Global Scientific Connections in 2018

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The Data

- Repository of electronic preprints (known as e-prints) approved for publication after moderation
- Consists of scientific papers in the fields of mathematics, physics, astronomy, computer science, quantitative biology, statistics, and quantitative finance
- January 2018

Questions of Interest

- In January 2018, which countries published most on ArXiv?
- Do certain countries tend to collaborate with each other?
- What do author collaborations look like?

Preprocess Nested Zipped Files

Pre-Processing

Loop through nested gz files

Create a folder for each article

Store all .tex files in respective article folder

Parse Emails for Countries & Institutions

Emails help us fill in missing January 2018 data

Scrape emails	Clean emails	Join External Data
Scrape emails & article id’s from .tex files using pySpark	Clean emails using regex & Python string methods	Cross-reference emails with external university & country data

Cross - Reference Data

Inner-join

Article	Email ends	domain
1	@bnu.edu.cn	.edu
2	@gmail.com	.com
3	@sciencespo.fr	24

Institution	Email ends	domain	Country
Beijing Normal University	@bnu.edu.cn	.edu	China
University of Tokyo	@ac.jp	.ac.jp	Japan
Leiden University	@bb.leiden.univ	.leiden.univ	Netherlands

Visualizing Global Authorship

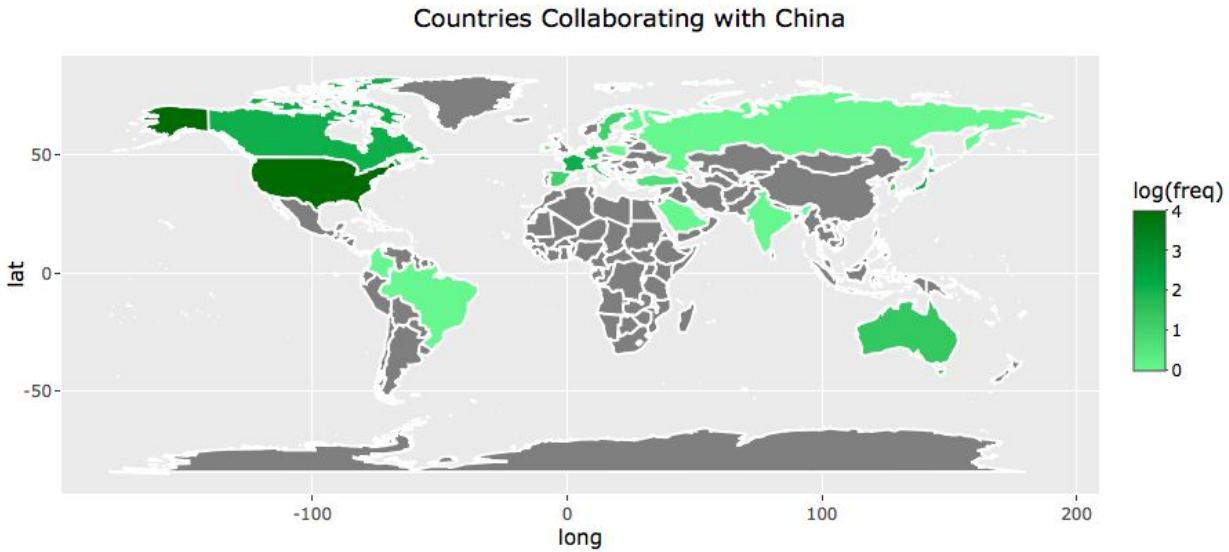
Article Relationships | Collaboration | Generic Emails | Overall View | Chord Diagram

Collaborating Countries

Select Country:

China

Select a Country and a map will render with the number of corresponding countries that have articles that are associated with the selected country.



https://flights.shinyapps.io/shiy/

Call API for external metadata

Fill in the gaps in our missing January 2018 data

Pull Filenames into RDD

Use spark to pull all arxiv-ids into an RDD

Map with API call

Map the arxiv-id RDD to a function that calls the arxiv API returning article information in an XML

Parse the XML into arxiv-id, title, authors, affiliations, journal reference, author comments, primary category, all categories, and abstract

