

# TIAGO DE PAULA PEIXOTO

Associate Professor, Dr. habil.

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## EMPLOYMENT

<i>Associate Professor</i> Department of Network and Data Science, Central European University, Austria	since 2019
<i>Assistant Professor (Lecturer) in Applied Mathematics</i> University of Bath, UK	2016-2019
<i>External Researcher</i> ISI Foundation, Turin, Italy	2015-2020
<i>Post-doc Researcher</i> Universität Bremen, Germany	2011-2016
<i>Post-doc Researcher</i> Universität Darmstadt, Germany	2008-2011

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## APPOINTMENTS

<i>Program Director, BA in Quantitative Social Sciences</i> Central European University, Austria	since 2020
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## EDUCATION AND QUALIFICATIONS

<i>Habilitation in Theoretical Physics</i> Universität Bremen, Germany	2017
<i>Ph.D. in Physics</i> Universidade de São Paulo, Brazil	2008
<i>B.Sc. in Physics</i> Universidade de São Paulo, Brazil	2004

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## PRIZES AND HONORS

<i>Erdős–Rényi Prize in Network Science, Network Science Society</i>	2019
<i>“For groundbreaking contributions to the statistical analysis and visualization of networks, including efficient and principled inference algorithms based on the stochastic block model, and compression and prediction of richly annotated or hierarchical structures.”</i>	
<i>Best presentation award, International School and Conference on Network Science, NetSci X, Wrocław, Poland</i>	2016
<i>6th recipient of the Zachary Karate Club Club Prize in Network Science</i>	2015

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## RESEARCH AREAS

Network Science, Statistical Physics, Bayesian Inference, Machine Learning, Dynamical Systems

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## GRANTS AND FELLOWSHIPS

GW4 Accelerator Grant “Recurrence analysis for the characterisation and classification of epileptic patients,” ca. £ 35,000 (co-PI, w. N. Masuda, L. Livi, J. Zhang) 2019

Post-doc research grant, project “Large-scale Properties in Dynamic Network Systems” under the program “Independent projects for post-docs,” Central Research Development Fund, University of Bremen, ca. € 330,000 (PI) 2012-2016

Alexander von Humboldt Foundation Fellowship, ca. € 80,000 (PI) 2008

FAPESP Ph.D. scholarship (“Direct to Ph.D.” program) 2004-2008

FAPESP undergraduate scholarship (“Inicição Científica”) 2000-2004

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## ACADEMIC SERVICES

Program committee member for NetSci (2016, 2017, 2018, 2019, 2020), CCS (2017, 2018, 2019, 2020), WWW (2018), SocInfo2017, Statphys26, SIAM NS (2017, 2018, 2019, 2020), COMPLENET (2018, 2019, 2020).

Served as referee for Science, PNAS, Physical Review Letters, Physical Review X, Physical Review E, Nature Communications, Science Advances, SIAM Review, Journal of Complex Networks, Journal of Statistical Mechanics, PLOS ONE, Nature Scientific Reports, Applied Network Science, Network Science, EPJ Data Science, IEEE Transactions on Network Science and Engineering, IEEE/ACM Transactions on Computational Biology and Bioinformatics, IEEE Transactions on Cybernetics-Review, BMC Bioinformatics, New Journal of Physics, Journal of Theoretical Biology, Statistica Neerlandica, Journal of Machine Learning.

Reviewed grant proposals for the European Research Council (ERC), Deutsche Forschungsgemeinschaft (DFG), Swiss National Science Foundation, Austrian Science Fund (FWF), Einstein Foundation, Le Fonds de la Recherche Scientifique (FNRS), French National Research Agency (ANR), Wiener Wissenschafts-, Forschungs- und Technologiefonds (WWFT), FONDECYT Chile.

