

# BASTIAN RIECK

SCIENTIFIC VISUALIZATION • DATA SCIENCE • TOPOLOGICAL DATA ANALYSIS • MACHINE LEARNING

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## Education

- 2011–2017 **Ph.D.** in computer science at Heidelberg University, final grade **1.0** (*summa cum laude*)  
*Persistent Homology in Multivariate Data Visualization*  
Advisors: [Prof. Dr. Heike Leitte](#), [Prof. Dr. Michael Gertz](#)
- 2011 Graduation, final grade **1.0** (*with distinction*)
- 2005–2011 Studies of mathematics and computer science at Heidelberg University, Germany
- 2005 *Abitur*<sup>1</sup>, final grade **1.0** (*very good*)
- 1996–2005 Leibniz-Gymnasium Östringen<sup>2</sup>

## Publications

- 2018 Christian Bock, Thomas Gumbsch, Michael Moor, Bastian Rieck, Damian Roqueiro, and Karsten Borgwardt. *Association Mapping in Biomedical Time Series via Statistically Significant Shapelet Mining*. *Bioinformatics*, Volume 34, Issue 13, pp. i438–i446, July 2018.
- Lutz Hofmann, Bastian Rieck, and Filip Sadlo. *Visualization of 4D Vector Field Topology*. *Computer Graphics Forum*, Volume 37, Issue 3, pp. 301–313.
- Kai Sdeo, Bastian Rieck, and Filip Sadlo. *Visualization of Fullerene Fragmentation*. Short Paper Proceedings of the IEEE Pacific Visualization Symposium (PacificVis), pp. 111–115.
- Bastian Rieck, Ulderico Fugacci, Jonas Lukasczyk, and Heike Leitte. *Clique Community Persistence: A Topological Visual Analysis Approach for Complex Networks*. *IEEE Transactions on Visualization and Computer Graphics*, Volume 24, Issue 1, pp. 822–831.
- 2017 Bastian Rieck. *Persistent Homology in Multivariate Data Visualization*. Ph.D. thesis, Heidelberg University.
- Bastian Rieck, Filip Sadlo, and Heike Leitte. *Persistence Concepts for 2D Skeleton Evolution Analysis*. Workshop on Topology-Based Methods in Visualization (TopoInVis), Tokyo, Japan. Accepted for presentation.
- Bastian Rieck, Filip Sadlo, and Heike Leitte. *Hierarchies and Ranks for Persistence Pairs*. Workshop on Topology-Based Methods in Visualization (TopoInVis), Tokyo, Japan. Accepted for presentation. Received an **award** for the best extended abstract.

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<sup>1</sup>General qualification for university entrance

<sup>2</sup>Secondary school

- 2016 Bastian Rieck, Heike Leitte. *‘Shall I compare thee to a network?’—Visualizing the Topological Structure of Shakespeare’s Plays*. Workshop on Visualization for the Digital Humanities at IEEE Vis 2016.
- Bastian Rieck, Heike Leitte. *Exploring and Comparing Clusterings of Multivariate Data Sets Using Persistent Homology*. Computer Graphics Forum, Volume 35, Issue 3, pp. 81–90.
- Jens Fangerau, Burkhard Höckendorf, Bastian Rieck, Christian Heine, Joachim Wittbrodt, and Heike Leitte. *Interactive Similarity Analysis and Error Detection in Large Tree Collections*. In: Visualization in Medicine and Life Sciences III, pp. 287–307, Springer, 2016.
- 2015 Bastian Rieck, Heike Leitte. *Comparing Dimensionality Reduction Methods Using Data Descriptor Landscapes*. Symposium on Visualization in Data Science at IEEE Vis 2015.
- Bastian Rieck, Heike Leitte. *Persistent Homology for the Evaluation of Dimensionality Reduction Schemes*. Computer Graphics Forum, Volume 34, Issue 3, pp. 431–440.
- Bastian Rieck, Heike Leitte. *Agreement Analysis of Quality Measures for Dimensionality Reduction*. Workshop on Topology-Based Methods in Visualization (TopoInVis). Also appears in: Topological Methods for Data Analysis and Visualization IV, pp. 103–117, Springer, 2017.
- 2014 Bastian Rieck, Heike Leitte. *Enhancing Comparative Model Analysis using Persistent Homology*. Workshop on Visualization for Predictive Analytics at IEEE Vis 2014.
- Bastian Rieck, Heike Leitte. *Structural Analysis of Multivariate Point Clouds using Simplicial Chains*, Computer Graphics Forum, Volume 33, Issue 8, pp. 28–37.
- 2013 Markus Forbriger, Hubert Mara, Bastian Rieck, Christoph Siart, and Olaf Wagener. *Der “Gesprengte Turm” am Heidelberger Schloss – Untersuchung eines Kulturdenkmals mithilfe hoch auflösender terrestrischer Laserscans*, Denkmalpflege in Baden-Württemberg, Nachrichtenblatt der Landesdenkmalpflege, Heft 3-2013, pp. 165–168.
- Bastian Rieck, Hubert Mara, and Susanne Krömker. *Unwrapping Highly-Detailed 3D Meshes of Rotationally Symmetric Man-Mode Objects*, ISPRS Annals of Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume II-5/W1, pp. 259–264.
- 2012 Bastian Rieck, Hubert Mara, and Heike Leitte. *Multivariate Data Analysis Using Persistence-Based Filtering and Topological Signatures*, IEEE Transactions on Visualization and Computer Graphics, Volume 18, Issue 12, pp. 2382–2391.
- 2011 Bastian Rieck. *Smoothness Analysis of Subdivision Algorithms*. Master’s thesis<sup>3</sup>, Heidelberg University.