Save the RDD

Write the new RDD to a csv

Resulting Dataset

arxiv-id	title	Authors	Affiliations	Journal Reference	Comments	Primary Category	Categories	Abstract
1801.01255v1	Duffing oscillator and elliptic curve cryptography	A. V. Tsiganov		No journal ref found	7 pages, LaTeX with AMS fonts	nlin.SI	nlin.SI, math-ph, math.DS, math.MP, 14H52, 37J35	A new approach to discretization of the Duffing equation is presented.Integrable discrete maps are obtained by using well-studied encryptingoperations in elliptic curve cryptography and, therefore, they do not dependupon standard small parameter assumption.
1801.09605v2	The Schwarzian Theory - Origins	Thomas G. Mertens		No journal ref found	40 pages + appendices, v2: corrected several equations in section 5, added discussion on particle on a group, typos corrected and references added	hep-th	hep-th	In this paper we further study the 1d Schwarzian theory, the universallow-energy limit of Sachdev-Ye-Kitaev models, using the link with 2d Liouvilletheory. We provide a path-integral derivation of the structural link betweenboth theories, and study the relation between 3d gravity, 2d Jackiw-Teitelboimgravity, 2d Liouville and the 1d Schwarzian. We then generalize the Schwarziandouble-scaling limit to rational models, relevant for SYK-type models withinternal symmetries. We identify the holographic gauge theory as a 2d BF theoryand compute correlators of the holographically dual 1d particle-on-a-groupaction, decomposing these into diagrammatic building blocks, in a manner verysimilar to the Schwarzian theory.
1801.00652v1	Assessing the long-term variability of acetylene and ethane in the stratosphere of Jupiter	Henrik Melin, L. N. Fletcher, P. T. Donnelly, T. Greathouse, J. Lacy, G. S. Orton, R. Giles, J. Sinclair, P. G. J. Irwin		Icarus, 2018	39 pages, 9 Figures, 2 tables, in press	astro-ph.EP	astro-ph.EP	Acetylene (C$_2$H$_2$) and ethane (C$_2$H$_6$) are both produced in thestratosphere of Jupiter via photolysis of methane (CH$_4$). Despite this commonsource, the latitudinal distribution of the two species is radically different,with acetylene decreasing in abundance towards the pole, and ethane increasingtowards the pole. We present six years of NASA IRTF TEXES mid-infraredobservations of the zonally-averaged emission of methane, acetylene and ethane.We confirm that the latitudinal distributions of ethane and acetylene aredecoupled, and that this is a persistent feature over multiple years. Theacetylene distribution falls off towards the pole, peaking at$\sim$30°N with a volume mixing ratio (VMR) of $\sim$0.8 parts permillion (ppm) at 1 mbar and still falling off at $\pm70^\circ$ with a VMR of$\sim$0.3 ppm. The acetylene distributions are asymmetric on average, but as wemove from 2013 to 2017, the zonally-averaged abundance becomes more symmetricabout the equator. We suggest that both the short term changes in acetylene andits latitudinal asymmetry is driven by changes to the vertical stratosphericmixing, potentially related to propagating wave phenomena. Unlike acetylene,ethane has a symmetric distribution about the equator that increases toward thepole, with a peak mole fraction of $\sim$18 ppm at about $\pm50^{\circ}$latitude, with a minimum at the equator of $\sim$10 ppm at 1 mbar. [...] Theequator-to-pole distributions of acetylene and ethane are consistent withacetylene having a shorter lifetime than ethane that is not sensitive to longeradvective timescales, but is augmented by short-term dynamics, such as verticalmixing. Conversely, the long lifetime of ethane allows it to be transported tohigher latitudes faster than it can be chemically depleted.