	Role	Name	Institution	Date
	Chair	Dávid Deritei	Central European Univeristy	2020
Thesis defences:	Examiner	Owen T. Courtney	Queen Mary University of London	2019
	Examiner	Edmund Barter	University of Bristol	2017
	Examiner	Sebastian Krause	Universität Bremen	2013

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## INVITED TALKS AT CONFERENCES AND WORKSHOPS

**Keynote speaker**, “Communities in Networks,” Networks 2021 Satellite  
Satellite Washington, Jul. 2021

Symposium, “Graph Exploitation Symposium” Boston, May 2021

**Keynote speaker**, “11th Conference on Complex Networks  
(CompleNet)” (cancelled due to COVID-19) Exeter, Mar. 2020

Symposium, “Graph Exploitation Symposium” (cancelled due to COVID-19)	Boston, Oct. 2020
“Fifth Workshop on Critical and Collective Effects in Graphs and Networks” (cancelled due to COVID-19)	Boston, 2020
Conference, “Barcelona Mathematical Days” (cancelled due to COVID-19)	Barcelona, Oct. 2020
Workshop, “Statistics of Network Analysis”, Alan Turing Institute (cancelled due to COVID-19)	London, May. 2020
Conference, “SIAM Conference on Uncertainty Quantification” (cancelled due to COVID-19)	Munich, Mar. 2020
Conference, “The International School and Conference on Network Science (NetSci 2019)”	Burlington, May 2019
Symposium, “NetSciEd 2019: The NetSci Satellite Symposium on Network Science and Education”	Burlington, May 2019
Workshop, “Physics, Inference and Learning,” Institute of Theoretical Physics, Chinese Academy of Sciences	Beijing, Oct. 2018
<b>Keynote speaker</b> , “European Cooperation for Statistics of Network Data Science (COSTNET18) conference”	Warsaw, Sep. 2018
Conference, “Applied Statistics 2018”	Ribno, Sep. 2018
Workshop, “Critical and Collective Effects in Graphs and Networks 2018”	Eindhoven, Jul. 2018
“SIAM Conference on Applied Mathematics Education”	Portland, Jul. 2018
Workshop, “Statistical Network Science,” Brunel University	Uxbridge, Jun. 2018
Workshop “Next Generation Network Analytics,” London Statistical Society	London, Jan. 2018
Conference, “Statistical Network Science”	Mallorca, Oct. 2017
Workshop, “Community detection and network reconstruction”	Eindhoven, Sep. 2017
Workshop, “Critical and collective effects in graphs and networks 2017,” Independent University of Russia	Moscow, May 2017
Workshop, “Maths and the City,” University of Bristol	Bristol, Jan. 2017
Workshop, “Evolving Networks and Collective Behaviour,” Tsinghua Sanya International Mathematics Forum	Sanya, Jan. 2017
<b>Keynote speaker</b> , The PIIK: 1st Symposium on Network Science, University of Zürich	Zürich, Nov. 2016
Workshop, “Dynamics on and of Networks,” CCS 2016	Amsterdam, Sep. 2016
Workshop, “Graph limits and statistics,” Isaac Newton Institute	Cambridge, July 2016
Workshop, “Higher-Order Models in Network Science,” NetSci 2016	Seul, June 2016
Workshop, “Inference in Complex Networks”, 2016 APS March Meeting	Baltimore, Mar 2016
Conference, NetSci X 2016	Wroclaw, Jan. 2016
ICMS workshop “Dynamical networks and network dynamics”	Edinburgh, Jan. 2016
Workshop, “Inference on Networks: Algorithms, Phase Transitions, New Models and New Data,” Santa Fe Institute	Santa Fe, Dec. 2015
ISNPS Meeting “Biosciences, Medicine, and novel Non-Parametric Methods”	Graz, Jul. 2015

Workshop, “Higher-Order Models in Network Science,” NetSci 2015	Zaragoza, Jun. 2015
Workshop, “NetSci Backstage,” NetSci 2015	Zaragoza, Jun. 2015
Workshop, “Statistical Inference for Network Models,” NetSci 2014	Berkeley, Jun. 2014
Mini-symposium “Evolution of cooperation in social-ecological systems”, The Leibniz Center for Tropical Marine Ecology	Bremen, Sep. 2011

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## INVITED TALKS AT SEMINARS

