funding (per researcher) than their peers in other topics.
- **Help improve grant applications** – we can truly help researchers to increase their grant success rate by focusing on high prominence topics.
- **Topics resonate with researchers** – researchers recognize them intuitively and agree with the level of granularity.



Mapping Research Topics--History and Competition

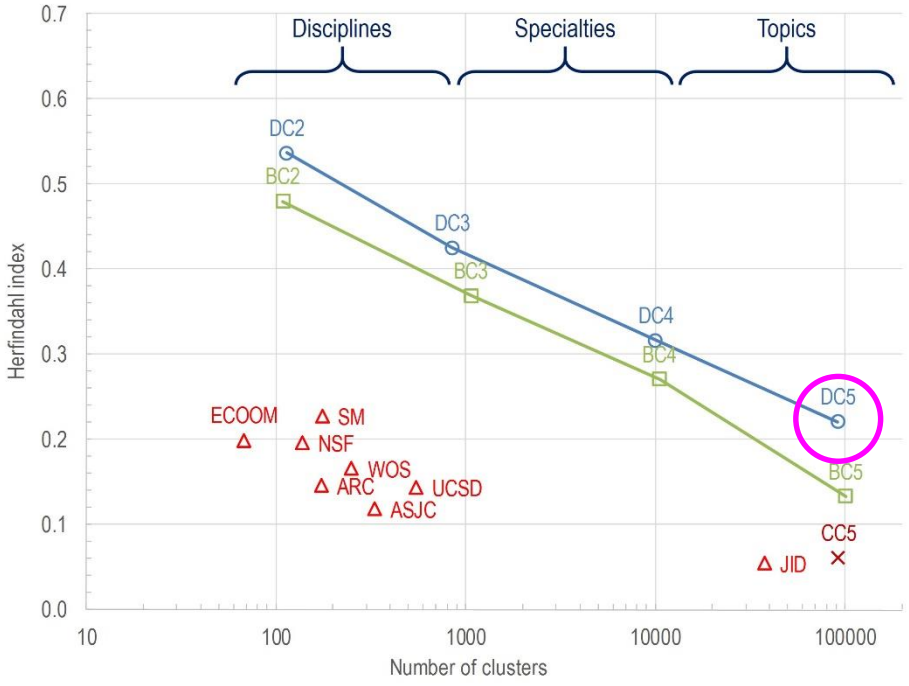
- 1985 – ISI (now Clarivate) develops **Research Fronts**
  - A bibliometric way to identify research opportunities
- 1988 – CRP (now SciTech) develops **Research Communities**
  - Same algorithms and lower thresholds to increase coverage
- 2007 – SciTech develops **Distinctive Competencies**
  - Clusters research communities using University strengths
- 2015 – SciTech develops **Topics**
  - Significantly increases coverage and accuracy
- 2017 – SciTech develops **Topic Prominence** indicator
  - Uses citations, downloads and journal impact
  - First time a bibliometric indicator is used to predict funding patterns

Mapping Research Topics--History and competition

- **Research Fronts (1985)** 2% coverage 10,000 clusters
  - (Clarivate is still using this!)
- **Research Communities (1988)** 4% coverage 35,000 clusters
- **Distinctive Competencies (2007)** 15% coverage 200,000 clusters
- **Topics (2015)** 95% coverage 100,000 clusters
- **Topic Prominence (2017)** 95% coverage Predicts funding
  - Full coverage, accurately models supply/demand for science

Topics of Prominence—Accuracy

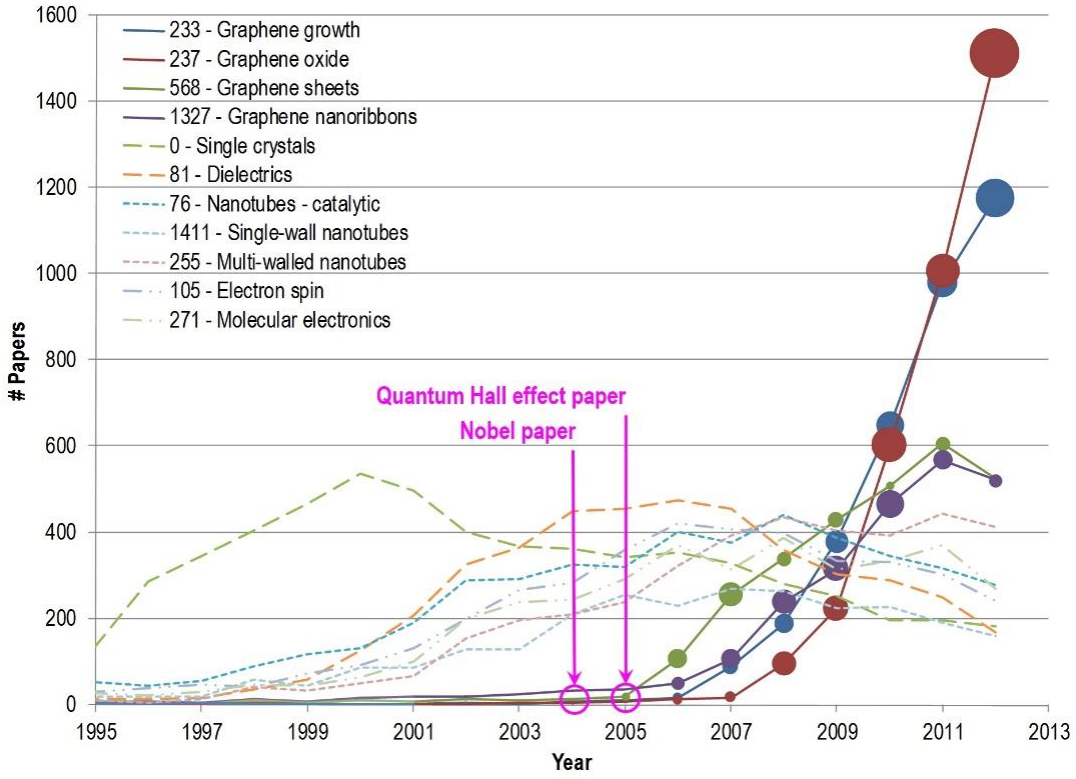
- NEEDS
  - Accuracy: Accurate topics that contain the right papers
  - Comprehensive analysis at scale shows that topics based on direct citation are far more accurate than those based on bibliographic coupling or co-citation
  - Also, they are much more accurate than journal categories
  - Use topics identified using direct citation



Klavans, R. and K.W. Boyack, Which type of citation analysis generates the most accurate taxonomy of scientific and technical knowledge? JASIST, 2017. 68(4): p. 984-998.

Topics of Prominence – Variance and Dynamics

- Stability: Topics with realistic dynamics
- Topics can be new or old, large or small, growing, emerging, declining, interdisciplinary, etc., and have varied histories
- Topics have persistent dynamics; low birth and death rates, s-curve histories



Boyack, K.W. and R. Klavans, R. Creation and analysis of large-scale bibliometric networks. Springer Handbook of Science and Technology Indicators, 2018 (to appear).

Topic Prominence—How is It Calculated?

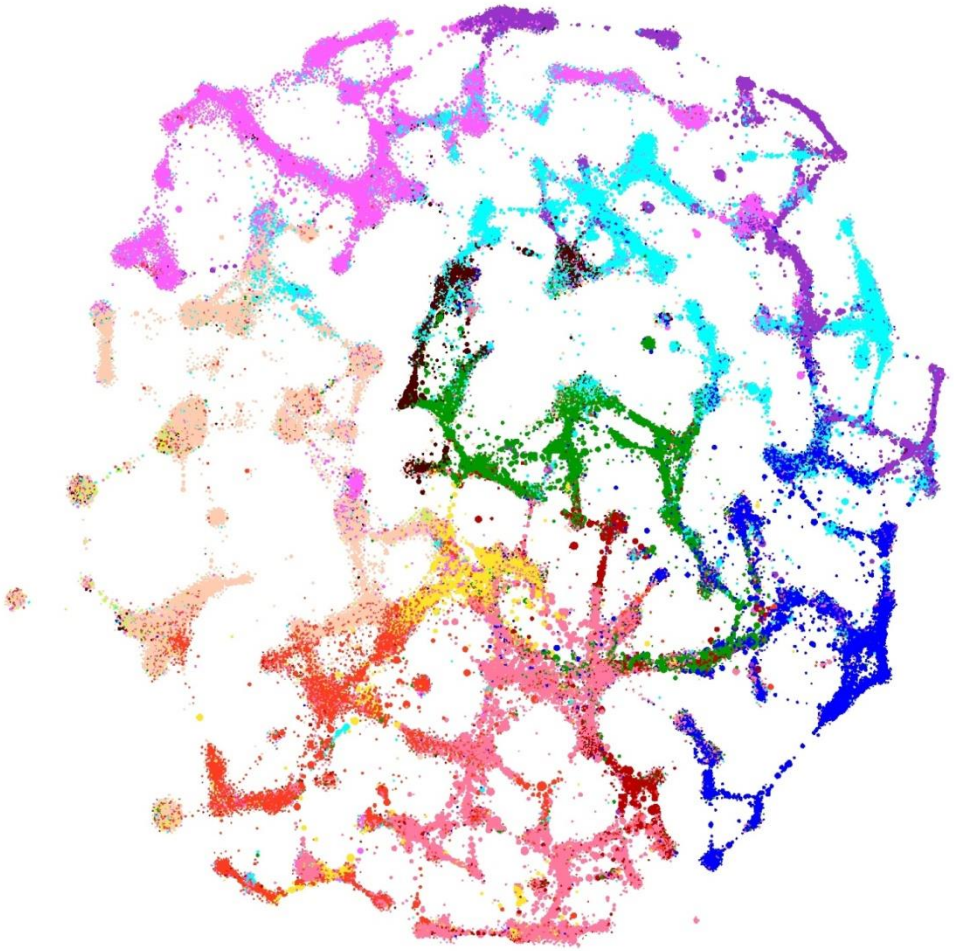
Table 2. Factor loadings and scoring coefficients used to calculate topic prominence.