Fix Categories

"nlin.SI"	"hep-th"	"astro-ph.EP"	"astro-ph.CO"	"astro-ph.SR"	"math.FA"	"math.MG"	"q-bio.QM"
"quant-ph"	"astro-ph.GA"	"cs.IT"	"cs.SE"	"math-ph"	"math.AG"	"hep-ph"	"gr-qc"
"stat.ML"	"physics.geo-ph"	"cond-mat.mes-hall"	"math.GT"	"math.CA"	"cs.SI"	"math.AC"	"cond-mat.mtrl-sci"
"math.CV"	"math.AT"	"stat.AP"	"nucl-th"	"cs.CV"	"cond-mat.soft"	"physics.atom-ph"	"math.NT"
"physics.app-ph"	"math.HO"	"q-fin.MF"	"math.AP"	"q-bio.NC"	"physics.comp-ph"	"physics.plasm-ph"	"stat.ME"
"math.OC"	"cs.CG"	"cs.RO"	"nucl-ex"	"physics.optics"	"math.CO"	"physics.ins-det"	"astro-ph.HE"
"eess.SP"	"math.QA"	"cs.CR"	"math.PR"	"cond-mat.str-el"	"physics.chem-ph"	"math.LO"	"physics.hist-ph"
"cond-mat.quant-gas"	"math.GN"	"math.OA"	"cs.CY"	"q-bio.CB"	"cs.HC"	"math.RT"	"physics.ao-ph"
"cs.DS"	"math.GR"	"cs.LG"	"cs.CL"	"math.NA"	"math.SP"	"q-bio.OT"	"cs.NI"
"cond-mat.dis-nn"	"math.ST"	"cs.MM"	"math.DG"	"hep-ex"	"math.DS"	"cs.NE"	"cond-mat.stat-mech"
"cs.AI"	"physics.flu-dyn"	"physics.bio-ph"	"cs.SY"	"cs.DC"	"stat.CO"	"econ.EM"	"physics.space-ph"
"math.RA"	"cs.DL"	"cs.GT"	"cs.MA"	"physics.gen-ph"	"q-fin.GN"	"physics.soc-ph"	"physics.atm-clus"
"cs.ET"	"math.GM"	"cs.CC"	"cs.IR"	"hep-lat"	"cond-mat.supr-con"	"q-bio.SC"	"cs.DM"
"astro-ph.IM"	"cs.NA"	"nlin.CD"	"q-bio.GN"	"cs.LO"	"nlin.PS"	"eess.IV"	"math.CT"
"q-bio.PE"	"physics.acc-ph"	"q-fin.CP"	"nlin.AO"	"cs.FL"	"cs.SD"	"cs.MS"	"physics.med-ph"
"cs.AR"	"q-fin.RM"	"q-fin.ST"	"stat.OT"	"physics.class-ph"	"physics.data-an"	"q-fin.EC"	"q-bio.MN"
"cond-mat.other"	"math.SG"	"cs.GR"	"q-bio.BM"	"physics.ed-ph"	"cs.CE"	"math.KT"	"cs.PL"
"cs.PF"	"cs.DB"	"cs.SC"	"physics.pop-ph"	"cs.OH"	"q-fin.PR"	"eess.AS"	"q-fin.TR"
"cs.OS"	"q-bio.TO"	"q-fin.PM"					