Webinar, Center for Research and Interdisciplinarity, Université de Paris	Paris, Dec. 2020
Webinar, Asian Institute of Management	Manila, Oct. 2020
Webinar, ANET Lab Seminar Series	Budapest, May 2020
Seminar, Center for the Study of Complex Systems (CSCS), University of Michigan	Michigan, Nov. 2019
Seminar, Department of Computer Science, University of Exeter	Exeter, Dec. 2018
TADS Seminar, Alan Turing Institute	London, Nov. 2018
Seminar, National Institute of Advanced Industrial Science and Technology	Tokyo, Nov. 2018
Seminar, Department of Mathematics, University of Brunel	Uxbridge, Oct. 2018
Seminar, Institute of Theoretical Physics, Chinese Academy of Sciences	Beijing, Jan. 2018
Seminar, Stochastic Processes Group, University College London	London, July 2017
Seminar, Department of Engineering Mathematics, University of Bristol	Bristol, Oct. 2016
Seminar, Institut für Festkörperphysik, Universität Darmstadt	Darmstadt, Feb. 2016
Seminar, C.N.R.S. Centre de Physique Théorique	Marseille, July. 2015
Institute Colloquium, Department of Computer Science, Aalto University	Helsinki, May. 2015
MAGNET Seminar, French National Institute for Computer Science and Applied Mathematics (INRIA)	Lille, Apr. 2015
Institute Seminar, ISI Foundation	Turin, Mar. 2015
Seminar, Department of Physics, Loránd Eötvös University	Budapest, Sep. 2014
Seminar, Department of Computer Science, University of Colorado	Boulder, May. 2014
Seminar, Santa Fe Institute	Santa Fe, May. 2014
Seminar, Department of Physics, Umeå University	Umeå, Apr. 2014
Seminar, Lab. de Physique Statistique, Ecole Normale Supérieure	Paris, Jan. 2014
Seminar, Max Planck Institute for the Physics of Complex Systems	Dresden, Dez. 2013
Seminar, ICBM, Carl von Ossietzky Universität Oldenburg	Oldenburg, Nov. 2013
Seminar, Honda Research Institute Europe	Offenbach, Nov. 2012
Seminar, Institut für Festkörperphysik, Universität Darmstadt	Darmstadt, Jun. 2012
Colloquium, Institute for Complex Systems and Mathematical Biology, University of Aberdeen	Aberdeen, Sep. 2010
Seminar, Complexity Science Group, University of Calgary	Calgary, Sep. 2009

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## INVITED LECTURES AT INTERNATIONAL SCHOOLS

Lecture, “Summer School on Data Science”	Split, Nov. 2020
Tutorial Talk, “DPG Spring Meeting of the Condensed Matter Section (SKM), Physics of Socio-economic Systems”	Regensburg, Mar. 2019
Lecture, “Early Career Training Event, European Cooperation for Statistics of Network Data Science (COSTNET)”	Munich, Feb. 2019
Lecture, “Tehran School on Theory and Applications of Complex Networks”	Tehran, Sep. 2018
Lecture, “Mediterranean School of Complex Networks”	Salina, Sep. 2017
Lecture, Summer School “Probabilistic and statistical methods for networks”	Berlin, Aug 2017
Lecture, “Mediterranean School of Complex Networks”	Salina, Sep. 2016
Lecture, Summer school “Complex networks: theory, methods and applications,” Lake Como School of Advanced Studies	Como, May 2016

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## CONFERENCE AND WORKSHOP ORGANIZATION

Virtual symposium, “Statistical Inference for Network Models 2021,” (co-organized w. Bailey Fosdick, Jean-Gabriel Young, Austin Benson, and Abigail Jacobs)	Washington, 2021
Virtual symposium, “Statistical Inference for Network Models 2020,” (co-organized w. Tina Eliassi-Rad, Bailey Fosdick, Dan Larremore, and Aaron Clauset)	Rome, 2020
Workshop “Physics challenges for Machine Learning and Network Science”, (co-organized w. Ginestra Bianconi), Queen Mary Universty of London	London, 2019
“SIAM Workshop on Network Science (NS18)”, (Co-chair w. Johan Ugander)	Portland, 2018

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## RESEARCH SUPERVISION

**PhD students:** Sebastian Morel-Balbi (since March 2018), Lizhi Zhang (since July 2018), Felipe Vaca (since January 2020).

**MSc students:** Sam Hawker (2017), Philipp C. Böttcher (2015), Christoph Schmal (2010).

**BSc students:** Tobias Punke (2017), Lukas Müller (2015), Eduard Kuhn (2015), Philipp Gersdorf (2011), Oliver Richters (2010).