	Factor 1	Factor 2	Normalized Score
L:Citations	0.837	- 0.244	0.495
L:Views	0.812	- 0.262	0.391
L:CiteScore	0.653	0.154	0.114
L:Authors	0.593	0.334	(not used)
Vitality	0.441	0.269	(not used)

- Factor 1 has an eigenvalue of 2.33 (very high), suggesting that the composite indicator should include Citations, Views, Citescore
- Other formulations with more features were tested, but they did not have greater explanatory power than the 3-feature indicator
- $P_j = 0.495\ (C_j - mean(C_j))/stdev(C_j) + 0.391\ (V_j - mean(V_j))/stdev(V_j) + 0.114\ (CS_j - mean(CS_j))/stdev(CS_j)$,

Example model and map

- Using 2013-10 datacut (source data 1996-2012)
- 582 million citing-cited pairs, 24.6 million source EID, 23.8 million cited non-indexed EID
- Calculated relatedness for 582 million pairs
- Ran SLM using resolution of 3×10^{-5}
- A few clusters with <50 items were merged with larger clusters
- Result – 91,726 clusters (topics)



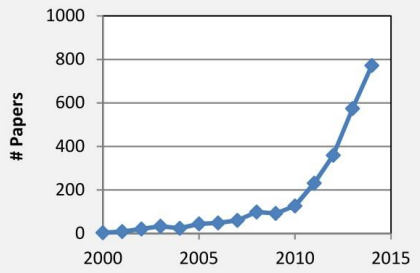
Klavans, R. and K.W. Boyack, Research portfolio analysis and topic prominence. Journal of Informetrics, 2017 (under review).

Single Topic Characterization for 92,000 Topics

DC5 7909 FOM: 2.9852 (98.07%); CPP: 21.069 ENGNG; DC4:20; DC3:269; DC2:23; REG:105

TOP PHRASES (2011-2015)	score
1 anode material	20
2 anode materials	20
3 batteries LIBs	20
4 capacity retention	20
5 cycling stability	20
6 discharge capacity	20
7 electrochemical performances	20
8 electrode materials	20
9 electron microscopy	20
10 graphene oxide	20

IDIOSYNCRATIC PHRASES (2011-2015)	score
1 mA g⁻¹	60.97
2 batteries LIBs	40.07
3 superior electrochemical	30.01
4 lithium storage	22.27
5 anode materials	16.07
6 anode material	15.77
7 mAh g⁻¹	15.65
8 reversible capacity	15.13
9 metal oxides	13.96
10 conversion reaction	12.85



TOP CATEGORIES (2011-2015)	score
1 Nanoscience & Nanotechnology	0.98
2 Energy	0.78
3 Materials	0.27
4 General Chemistry	0.05
5 Unclassified	0.04
6 Physical Chemistry	0.03
7 Inorganic & Nuclear Chemistry	0.03
8 Organic Chemistry	0.01
9 Chemical Physics	0.01
10 Applied Physics	0.01

TOP SOURCES (2011-2015)	score
1 electrochim acta	2.96
2 j mater chem a	2.85
3 j power sources	1.78
4 nano energy	1.13
5 acs appl mater interfaces	0.78
6 rsc adv	0.59
7 nanoscale	0.45
8 j mater chem	0.43
9 mater lett	0.41
10 j alloys compd	0.26

TOP INSTITUTIONS (2011-2015)	count
1 Nanyang Technological University	130
2 University of Science and Technology of	108
3 Shandong University	115
4 XiangTan University	37
5 CAS - Changchun Institute of Applied Ch	40
6 China Three Gorges University	30
7 University of Wollongong	49
8 Anhui University of Technology	24
9 Zhejiang Normal University	26
10 CAS - Shanghai Institute of Ceramics	24

TOP AUTHORS (2011-2015)	score
1 Ni S. (China Three Gorges University)	29
2 Qian Y. (University of Science and Techn	44
3 Yang X. (China Three Gorges University)	29
4 Ma J. (China Three Gorges University)	14
5 Lv X. (China Three Gorges University)	14
6 Pereira N. (Rutgers University)	14
7 Amatucci G.G. (Rutgers University)	19
8 Xiong Q.Q. ()	16
9 Zhang J. (China Three Gorges University	10
10 Xiong S. (Shandong University)	19

REPRESENTATIVE PAPERS (2011-2014)	ncited
1 Reddy M.V. (2013) Metal oxides and oxysalts as anode materials for Li ion batteries. Chemical Reviews	530
2 Zhu X. (2011) Nanostructured reduced graphene oxide/Fe2O3 composite as a high-performance anode mater	514
3 Ji L. (2011) Recent developments in nanostructured anode materials for rechargeable lithium-ion batteries. En	576
4 Wang Z. (2012) Assembling carbon-coated Î±-Fe2O3 hollow nanohorns on the CNT backbone for superior lith	270
5 Wang J.-Z. (2011) Graphene-encapsulated fe3O4 nanoparticles with 3d laminated structure as superior anode	230
6 Wang B. (2011) Quasiemulsion-templated formation of Î±-Fe2O3 hollow spheres with enhanced lithium storag	350
7 Sun B. (2011) MnO/C core-shell nanorods as high capacity anode materials for lithium-ion batteries. Journal o	118
8 Deng Y. (2011) One-pot synthesis of ZnFe2O4/C hollow spheres as superior anode materials for lithium ion ba	106
9 Jin S. (2011) Facile synthesis of hierarchically structured Fe3O4/carbon micro-flowers and their application to	127
10 Wu H.B. (2012) Nanostructured metal oxide-based materials as advanced anodes for lithium-ion batteries. Na	324

Topics of Prominence—Highly Correlated with Funding

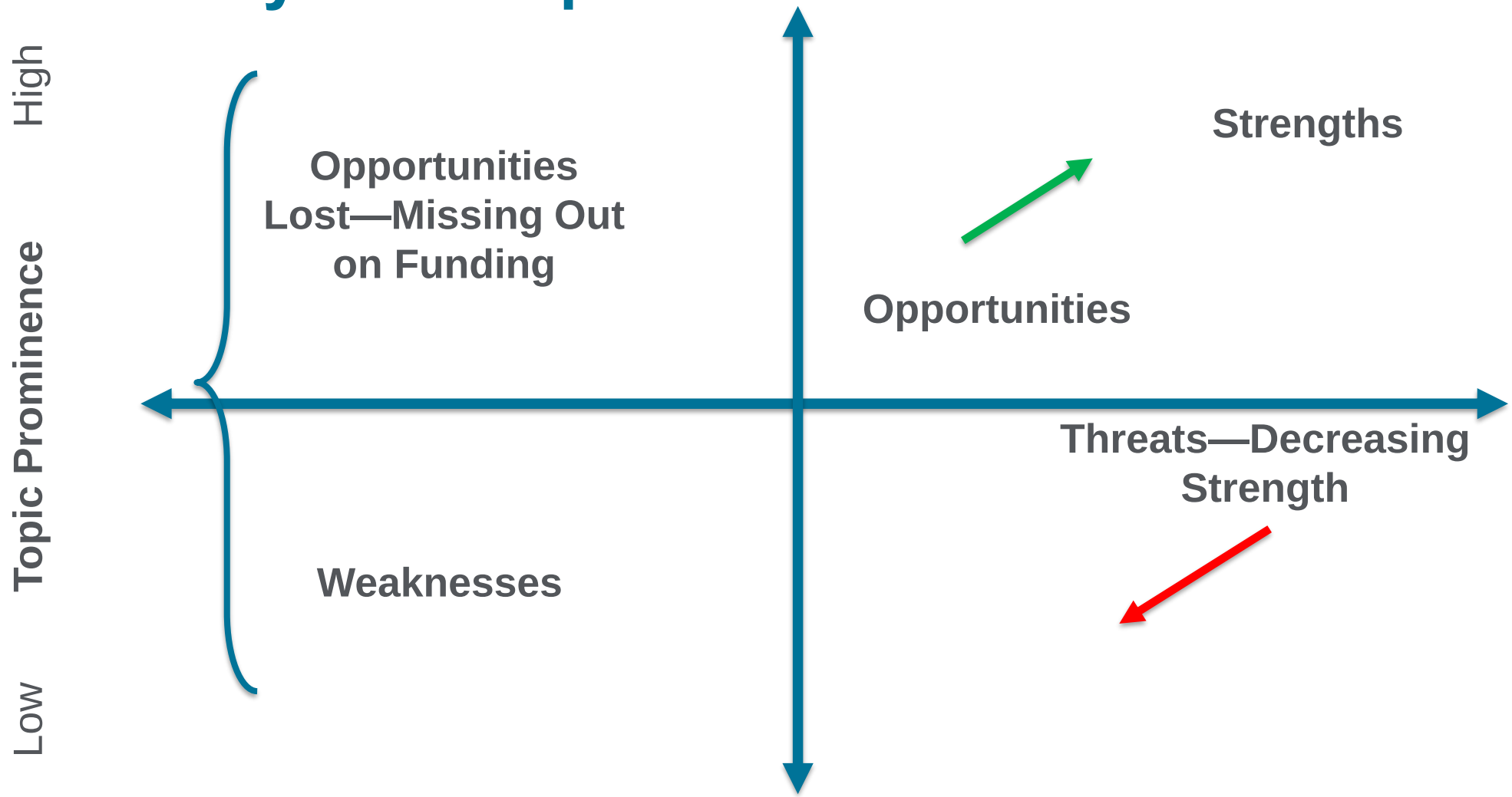
- Funding divided into two time periods (2008-10, 2011-13)
- Prominence was calculated as of 2010

Table 4. Correlation matrix for variables considered in the funding prediction analysis.