## Talks

*An enchiridion for topological data analysis*

June 2018, Basel Postdoc Retreat, Klosters

*Statistically significant shapelet mining for biomedical time series*

June 2018, Heidelberg University

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<sup>3</sup>Diplomarbeit

*Persistent homology and networks*  
February 2018, ETH Zürich

*A gentle introduction to Gaussian processes*  
November 2017, Heidelberg University

*Persistent homology for data analysis*  
October 2017, ETH Zürich

*A primer in VTK & Python*  
June 2017, Kaiserslautern University

*Persistent homology for complex network analysis*  
June 2017, Heidelberg University

*Persistent homology in multivariate data visualization*  
April 2017, Heidelberg University

*Aspects of human perception*  
December 2016, Heidelberg University

*A primer in persistent homology*<sup>4</sup>  
August 2016, Workshop on Industrial and Applied Mathematics, Hamburg

*Shakespearean Social Network Analysis using Topological Methods*  
July 2016, Heidelberg University

*An introduction to persistent homology*  
May 2016, Public Lecture of the Heidelberg Chapter of SIAM

*Ein Bild sagt mehr als tausend Worte: Graphische Darstellungen komplexer Daten*  
May 2016, Akademische Mittagspause Heidelberg

*Persistent homology for multivariate data visualization*  
February 2016, Sorbonne Universités UPMC

*Aspects of human perception*  
June 2015, Heidelberg University

*The Poincaré conjecture and the shape of the universe*  
May 2014, Privatgymnasium St. Leon-Rot

*Persistent homology for similarity analysis*  
April 2014, Heidelberg University

*Aspects of human perception*  
January 2014, Heidelberg University

*C++11 programming concepts*  
November 2013, Heidelberg University

*Weniger Klartext reden!*  
September 2013, Science Academy

*Oh my god, it's full of data—A biased & incomplete introduction to visualization*  
April 2014, HGS MathComp Fellows Seminar

*The Poincaré conjecture*  
September 2012, Science Academy

*Applied algebraic topology*  
July 2011, Heidelberg University

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<sup>4</sup>I was unable to attend the workshop due to a family emergency, but a colleague was kind enough to give my talk for me.

## Thesis co-supervision

2018	Jens Beyermann <i>Analyse persistenter Homologie auf Graphen</i>
2017	Kai Sdeo <i>Visualization of Laser-Induced Fullerene Fragmentation</i>
2015	Daniel Beyer <i>Using Pathline Data Depth to Analyse Time-Dependent Vector Fields</i> Karsten Hanser <i>Visualisierung hochdimensionaler skalarer Felder mittels Graßmann-Mannigfaltigkeiten</i> Jan Greulich <i>Rekonstruktion von segmentierten Grenzschichten mittels B-Spline Fitting</i> Markus Kurz <i>Quality-based ranking of scatter plots for dimensionality reduction</i>
2013	Daniel Beyer <i>Implementierung und Parameteruntersuchung zur Transferfunktionsbestimmung für Volumendaten mittels Segmentierung des Intensität-Gradient-Histogramms</i>
2012	Alexander Eck <i>Clustering algorithms for cell cycle phase detection</i>

## IT & programming skills

Strong knowledge of C++ and object-oriented programming, along with numerous well-known APIs (Boost, STL, Qt). Highly-proficient in large-scale software development and maintenance. Experienced with graphics programming APIs and toolkits (VTK, OpenGL, OpenSceneGraph).

Good knowledge of Python for data analysis purposes (numpy, scipy, scikit-learn, plus matplotlib, seaborn), as well as markup languages (HTML, CSS).

Working knowledge of R, JavaScript (in particular d3.js), Perl, Java, and Haskell.

Good knowledge of digital typesetting languages (TEX, L<sup>A</sup>T<sub>E</sub>X).