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## PRESS COVERAGE

TechXplore, “A new complex network-based approach to topic modeling,”	2018
Physics, “Synopsis: Robust Networks”, American Physical Society	2012
Phys.org, “High gas prices may be explained by self-organized cartel behavior.”	2012
Physics Arxiv Blog, “Cartels Are an Emergent Phenomenon, Say Complexity Theorists,” MIT Technology Review	2012
Juraforum.de, “Bremer Uni-Studie: Flächendeckend höhere Benzinpreise deuten nicht gleich auf Preisabsprachen hin.”	2012
Kreiszeitung.de, “Benzinpreis: Kein Hinweis auf Absprache,”	2012

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## TEACHING

### At CEU:

- 2020/21 Winter “Network inference and reconstruction” (PhD)
- 2020/21 Winter “Data and network visualization” (PhD)
- 2019/20 Winter “Data and network visualization” (PhD)
- 2019/20 Fall “Scientific Python” (PhD)
- 2020/21 Fall “Scientific Python” (PhD)

### At Bath:

- 2018/19 Sem 2 “Graphs and networks: theory and applications” (BSc)
- 2017/18 Sem 2 “Graphs and networks: theory and applications” (BSc)
- 2018/19 Sem 2 “Large-scale and Bayesian methods” (PhD)
- 2017/18 Sem 2 “Large-scale and Bayesian methods” (PhD)
- 2017/18 Sem 2 “Process dynamics, modelling and control” (BSc)
- 2016/17 Sem 2 “Process dynamics, modelling and control” (BSc)

### At Bremen:

- 2015/2016 Summer “Physik komplexer Netzwerke” (joint BSc/MSc)
- 2014/2015 Summer “Physik komplexer Netzwerke” (joint BSc/MSc)
- 2013/2014 Summer “Physik komplexer Netzwerke” (joint BSc/MSc)
- 2012/2013 Summer “Physik komplexer Netzwerke” (joint BSc/MSc)
- 2013/2014 Summer “Komplexe adaptive dynamische Systeme” (joint BSc/MSc)
- 2012/2013 Summer “Komplexe adaptive dynamische Systeme” (joint BSc/MSc)

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## RESEARCH OUTPUT

**45 journal papers**, **2 pre-prints** (2371 citations; h-index 23; i10-index 35) (Source: Google Scholar, 05/2021), and **2 book chapters**.

### Pre-prints

- [P1] Tiago P. Peixoto, “Disentangling homophily, community structure and triadic closure in networks,” arXiv: 2101.02510
- [P2] Jean-Gabriel Young, Giovanni Petri, Tiago P. Peixoto, “Hypergraph reconstruction from network data,” arXiv: 2008.04948

### Journal papers

- [1] Tiago P. Peixoto, “Revealing consensus and dissensus between network partitions,” *Phys. Rev. X* 11 021003 (2021)
- [2] Lizhi Zhang, Tiago P. Peixoto, “Statistical inference of assortative community structures,” *Phys. Rev. Research* 2 043271 (2020)
- [3] Tiago P. Peixoto, “Merge-split Markov chain Monte Carlo for community detection,” *Phys. Rev. E* 102 012305 (2020)
- [4] Tiago P. Peixoto, “Latent Poisson models for networks with heterogeneous density,” *Phys. Rev. E* 102 012309 (2020)
- [5] Sebastian Morel-Balbi, Tiago P. Peixoto, “Null models for multi-optimized large-scale network structures,” *Phys. Rev. E* 102 032306 (2020)
- [6] Tiago P. Peixoto, “Network reconstruction and community detection from dynamics,” *Phys. Rev. Lett.* 123 128301 (2019)
- [7] Tiago P. Peixoto, “Reconstructing networks with unknown and heterogeneous errors,” *Phys. Rev. X* 8 041011 (2018)
- [8] Martin Gerlach, Tiago P. Peixoto, Eduardo G. Altmann, “A network approach to topic models,” *Science Advances* 4 eaaq1360 (2018)
- [9] Tiago P. Peixoto, “Nonparametric weighted stochastic block models,” *Phys. Rev. E* 97 012306 (2018)
- [10] Tiago P. Peixoto, Laetitia Gauvin, “Change points, memory and epidemic spreading in temporal networks,” *Sci. Rep.* 8 15511 (2018)
- [11] Toni Vallès-Català, Tiago P. Peixoto, Roger Guimerà, Marta Sales-Pardo, “Consistencies and inconsistencies between model selection and link prediction in networks,” *Phys. Rev. E* 97 062316 (2018)
- [12] Tiago P. Peixoto, Martin Rosvall, “Modeling sequences and temporal networks with dynamic community structures,” *Nature Communications* 8, 582 (2017)
- [13] Tiago P. Peixoto, “Nonparametric Bayesian inference of the microcanonical stochastic block model,” *Phys. Rev. E* 95 012317 (2017)
- [14] Guilherme Ferraz de Arruda, Emanuele Cozzo, Tiago P. Peixoto, Francisco A. Rodrigues, Yamir Moreno, “Disease localization in multilayer networks,” *Phys. Rev. X* 7 1 011014 (2017)