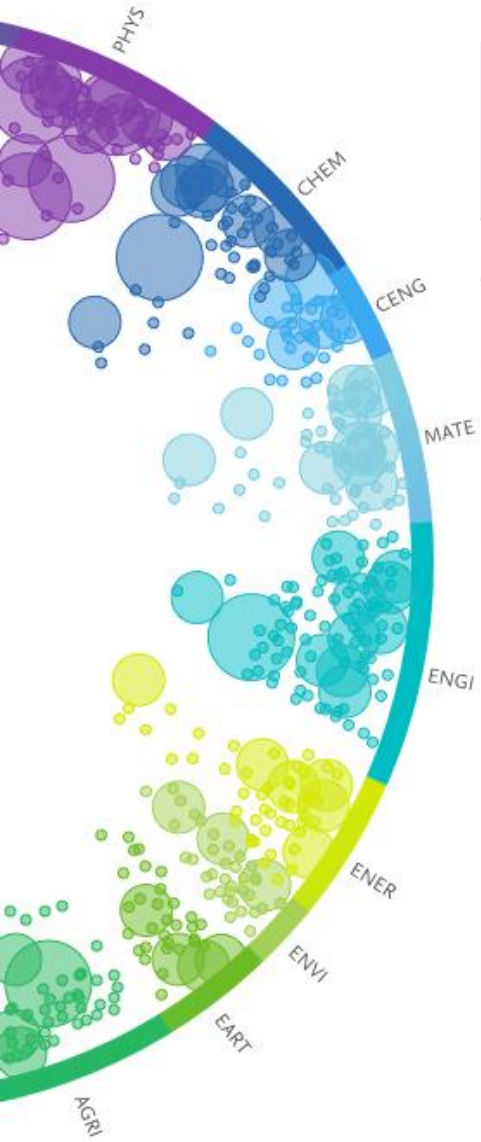
	L:Fund1113	L:Fund0810	Prominence	Vitality	L:Authors
L:Fund1113	1.000				
L:Fund0810	0.837	1.000			
Prominence	0.606	0.616	1.000		
Vitality	0.166	0.162	0.314	1.000	
L:Authors	0.160	0.171	0.242	0.202	1.000

- Funding in two time periods is extremely highly correlated
- Prominence is highly correlated with funding in both time periods

SWOT Analysis in Topics of Prominence



United States—Country Output



United States

2012 to 2016 | no subject area filter selected | ASJC | Data sources

Summary | Topics | Awarded Grants | Published | Viewed | Cited | Economic Impact | Authors | Institutions

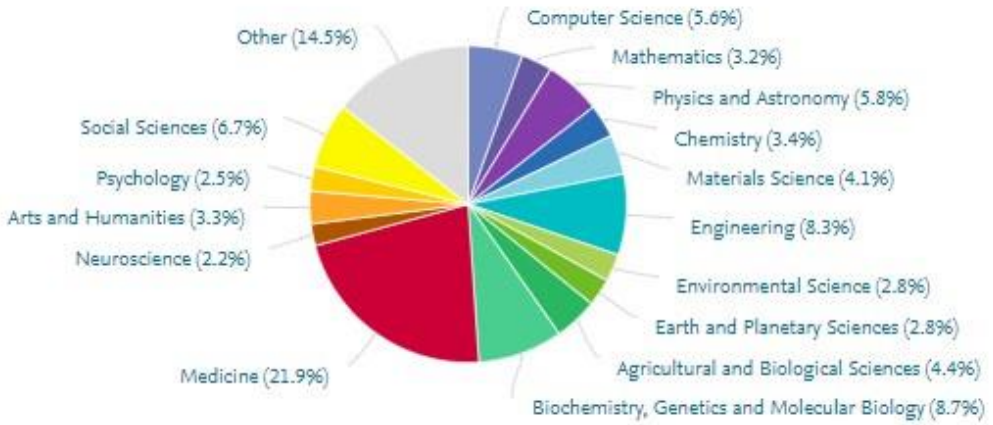
Overall research performance

Download page as PDF | Export

Publications	Citations	Authors	Field-Weighted Citation Impact	Citations per Publication
3,210,189 ▼	24,767,636	2,560,062 ▲	1.47	7.7

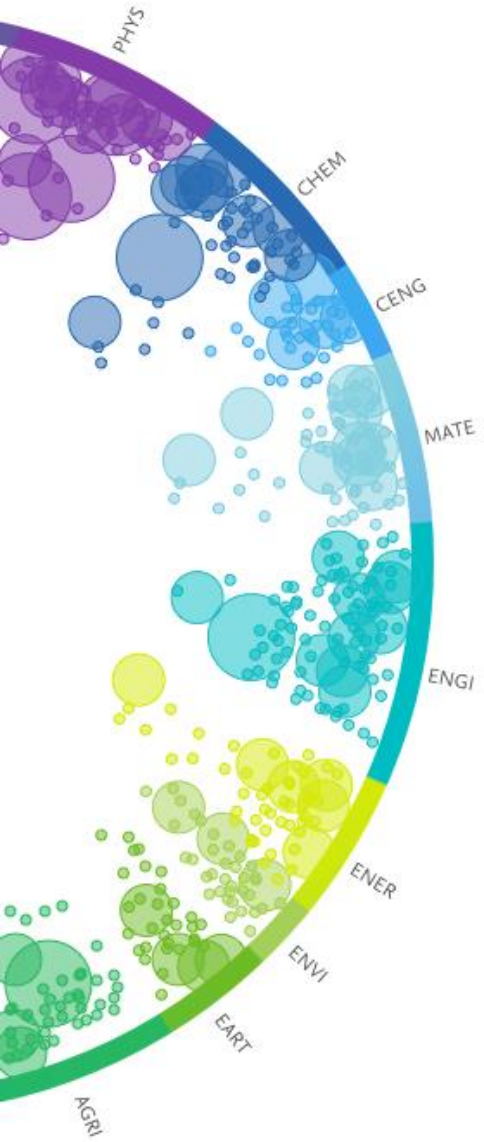
View list of publications

+ Add to Reporting



› Analyze in more detail

United States—Topics of Prominence



United States

2012 to 2016 | no subject area filter selected | ASJC | Data sources

Summary | Topics | Awarded Grants | Published | Viewed | Cited | Economic Impact | Authors | Institutions

Browse Topics

Export

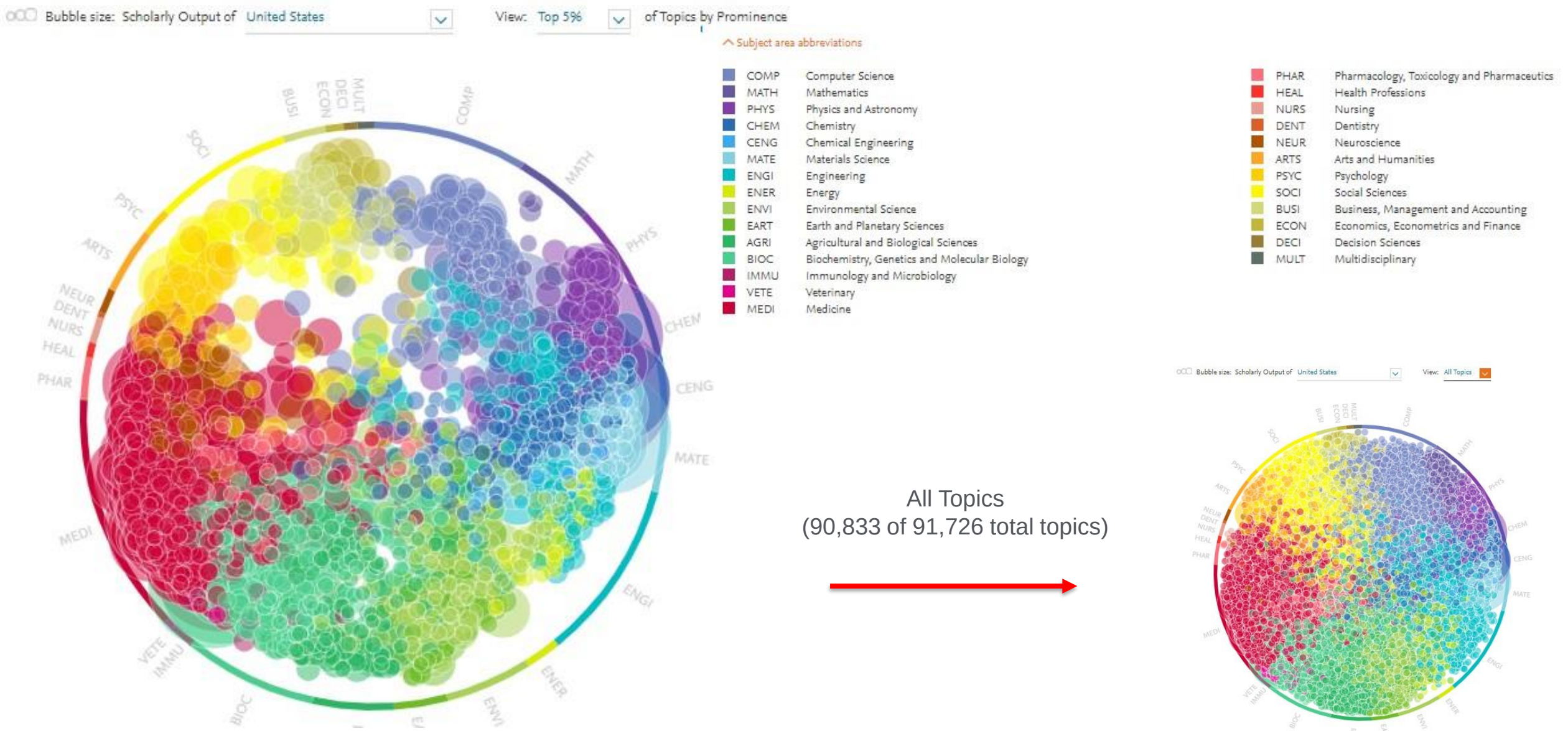
Researchers in the United States have contributed to 70,833 topics between 2012 to 2016