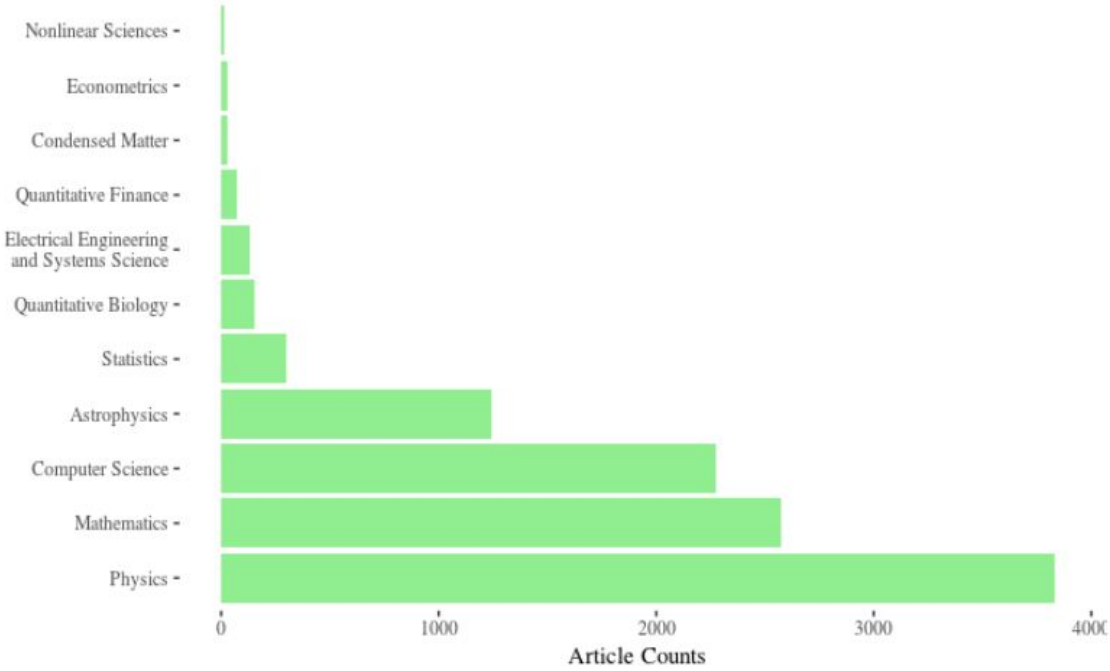
Semi-Manual Munging

Astrophysics
Mathematics
Statistics
Condensed Matter

Physics
Quantitative Biology
Econometrics
Nonlinear Sciences

Computer Science
Quantitative Finance
Electrical Engineering\nand Systems Science

Fix Categories



Visualizing Collaboration

We were curious about collaboration in the scientific field (on arxiv) and wanted to visualize networks of collaboration.

Authors:

- We explored a network of authors showing connections where authors had published together.
- However, this was much too large for a network graph: 35,480 unique authors that had published with at least one other person.
- Filtering down to only authors who had published with three or more other people still left us with 7,831 unique authors
- Research indicated network graphs show significant slow down with ~4000 nodes and ~3000 links.
- We struggled to plot 1/1000th of the data