- [15] Darko Hric, Tiago P. Peixoto, Santo Fortunato, “Network structure, metadata, and the prediction of missing nodes and annotations,” *Phys. Rev. X* 6 3 031038 (2016)
- [16] M. E. J. Newman, Tiago P. Peixoto, “Generalized communities in networks,” *Phys. Rev. Lett.* 115, 088701 (2015)
- [17] Rico Fisher, Jorge C. Leitão, Tiago P. Peixoto, Eduardo G. Altmann, “Sampling motif-constrained ensembles of networks,” *Phys. Rev. Lett.* 115, 188701 (2015)
- [18] Tiago P. Peixoto, “Inferring the mesoscale structure of layered, edge-valued and time-varying networks,” *Phys. Rev. E* 92, 042807 (2015)
- [19] Tiago P. Peixoto, “Model selection and hypothesis testing for large-scale network models with overlapping groups,” *Phys. Rev. X* 5, 011033 (2015)
- [20] Marco Möller, Tiago P. Peixoto, “Maximum-entropy large-scale structures of Boolean networks optimized for criticality,” *New J. Phys.* 17 043021 (2015)
- [21] Christopher Priester, Sebastian Schmitt, Tiago P. Peixoto, “Limits and Trade-Offs of Topological Network Robustness,” *PLoS ONE* 9(9): e108215 (2014)
- [22] Tiago P. Peixoto, “Hierarchical block structures and high-resolution model selection in large networks,” *Phys. Rev. X* 4, 011047 (2014)
- [23] Tiago P. Peixoto, “Efficient Monte Carlo and greedy heuristic for the inference of stochastic block models,” *Phys. Rev. E* 89, 012804 (2014)
- [24] Tiago P. Peixoto, “Eigenvalue Spectra of Modular Networks,” *Phys. Rev. Lett.* 111 9 098701 (2013)
- [25] Sebastian M. Krause, Tiago P. Peixoto, Stefan Bornholdt, “Spontaneous centralization of control in a network of company ownerships,” *PLoS ONE* 8(12): e80303 (2013)
- [26] Tiago P. Peixoto, “Parsimonious Module Inference in Large Networks,” *Phys. Rev. Lett.* 110 148701 (2013)
- [27] Tiago P. Peixoto, Stefan Bornholdt, “Evolution of Robust Network Topologies: Emergence of Central Backbones,” *Phys. Rev. Lett.* 109 11 118703 (2012)
- [28] Tiago P. Peixoto, “Entropy of stochastic blockmodel ensembles,” *Phys. Rev. E* 85 5 056122 (2012)
- [29] Tiago P. Peixoto, Stefan Bornholdt, “No Need for Conspiracy: Self-Organized Cartel Formation in a Modified Trust Game,” *Phys. Rev. Lett.* 108 21 218702 (2012)
- [30] Tiago P. Peixoto, “Emergence of robustness against noise: A structural phase transition in evolved models of gene regulatory networks,” *Phys. Rev. E* 85 4 041908 (2012)
- [31] Eva Ackermann, Tiago P. Peixoto, Barbara Drossel, “Reliable dynamics in Boolean and continuous networks,” *New J. Phys.* 14 12 123029 (2012)
- [32] Tiago P. Peixoto, “The behavior of noise-resilient Boolean networks with diverse topologies,” *J. Stat. Mech.* 2012 01 P01006 (2012)
- [33] Oliver Richters, Tiago P. Peixoto, “Trust Transitivity in Social Networks,” *PLOS ONE* 6 4 e18384 (2011)
- [34] Tiago P. Peixoto, Barbara Drossel, “Density profile and polymer configurations for a polymer melt in a regular array of nanotubes,” *New J. Phys.* 13 7 073030 (2011)