Table | Wheel

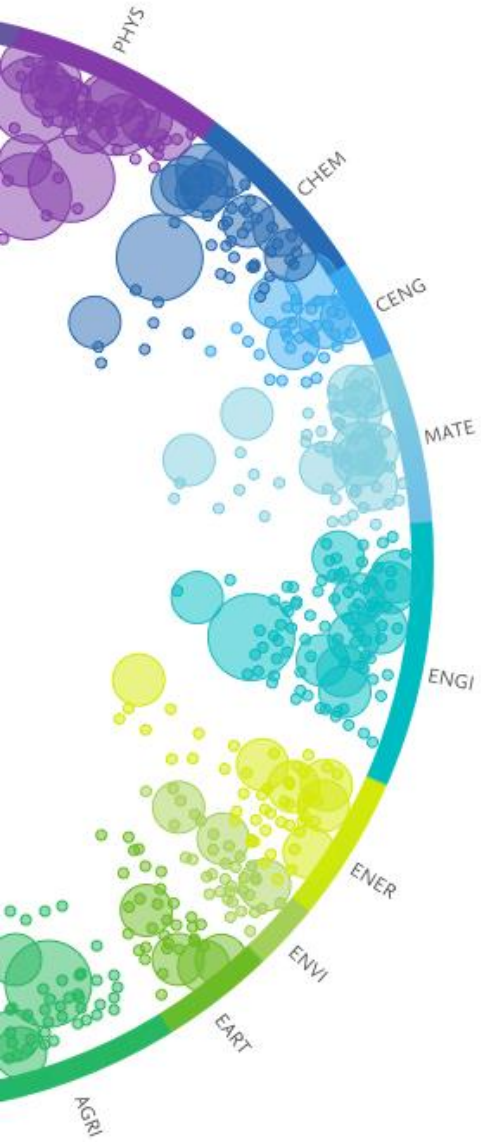
Search this Country's Topics

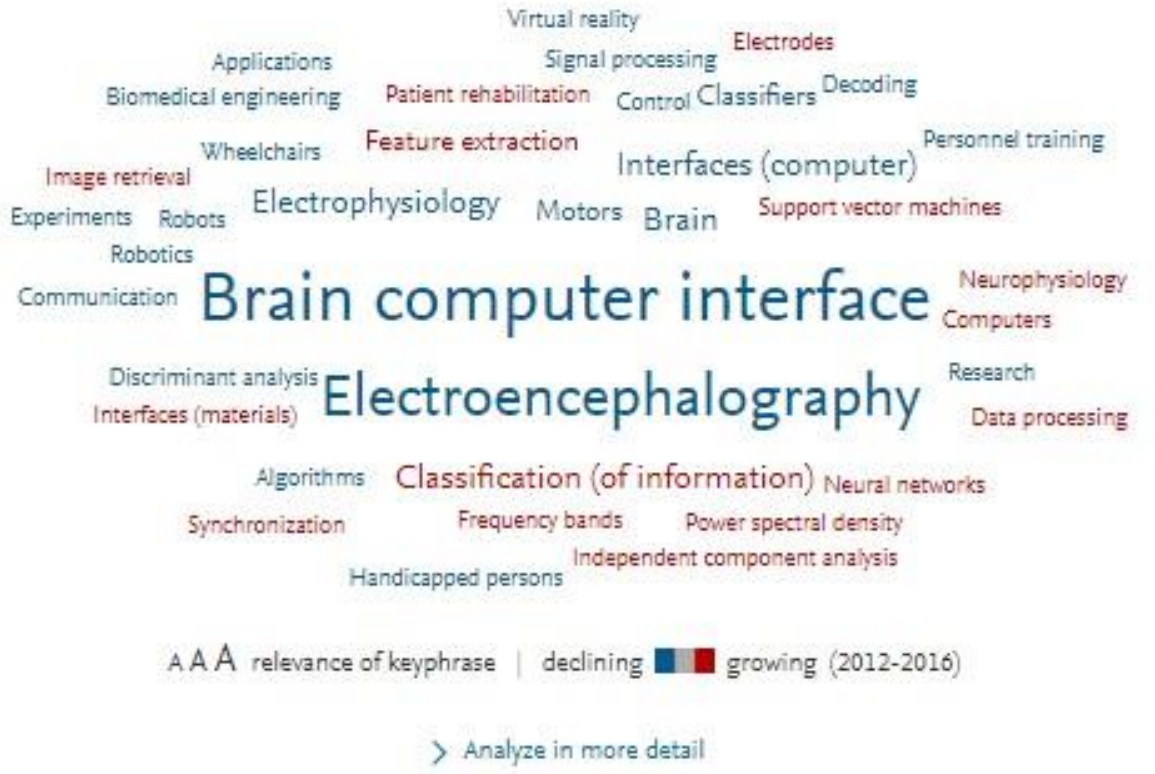
Topic	At this Country: Scholarly Output	At this Country: Publication Share	World: Prominence
Genome; High-Throughput Nucleotide Sequencing; parallel sequencing ... T.2538	2,000	48.24%	99.976 percentile
Metagenome; Probiotics; microbial composition ... T.1279	1,999	41.12%	99.993 percentile
Graphene; Chemical vapor deposition; graphene grown ... T.233	1,846	28.71%	99.990 percentile
MicroRNAs; Neoplasms; expression level ... T.37	1,815	20.74%	99.988 percentile
Brain; Magnetic Resonance Imaging; network DMN ... T.1493	1,726	44.72%	99.973 percentile
Solar cells; Heterojunctions; polymer solar ... T.4	1,693	22.04%	99.996 percentile
Autophagy; Apoptosis; autophagy inhibitor ...	1,692	32.39%	99.982 percentile

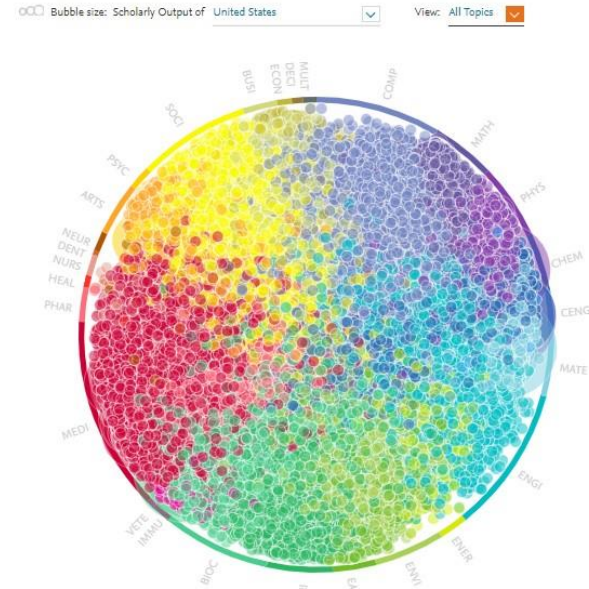
United States—Topics of Prominence—Top 5%