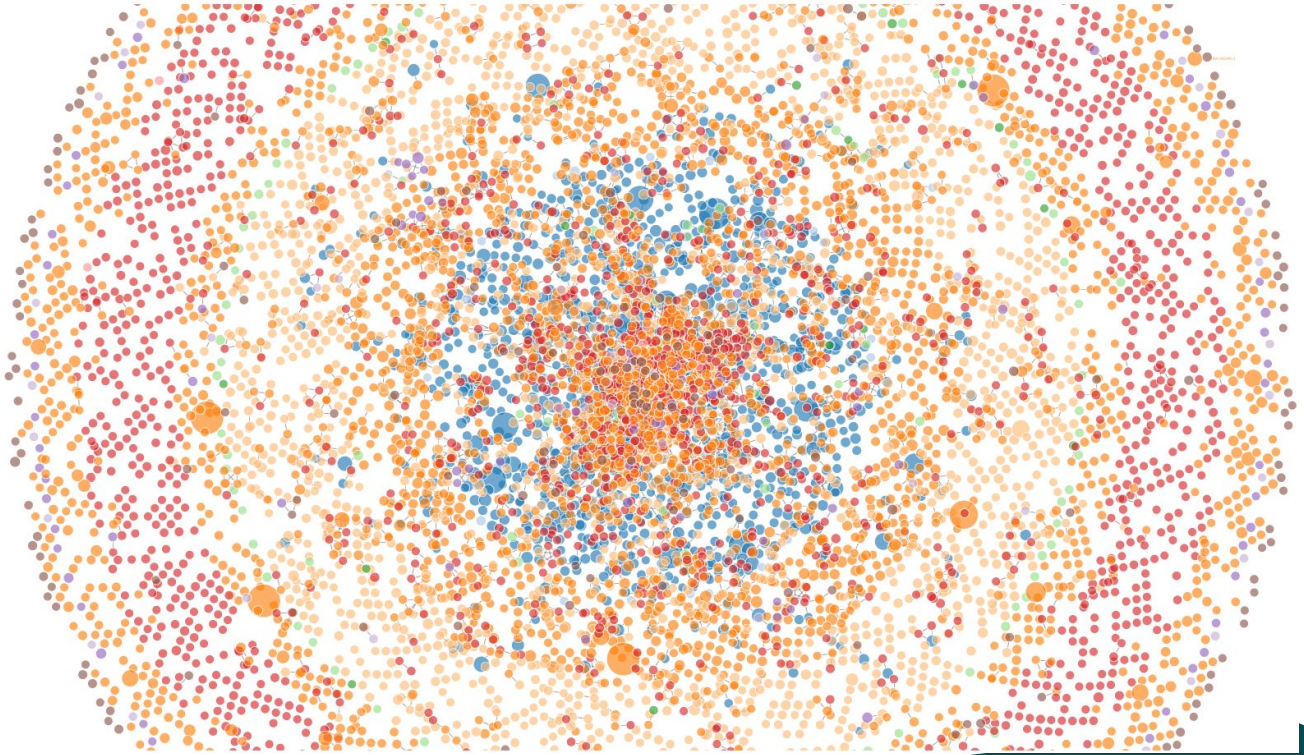
Visualizing Collaboration

We were curious about collaboration in the scientific field (on arxiv) and wanted to visualize networks of collaboration.

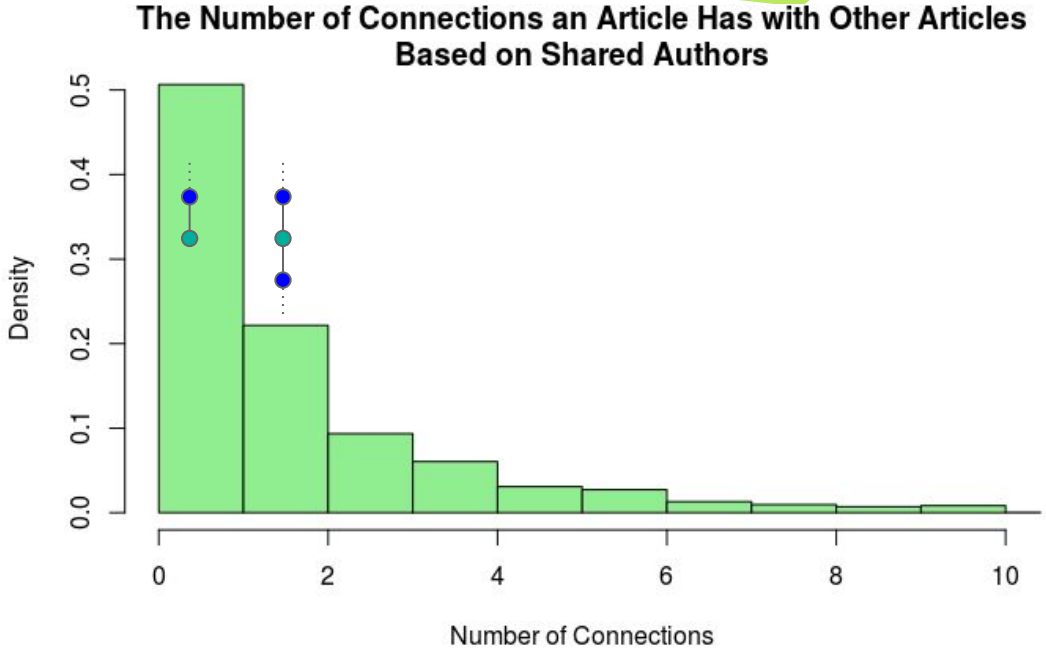
Articles:

- We explored a network of articles showing connections where articles shared at least 1 author

Article Network - Links indicate at least 1 shared author



Article Network



Link to show viz

Conclusions

Conclusions

- United States authored most publications, followed by China and Germany.
- Authors from the United States and Switzerland tended to collaborate with each other more followed by China and the United States.
- Most articles had between 1-4 authors collaborating. The most common pairing was 2 authors per article.

Thanks!

Questions?

Check out our repo!

https://bit.ly/2Ii4ehw