- [35] T. P. Peixoto, “The phase diagram of random Boolean networks with nested canalizing functions,” *Eur. Phys. J. B* 78 2 187–192 (2010)
- [36] Christoph Schmal, Tiago P Peixoto, Barbara Drossel, “Boolean networks with robust and reliable trajectories,” *New J. Phys.* 12 11 113054 (2010)
- [37] Tiago P. Peixoto, “Redundancy and Error Resilience in Boolean Networks,” *Phys. Rev. Lett.* 104 4 048701 (2010)
- [38] Tiago P. Peixoto, Katharina Doblhoff-Dier, Jörn Davidsen, “Spatiotemporal correlations of aftershock sequences,” *J. Geophys. Res.* 115 B10309 (2010)
- [39] Pitamber Mahanandia, Jörg J. Schneider, Marina Khanefit, Bernd Stühn, Tiago P. Peixoto, Barbara Drossel, “Polymer confinement effects in aligned carbon nanotubes arrays,” *Phys. Chem. Chem. Phys.* 12 17 4407 (2010)
- [40] Tiago P. Peixoto, Barbara Drossel, “Boolean networks with reliable dynamics,” *Phys. Rev. E* 80 5 056102 (2009)
- [41] Tiago P. Peixoto, Barbara Drossel, “Noise in random Boolean networks,” *Phys. Rev. E* 79 3 036108 (2009)
- [42] Tiago P. Peixoto, Jörn Davidsen, “Network of recurrent events for the Olami-Feder-Christensen model,” *Phys. Rev. E* 77 6 066107 (2008)
- [43] Tiago P. Peixoto, Carmen P. C. Prado, “Network of epicenters of the Olami-Feder-Christensen model of earthquakes,” *Phys. Rev. E* 74 1 016126 (2006)
- [44] Tiago P. Peixoto, Carmen P. C. Prado, “Statistics of epicenters in the Olami-Feder-Christensen model in two and three dimensions,” *Physica A* 342 1-2 171–177 (2004)
- [45] Tiago P. Peixoto, Carmen P. C. Prado, “Distribution of epicenters in the Olami-Feder-Christensen model,” *Phys. Rev. E* 69 2 025101 (2004)

### Book chapters

- [B1] Tiago P. Peixoto, “Bayesian stochastic blockmodeling,” Chapter in “Advances in Network Clustering and Blockmodeling,” edited by P. Doreian, V. Batagelj, A. Ferligoj (Wiley, 2019)
- [B2] Tiago P. Peixoto, Martin Rosvall, “Modelling Temporal Networks with Markov Chains, Community Structures and Change Points,” Chapter in “Temporal Network Theory,” edited by Holme P., Saramäki J. (Springer, 2019)

### Other publications

- [O1] Tiago P. Peixoto, “The `graph-tool` Python library,” figshare (2014), Available at <https://graph-tool.skewed.de>

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## SOFTWARE PROJECTS

**graph-tool:** A comprehensive Python network library, including structural, dynamical and statistical algorithms, as well as visualization. Free and Open Source, released under the LGPLv3 license, fully documented, with high-performance algorithms written in C++, using template meta-programming and OpenMP parallelism. Available at: <https://graph-tool.skewed.de>

**Netzschleuder:** Online catalogue and repository of over 160K network datasets with the aim of aiding scientific research. The website is meant to be browsed both by humans and machines alike, and can also be accessed via a convenient JSON API, or via the **graph-tool** library. The network datasets themselves are available in several machine-readable formats, in particular gt, GraphML, GML and CSV. Available at: <https://networks.skewed.de>