Semantic Word Cloud by Topic







Leading Institutions in High-Throughput Genetic Sequencing

Genome; High-Throughput Nucleotide S

2012 to 2016 | no subject area filter selected | ASJC

Summary | Institutions | Countries | Authors | Scopus Sources | Keyphras

Top Institutions

Worldwide | All sectors | ← Filter for more (regional) detail

Map | Table | Chart

Top 100 Institutions in this Topic, by Scholarly Output

Size: Scholarly Output | total value | Color: Views Cour

Organic light emitting diodes (OLED); Phosphorescence; Light emission T.158

2012 to 2016 | no subject area filter selected | ASJC

Summary | Institutions | Countries | Authors | Scopus Sources | Keyphrases

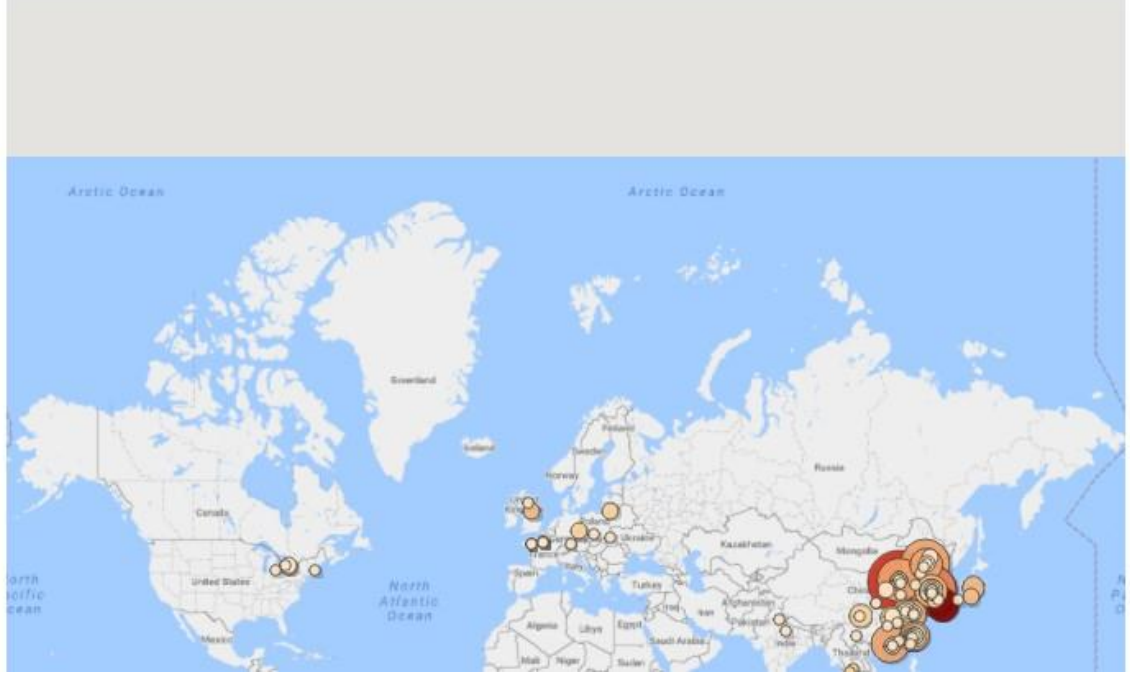
Top Institutions

Worldwide | All sectors | ← Filter for more (regional) detail

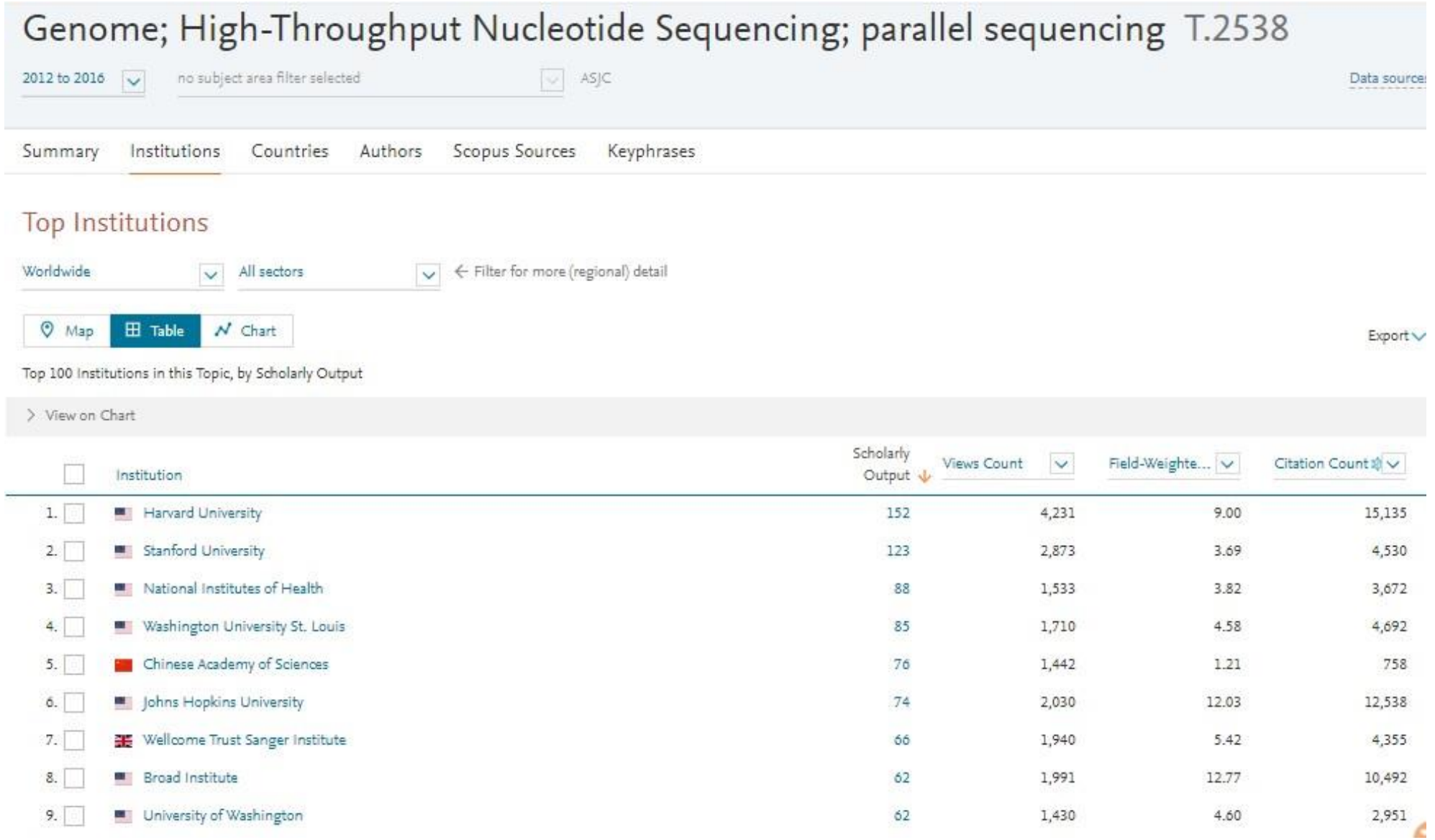
Map | Table | Chart

Top 100 Institutions in this Topic, by Scholarly Output

Size: Scholarly Output | total value | Color: Views Count | total value



Leading Institutions in High-Throughput Genetic Sequencing



Genome; High-Throughput Nucleotide Sequencing; parallel sequencing T.2538

2012 to 2016 | no subject area filter selected | ASJC | Data source

Summary | Institutions | Countries | Authors | Scopus Sources | Keyphrases

Top Institutions

Worldwide | All sectors | ← Filter for more (regional) detail

Map | Table | Chart | Export

Top 100 Institutions in this Topic, by Scholarly Output

> View on Chart

	Institution	Scholarly Output	Views Count	Field-Weighte...	Citation Count
1.	Harvard University	152	4,231	9.00	15,135
2.	Stanford University	123	2,873	3.69	4,530
3.	National Institutes of Health	88	1,533	3.82	3,672
4.	Washington University St. Louis	85	1,710	4.58	4,692
5.	Chinese Academy of Sciences	76	1,442	1.21	758
6.	Johns Hopkins University	74	2,030	12.03	12,538
7.	Wellcome Trust Sanger Institute	66	1,940	5.42	4,355
8.	Broad Institute	62	1,991	12.77	10,492
9.	University of Washington	62	1,430	4.60	2,951

US Topics of Prominence—Shale, Hydraulic Fracturing

Shale; Hydraulic fracturing; unconventional natural T.26182

2012 to 2016 | no subject area filter selected | ASJC | Data source

Summary | Institutions | Countries | Authors | Scopus Sources | Keyphrases

Top Institutions

Worldwide | All sectors | ← Filter for more (regional) detail

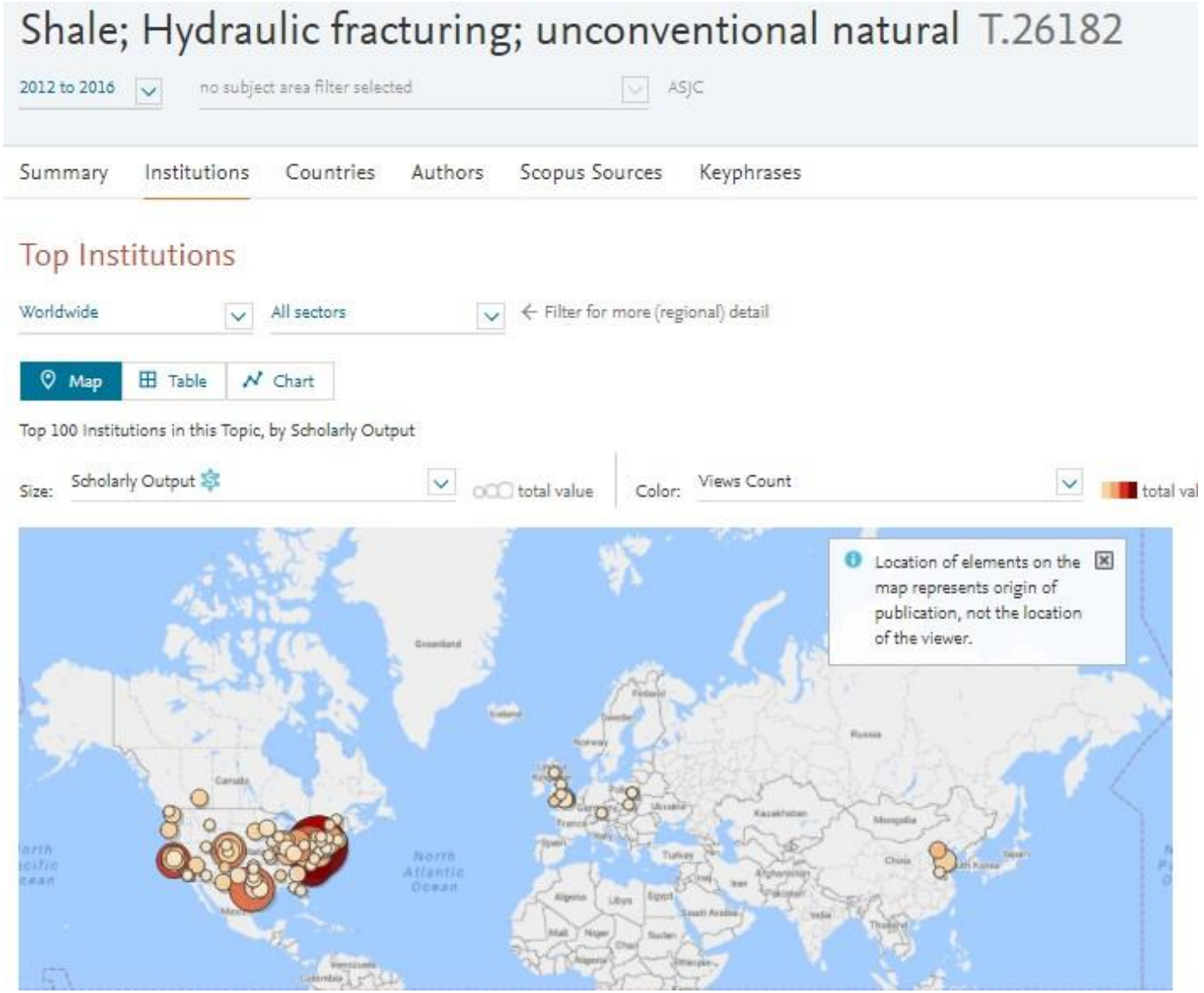
Map | Table | Chart | Export

Top 100 Institutions in this Topic, by Scholarly Output

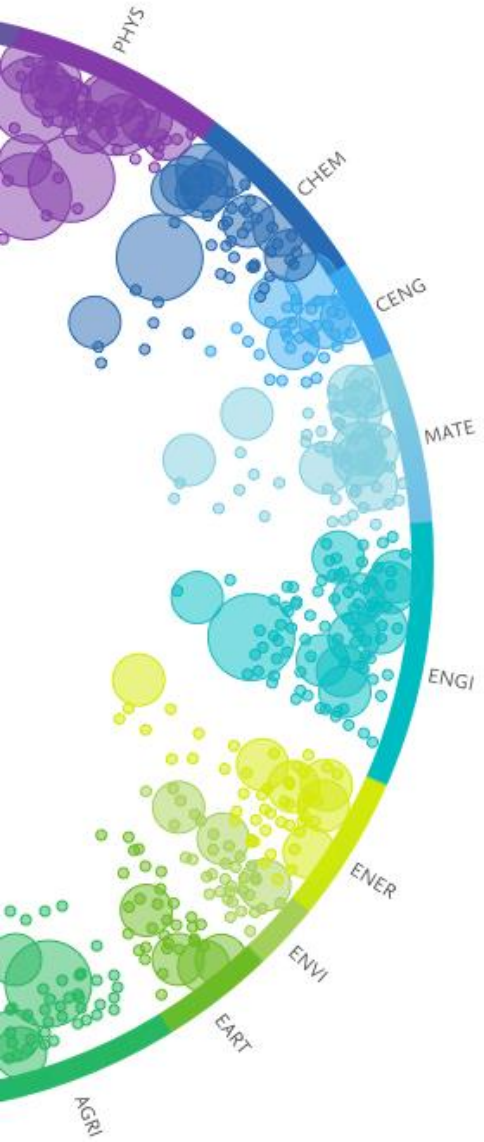
> View on Chart

	Institution	Scholarly Output	Views Count	Field-Weighte...	Citation Count
1.	Pennsylvania State University	45	3,275	5.86	1,389
2.	University of Pittsburgh	36	3,441	5.63	1,325
3.	Cornell University	31	2,778	3.81	952
4.	Carnegie Mellon University	30	1,760	3.59	749
5.	University of Texas at Austin	29	1,881	3.37	869
6.	Duke University	27	3,468	4.32	1,537
7.	West Virginia University	22	581	2.09	145
8.	National Energy Technology Laboratory	20	978	2.62	349
9.	Stanford University	19	2,444	3.38	925