In-depth knowledge of the Git revision control system and CMake.

Proficiency in all major operating systems (Windows, Linux, FreeBSD, MacOS X).

## Professional experience

01/2018–...	Postdoctoral researcher in the ‘ <b>Machine Learning and Computational Biology Lab</b> ’ (MLCB) of <b>Prof. Dr. Karsten Borgwardt</b> , ETH Zürich, Switzerland.
11/2017–12/2017	Senior researcher in the ‘ <b>Visual Computing</b> ’ research group, Heidelberg University, Germany In collaboration with Prof. Dr. sc. Filip Sadlo, I developed novel scientific visualization approaches for the analysis of 4D vector fields as well as for molecular dynamics simulations.
11/2014–10/2017	Researcher in the ‘ <b>Visual Information Analysis</b> ’ research group, Kaiserslautern University, Germany I continued my research in the field of topology-based visualization methods, topological data analysis, and topological machine learning. Later on, I started to focus on the comparative analysis of complex networks.
10/2011–10/2014	Scholarship holder of the <b>Heidelberg Graduate School of Mathematical and Computational Methods for the Sciences</b> , Heidelberg University, Germany
06/2011–12/2014	Ph.D. student in the ‘ <b>Computer Graphics and Visualization</b> ’ research group, Interdisciplinary

Center for Scientific Computing, Germany

I developed novel techniques for understanding complex multivariate data sets. My research bridged a gap between methods from pure mathematics (algebraic topology) and computer science (visualization).

I also regularly taught classes about ‘Visualization I’, ‘Visualization II’, and ‘Computational Geometry’.

01/2010–06/2011

Research assistant, ‘**Visualization and Numerical Geometry Group**’, Interdisciplinary Center for Scientific Computing, Germany

I developed software methods for supporting the analysis of objects from cultural heritage, which ultimately resulted in a publication and multiple collaborations.

2009–2010

Teaching assistant for ‘Computer graphics I’ and ‘Computer graphics II’, Heidelberg University, Germany

I helped develop a pool of exercises for OpenGL rendering. I furthermore graded exercises, held oral tutorials, and served as an examiner.

2007–2010

Student trainee for software quality management, SAP AG, Germany

I found bugs in front-end software and helped refine the test suites. Later on, I assumed additional responsibilities for the virtual server infrastructure required for testing. I also developed scripts for automating some aspects of testing and installation.

2005–2007

Student worker for systems and network administration, Heidelberg Center for American Studies, Germany

I co-managed workstations and servers for the employees.

## Languages

*German* native speaker  
*English* professional proficiency  
*French* working knowledge  
*Russian* elementary proficiency

## Awards

- Outstanding reviewer for ICML 2018
- Award for the best extended abstract at TopoInVis 2017

## Volunteer work & extracurricular activities

### *Conference & journal reviewer*

I am a regular reviewer for conferences & journals in my field. Previously, I have been reviewing for EuroVis 2012, IEEE VisWeek 2012, EuroVis 2013, IEEE Vis 2013, EuroVis 2014 Short Papers, IEEE Vis 2015, EuroVis 2016, IEEE Vis 2016, EuroVis 2017, IEEE Vis 2017, TopoInVis<sup>5</sup> 2017, EuroVis 2018, EuroVis 2018 Short Papers, ISMB<sup>6</sup> 2018, ICML<sup>7</sup> 2018, OUP Bioinformatics,

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<sup>5</sup>Topology-Based Methods in Visualization

<sup>6</sup>Intelligent Systems for Molecular Biology

<sup>7</sup>International Conference on Machine Learning

JMLR<sup>8</sup>, and NIPS<sup>9</sup> 2018. Moreover, I have been invited to become an external reviewer for IEEE Transactions on Signal Processing and IEEE Access.

#### *Heidelberg Laureate Forum Film Festival*

As part of the annual Heidelberg Laureate Forum—a gathering of world-renowned computer scientists and mathematicians—I have been working with school classes and adults to discuss mathematical aspects of films.

## Hobbies

I am an avid reader and try to broaden my understanding of many different topics (psychology, neurology, logic, cryptography, history, to name a few). In 2006, I started a [personal blog](#) to improve my writing skills. My posts are dealing with technical subjects (computer security, software development) and I aim to explain complicated phenomena or techniques. Furthermore, I love classical music (especially from baroque times) and used to play the clarinet and the Scottish bagpipes. Recently, I discovered endurance sports. I commute regularly via bicycle and run medium distances (10 km).

## References

PROF. DR. HEIKE LEITTE  
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PROF. DR. MICHAEL GERTZ  
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Further references and credentials are available on request.

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<sup>8</sup>Journal of Machine Learning Research

<sup>9</sup>Neural Information Processing Systems