US Topics of Prominence—Shale, Hydraulic Fracturing



US—Topics of Prominence—Leading Authors



Graphene; Oxides; graphene nanosheets T.237

2012 to 2016 | no subject area filter selected | ASJC | Data sources

Summary | Institutions | Countries | Authors | Scopus Sources | Keyphrases

Top authors

North America | All countries | reset filter

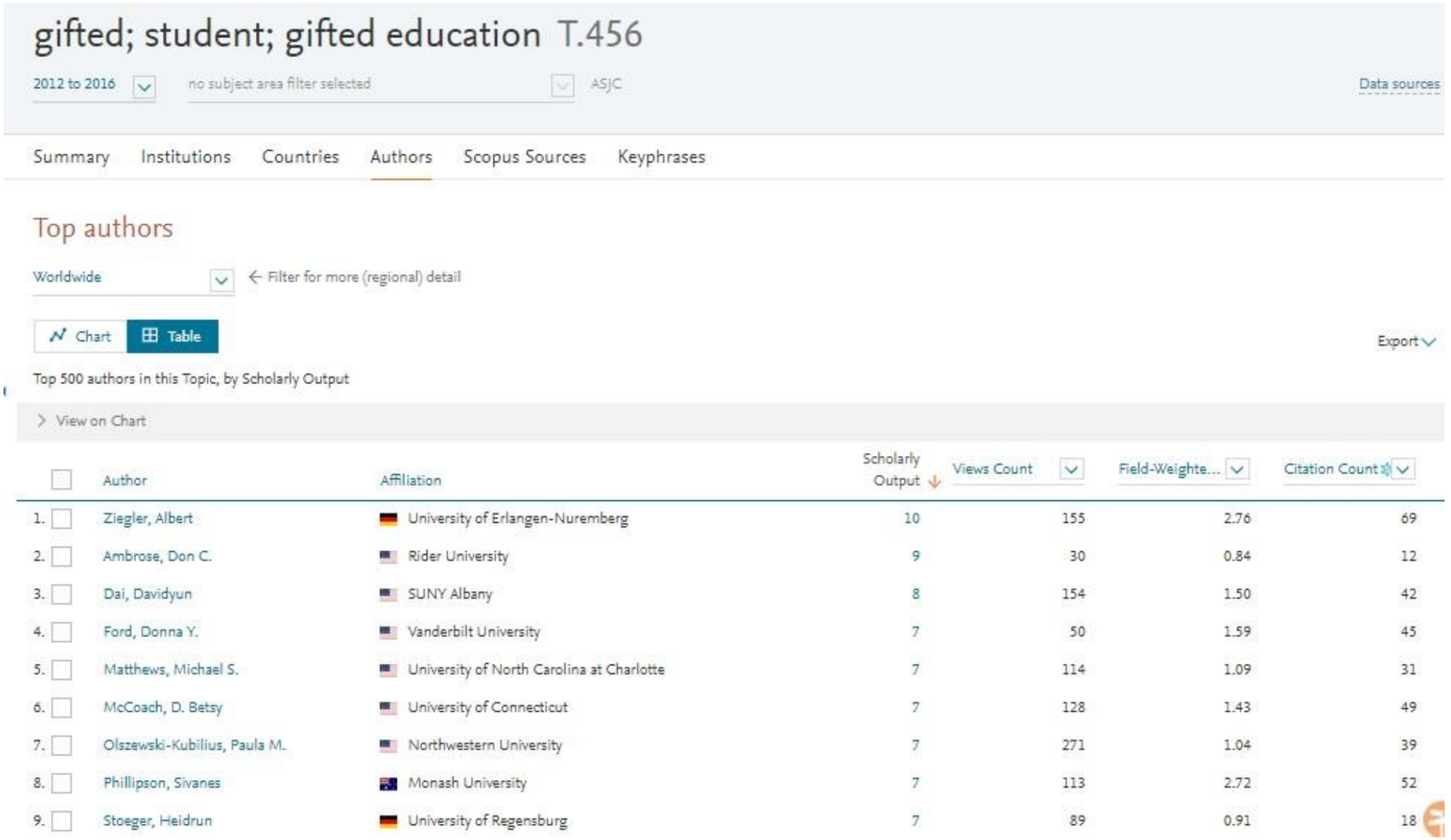
Chart | Table | Export

Top 500 authors in this Topic, by Scholarly Output

View on Chart

	Author	Affiliation	Scholarly Output	Views Count	Field-Weighte...	Citation Count
1.	Chen, Junhong	University of Wisconsin-Milwaukee	27	1,860	4.68	1,609
2.	Ajayan, Pulickel M.	Rice University	25	1,640	4.70	946
3.	Dai, Liming	Case Western Reserve University	25	2,053	7.77	2,133
4.	Huang, Jiaxing	Northwestern University	23	2,198	6.11	1,413
5.	Ruoff, Rodney S.	University of Texas at Austin	19	1,449	5.83	942
6.	Hersam, Mark C.	Northwestern University	17	1,356	7.16	742
7.	Mao, Shun	University of Wisconsin-Milwaukee	15	1,437	7.26	1,422
8.	Wong, Chingping	Georgia Institute of Technology	15	578	3.15	447
9.	Cui, Shumao	University of Wisconsin-Milwaukee	14	795	5.47	864

Topics of Prominence—Leading Authors Globally



gifted; student; gifted education T.456

2012 to 2016 | no subject area filter selected | ASJC | Data sources

Summary | Institutions | Countries | Authors | Scopus Sources | Keyphrases

Top authors

Worldwide ← Filter for more (regional) detail

Chart | Table | Export

Top 500 authors in this Topic, by Scholarly Output

View on Chart

	Author	Affiliation	Scholarly Output	Views Count	Field-Weighte...	Citation Count
1.	Ziegler, Albert	University of Erlangen-Nuremberg	10	155	2.76	69
2.	Ambrose, Don C.	Rider University	9	30	0.84	12
3.	Dai, Davidyun	SUNY Albany	8	154	1.50	42
4.	Ford, Donna Y.	Vanderbilt University	7	50	1.59	45
5.	Matthews, Michael S.	University of North Carolina at Charlotte	7	114	1.09	31
6.	McCoach, D. Betsy	University of Connecticut	7	128	1.43	49
7.	Olszewski-Kubilius, Paula M.	Northwestern University	7	271	1.04	39
8.	Phillipson, Sivanes	Monash University	7	113	2.72	52
9.	Stoeger, Heidrun	University of Regensburg	7	89	0.91	18

Topics of Prominence—Top Author Collaborations

Ziegler, Albert

University of Erlangen-Nuremberg ... Show all affiliations | View this Researcher in Scopus

2012 to 2016 | no subject area filter selected | ASJC | Data sources

Summary | Collaboration | Published | Viewed | Cited | Economic Impact

Overall | Top collaborating Institutions

Top collaborating Institutions

+ Add to Reporting | Export | Shortcuts

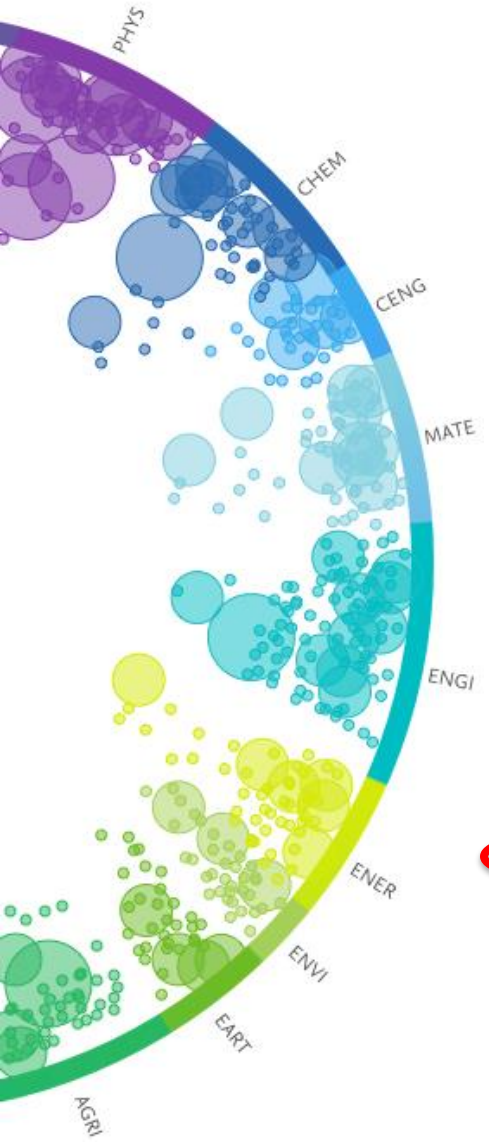
Worldwide, by number of publications co-authored with Ziegler, Albert

Institution	Co-authored publications	Citations
1. University of Erlangen-Nuremberg	14	35
2. University of Regensburg	12	34
3. University of Wollongong	8	24
4. Chinese Academy of Sciences	4	14
5. University of Glasgow	4	4
6. Universitat Augsburg	4	11
7. University of Vienna	4	11
8. Monash University	4	42
9. Institute of Psychology Chinese Academy of Sciences	3	17
10. Technische Universitat Darmstadt	3	8

Agenda

- Data Sources and Technologies: Scopus, SciVal, Elsevier Fingerprint Engine
- Advances in SciVal Metrics – Topics of Prominence (TOP)
  - What are TOP, how do they work?
  - Why are they different and better than previous methods?
  - Broadening SciVal use cases
- Research Strengths and SWOT Analysis
  - How can TOP be used to identify specific strengths at an institutional or national level?
- Driving University-Industry Partnerships
- Q&A

Wayne State University--Topics



Wayne State University

461-470 (QS) · 351–400 (THE) · 301-400 (ARWU) | United States | More details on this Institution

2012 to 2016 | no subject area filter selected | ASJC

Summary | Topics | Awarded Grants | Collaboration | Published | Viewed | Cited | Economic Impact | Societal Impact | Authors

Browse Topics

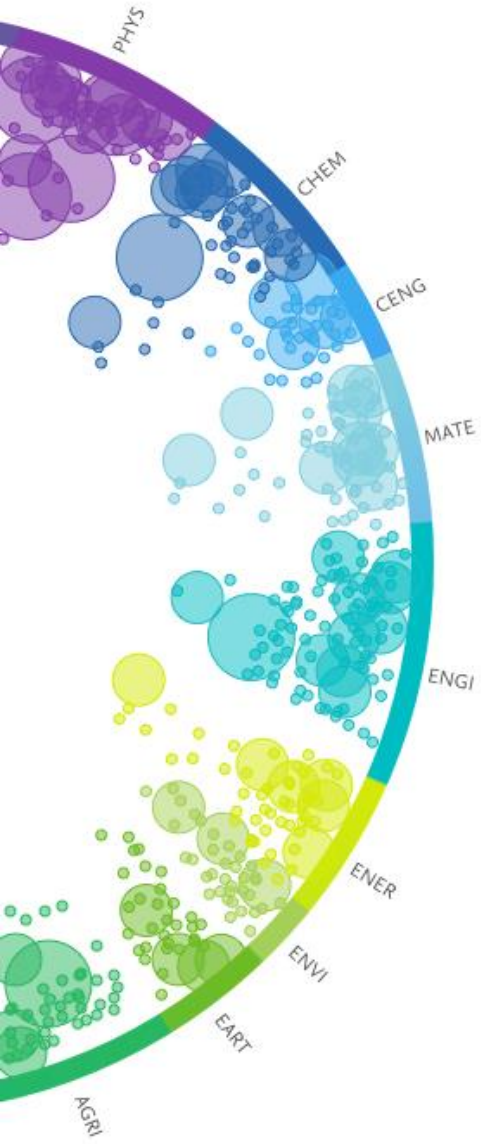
Researchers at Wayne State University have contributed to 6,613 topics between 2012 to 2016

Table | Wheel

Search this Institution's To

Topic	At this Institution: Scholarly Output	Publication Share	Worldwide: Prominence
quarks; production; asymmetry ... T.1868	108	11.05% ▲	98.009 percentile
collisions; jets; quarks ... T.649	92	8.31% ▲	97.712 percentile
jets; production; collisions ... T.1026	92	6.31% ▲	99.757 percentile
collisions; ionic collisions; flow ... T.633	79	5.16% ▲	99.229 percentile
Daptomycin; Vancomycin; Methicillin-Resistant Staphylococcus aureus ... T.4002	55	6.10% ▼	97.041 percentile
Iron; Brain; Multiple Sclerosis ... T.6947	48	6.29% ▲	98.011 percentile
dissociation; Protonation; cations ... T.12611	48	19.51% ▲	89.322 percentile
Chorioamnionitis; Premature Birth; Amniotic Fluid ... T.3128	47	8.45% ▲	96.122 percentile
supersymmetry; collisions; jets ... T.23456	47	11.96% ▲	97.206 percentile

Wayne State University--Topics



Daptomycin; Vancomycin; Methicillin-Resistant Staphylococcus aureus T.4002

2012 to 2016 | no subject area filter selected | ASJC

Summary | Institutions | Countries | Authors | Scopus Sources | Keyphrases

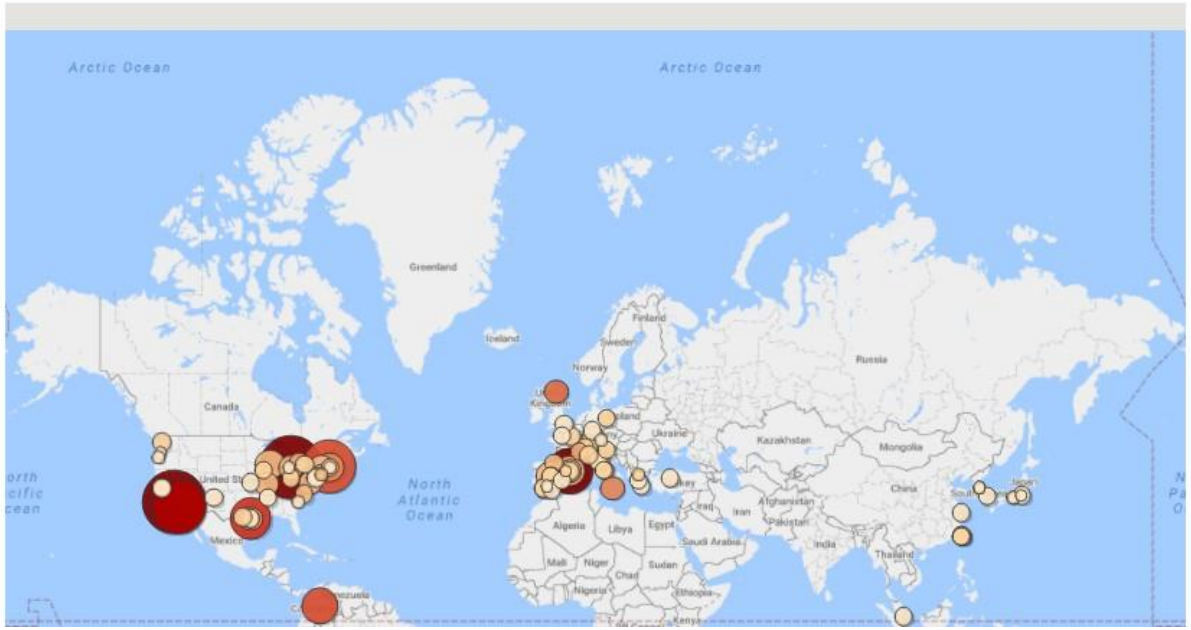
Top Institutions

Worldwide | All sectors | ← Filter for more (regional) detail

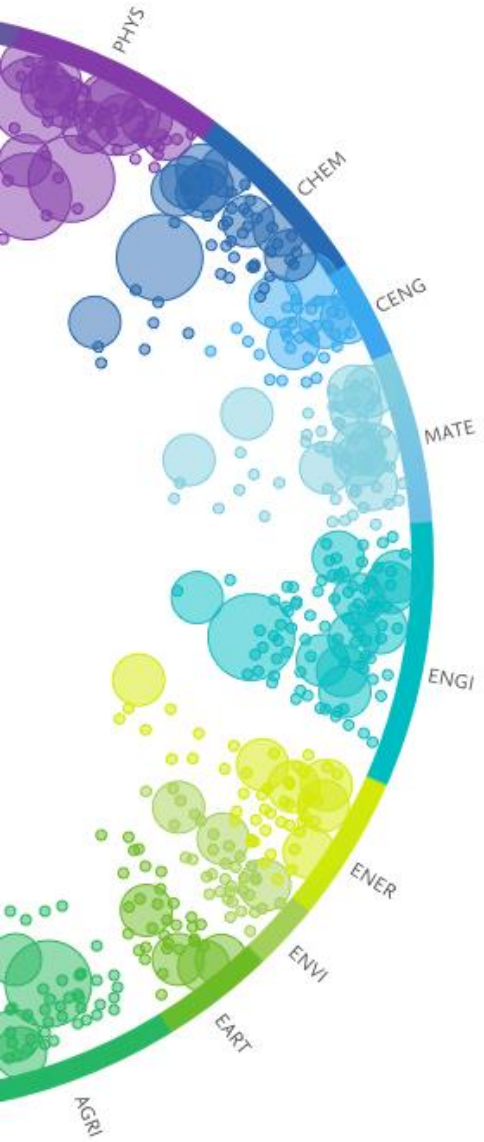
Map | Table | Chart

Top 100 Institutions in this Topic, by Scholarly Output

Size: Scholarly Output — total value | Color: Views Count — total value



Wayne State University--Topics



Daptomycin; Vancomycin; Methicillin-Resistant Staphylococcus aureus T.4002

2012 to 2016 | no subject area filter selected | ASJC | Data sources

Daptomycin; Vancomycin; Methicillin-Resistant Staphylococcus aureus T.4002

2012 to 2016 | no subject area filter selected | ASJC | Data sourc

Summary | Institutions | Countries | Authors | Scopus Sources | Keyphrases

Top Institutions

Worldwide | Corporate | reset filter

Map | Table | Chart

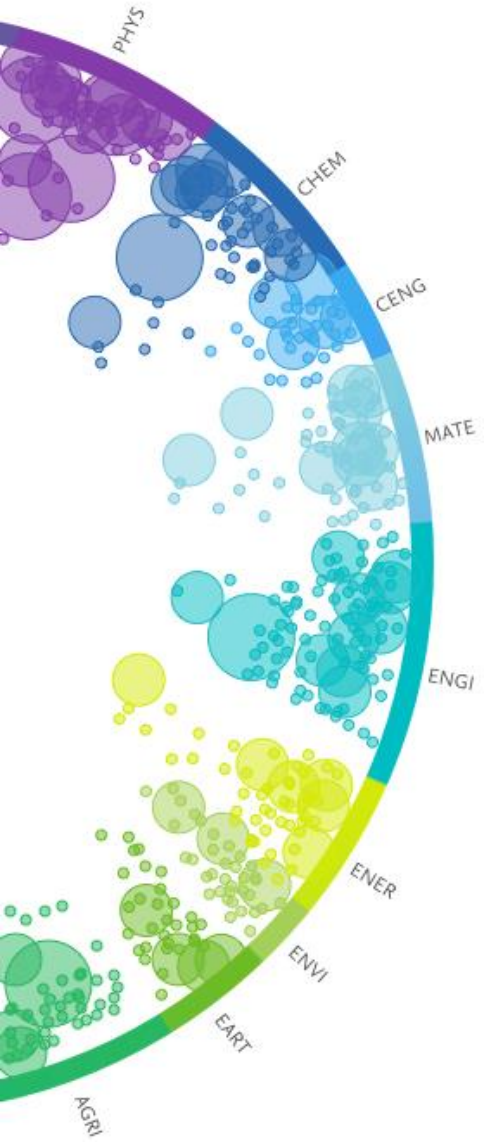
Top 100 Institutions in this Topic, by Scholarly Output

View on Chart

Export

	Institution	Scholarly Output	Views Count	Field-Weighte...	Citation Count
1.	Cubist Pharmaceuticals, Inc.	40	422	2.17	672
2.	Novartis	10	112	2.15	117
3.	Merck	7	52	1.97	30
4.	Kitasato Institute	1	1	0.00	0
5.	Philips HealthTech	1	2	0.50	3
6.	Shionogi & Co., Ltd.	1	21	0.50	6
10.	Universitat Autonoma de Barcelona	19	182	1.72	181
11.	Harvard University	17	260	2.66	398

Microsoft USA--Topics



Microsoft USA

United States More details on this Institution

2012 to 2016 | no subject area filter selected | ASJC | Data sou

Summary | Topics | Awarded Grants | Collaboration | Published | Viewed | Cited | Economic Impact | Societal Impact | Authors

Browse Topics

Expor

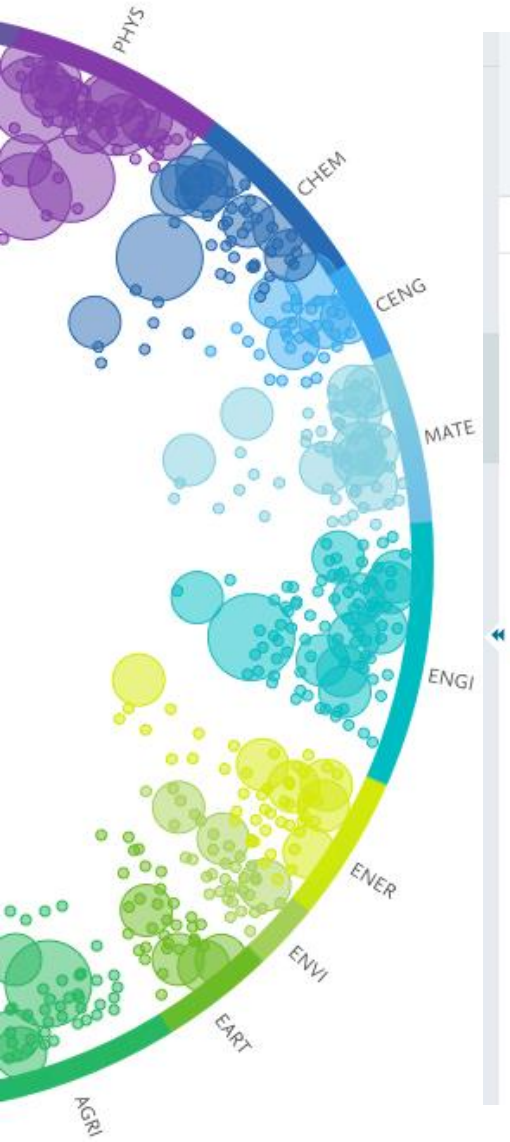
Researchers at Microsoft USA have contributed to 1,465 topics between 2012 to 2016

Table | Wheel

Search this Institution's Topics

Topic	At this Institution: Scholarly Output	At this Institution: Publication Share	World: Prominence
Search engines; Information retrieval; search logs ... T.3454	112	13.05%	95.814 percentile
Earnings; Machine design; truthful mechanisms ... T.4366	84	11.19%	95.844 percentile
Verification; Model checking; loop invariants ... T.2248	67	7.75%	93.932 percentile
Algorithms; Computer vision; feature transform ... T.250	65	1.29%	99.714 percentile
Models; Research; crowd workers ... T.10075	58	3.87%	99.374 percentile
Speech recognition; Neural networks; discriminative training ... T.6136	52	9.30%	95.997 percentile

Top Global Institutions—Verification, Model Checking



Model checking; Verification; Interpolation T.9134

2012 to 2016 | no subject area filter selected | ASJC | Data sourc

Summary | Institutions | Countries | Authors | Scopus Sources | Keyphrases

Top Institutions

Worldwide | All sectors | ← Filter for more (regional) detail

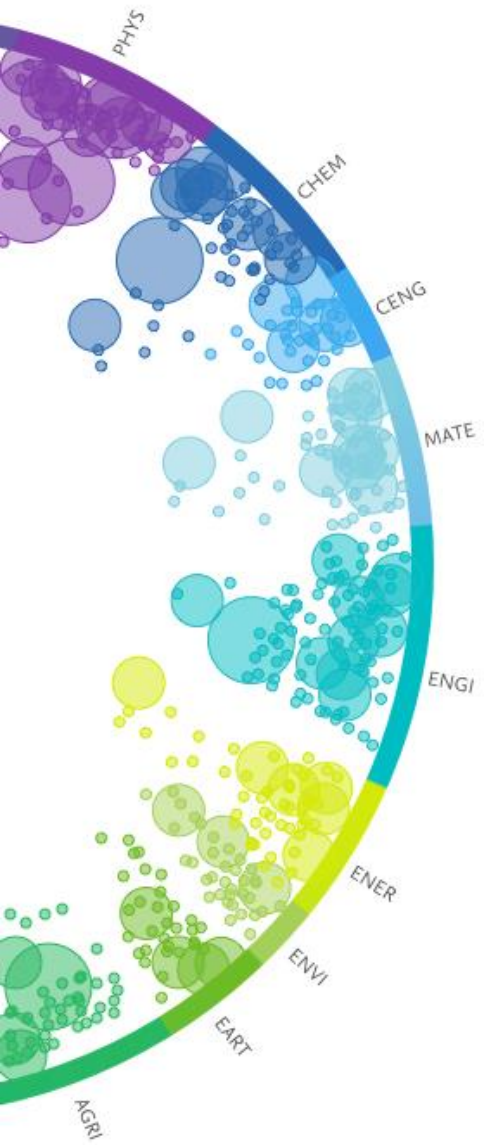
Map | Table | Chart | Export

Top 100 Institutions in this Topic, by Scholarly Output

View on Chart

	Institution	Scholarly Output	Views Count	Field-Weighte...	Citation Count
1.	University of Passau	40	181	6.42	366
2.	Microsoft USA	39	178	3.94	403
3.	University of Oxford	36	141	2.18	133
4.	University of Lugano	34	162	2.05	198
5.	Carnegie Mellon University	32	165	4.02	224
6.	Vienna University of Technology	26	83	1.56	90
7.	University of Freiburg	24	63	4.18	171
8.	Fondazione Bruno Kessler	19	111	6.13	310
9.	University of Chieti	18	168	2.06	91
10.	CNR	17	161	2.18	91

Top US Institutions—Verification, Model Checking



Model checking; Verification; Interpolation T.9134

2012 to 2016 | no subject area filter selected | ASJC | Data sources

Summary | Institutions | Countries | Authors | Scopus Sources | Keyphrases

Top Institutions

North America | United States | All sectors | reset filter

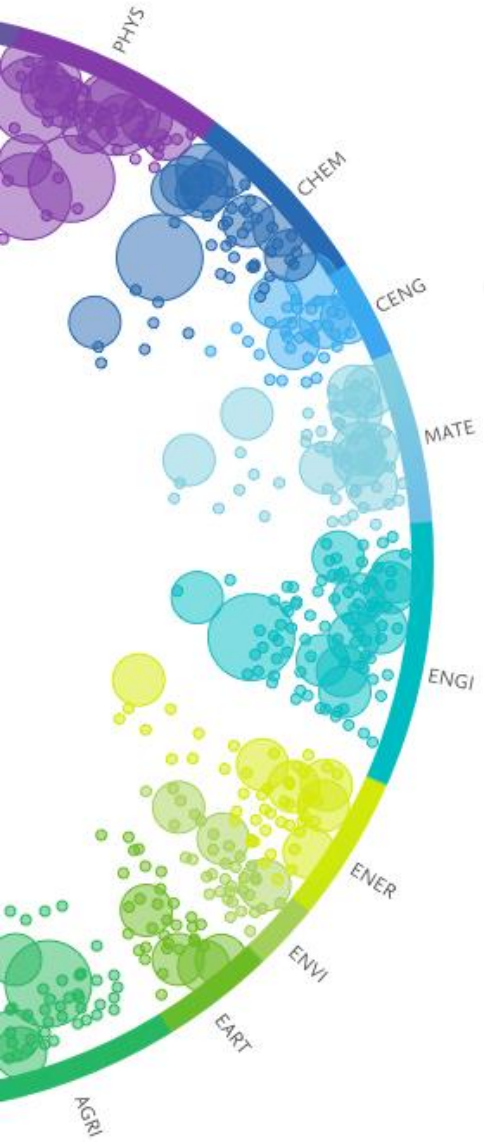
Map | Table | Chart | Export

Top 100 Institutions in this Topic, by Scholarly Output

View on Chart

	Institution	Scholarly Output	Views Count	Field-Weighte...	Citation Count
1.	Microsoft USA	39	178	3.94	403
2.	Carnegie Mellon University	32	165	4.02	224
3.	NASA Ames Research Center	11	46	2.07	39
4.	University of California at Berkeley	11	27	3.56	68
5.	University of Colorado Boulder	9	28	1.53	52
6.	Princeton University	8	25	0.75	19
7.	Stanford University	8	58	3.85	80
8.	University of Illinois at Urbana-Champaign	7	32	4.19	48
9.	IBM Research	6	8	2.08	24
10.	New York University	6	9	2.03	27
11.	College of William and Mary	5	35	2.88	46
12.	Intel	5	16	1.25	20
13.	SRI International	5	18	1.27	4

Top US Institutions—Verification, Model Checking



Publications at Carnegie Mellon University

Within: **Model checking; Verification; Interpolation** T.9134 | Year range: 2012 to 2016

Expor

Authors

- **All authors**
- Gurfinkel, A. 24
- Chaki, S. 8
- Kahsai, T. 8
- Albarghouthi, A. 5
- Chechik, M. 5

Show more

Institutions

- **All institutions**
- Carnegie Mellon University 32
- University of Toronto 5
- NASA Ames Research Center 4
- Technion-Israel Institute of Technology 4
- ONERA 3

Show more

- Countries
- Scopus Sources
- Subject Areas
- Publication years
- Publication types

32 publications

Title	Authors	Year	Scopus Source	Citations
Whale: An interpolation-based algorithm for inter-procedural verification View abstract View in Scopus	Albarghouthi, A., Gurfinkel, A., Chechik, M.	2012	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	26
UFO: Verification with interpolants and abstract interpretation: (Competition contribution) View abstract View in Scopus	Albarghouthi, A., Gurfinkel, A., Li, Y. and 2 more	2013	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	18
SMT-based model checking for recursive programs View abstract View in Scopus	Komuravelli, A., Gurfinkel, A., Chaki, S.	2014	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	18
Automatic abstraction in SMT-based unbounded software model checking View abstract View in Scopus	Komuravelli, A., Gurfinkel, A., Chaki, S. and 1 more	2013	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	16
From under-approximations to over-approximations and back View abstract View in Scopus	Albarghouthi, A., Gurfinkel, A., Chechik, M.	2012	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	15
Ufo: A framework for abstraction- and interpolation-based software verification View abstract View in Scopus	Albarghouthi, A., Li, Y., Gurfinkel, A. and 1 more	2012	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	14
Regression verification for multi-threaded programs View abstract View in Scopus	Chaki, S., Gurfinkel, A., Strichman, O.	2012	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	11
Horn clause solvers for program verification View abstract View in Scopus	Bjørner, N., Gurfinkel, A., McMillan, K. and 1 more	2015	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	10

Topics of Prominence Paper References

Which Type of Citation Analysis Generates the Most Accurate Taxonomy of Scientific and Technical Knowledge? Journal of the Association for Information Science and Technology, 68(4):984–998, 2017

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Kevin W. Boyack, SciTech Strategies, Inc., Albuquerque, NM 87122. E-mail: kboyack@mapofscience.com

Elsevier Research Intelligence

Q&A Session

Thank You!

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