Samuel Gerber

Data Analysis & Visualization Researcher

242 Valley Park Dr.
27514 Chapel Hill
United States
✆ *+1 (801) 815 9753*
✉ *smlgrbr@gmail.com*
🖰 *www.kitware.com/samuel-gerber*

Education

2006–2012 **PhD in Computer Science**, *University of Utah*, Salt Lake City, UT, USA.

2002–2005 **Software Engineer**, *Fachhochschule Nordwestschweiz*, Windisch, Switzerland.

PhD Thesis

Title *Nonparametric Models for High-Dimensional Data Analysis*

Supervisors Ross T. Whitaker

Description Developed a statistical manifold learning algorithm based on the notion of principal curves and applied it to analyze magnetic resonance brain image data to determine variability in brain anatomy. Combined Morse theoretic tools and dimension reduction for visualization and regression of high dimensional scalar functions with applications to parameter space exploration of climate simulations.

Experience

2017–Current **Senior Research & Development Engineer**, *Kitware Inc.*, Carrboro, NC, USA.

Lead research projects in collaboration with academic and industrial partners. Write grant applications targeting research grants (R01, R21) and small business innovation and technology transfer grants (SBIR, STTR) from the National Institute of Health (NIH) Detailed achievements:

○ Invented a new algorithm for detecting anatomical differences in large image population studies:
  – Acquired a Small Business Technology Transfer Research (STTR) grant from the National Institute of Health (NIH) for this research (Phase 1 & 2).
  – Publications at the International Conference on Medical Image Computing and Computer Assisted Intervention.
○ Developed software applications for real-time and automatic detection of brain trauma from ultrasound scans.
○ Developed software applications for real-time surgical navigation.
○ Developed software applications for surgery planning.

Major publications: [1, 3, 8]

2015–2017 **Research Scientist**, *University of Oregon*, Eugene, OR, USA.

Performed research on data analysis methodology and provide data analysis support to faculty and students of the College of Arts and Science.

Major publications: [9]

2012–2015 **Visiting Assistant Professor, Mathematics**, *Duke University*, Durham, NC, USA.
Researched multiscale methods for data analysis. In particular fast algorithms for optimal transport and persistence homology.
Major publications: [7, 12]

2006–2012 **Research Assistant**, *University of Utah*, Salt Lake City, UT, USA.
Performed research on PhD thesis and assisted in teaching classes.
Major publications: [11, 14, 15, 18, 19, 22, 25]

2010-2010 **Teaching Assistant**, *Institute for Advanced Study*, Park City, UT, USA.
Teaching assistant at the IAS summer program on image processing.

2007–2007 **IPAM Fellow**, *University of California Los Angeles*, Los Angeles, CA, USA.
Core participant in IPAM program on "Mathematics of Knowledge and Search Engines". Investigated the properties and use of the graph Laplacian for data analysis tasks.

2005-2006 **Research Assistant**, *Institute for 4D Technologies and Data Spaces*, Windisch, Switzerland.
Research on efficient numerical calculations and result visualization for a civil engineering application on structural behavior of beams under torsion and lateral stress.

Research Funding

2018–2021 **National Institute of Health, STTR Phase I & II**, *$2M*, Enhanced Software Tools for Detecting Anatomical Differences in Large Image Data Sets.
Grant for the development of novel morphometric analysis tools for MR brain images. Collaboration with the Computer Science Department at the University of North Carolina, Chapel Hill and a Neurosurgeon at the University of Washington, St. Louis.

Awards

2014 MICCAI Young Scientist Publication Impact Award

2009 Best paper award, Journal of Medical Image Analysis

2008 Fellowship for summer program, Institute for Pure and Applied Mathematics

2006 Scholarship from the ABB company for a masters program in the US

2006 Scholarship from the Swiss friends of the USA for a masters program in the US

2005 Best diploma thesis award, Fachhochschule Nordwestschweiz

Invited Talks

2018 MICCAI, International Conference

2013 Working Group on Manifold Learning, SAMSI

2011 MICCAI, International Conference

2010 IEEE Visualization Conference

2010 Image Analysis and Vision Group, University of Carolina at Chapel Hill

2009 Laboratory of Mathematics in Imaging, Harvard Medical School Boston

2009 Computer Vision Laboratory, ETH Zürich

2009 MICCAI, International Conference

2008 Workshop on Mathematical Methods in Biomedical Image Analysis

2007 International Conference on Machine Learning

Peer Review

- IEEE Transactions on Pattern Analysis and Machine Intelligence
- IEEE Transactions on Visualization and Computer Graphics
- IEEE Transaction on Neural Networks and Learning Systems
- IEEE Transaction on Medical Imaging
- Computer Aided Geometric Design
- Neurocomputing
- International Conference on Pattern Recognition
- Medical Image Analysis
- PLOS ONE
- Neural Information Processing Systems
- European Science Foundation

Software

Programming	C, C++, R, Python, JavaScript, Java, Matlab, SQL, OpenGL, ITK, VTK, GLPK, MOSEK, CPLEX, Tensorflow, Keras, Docker
Github	https://github.com/samuelgerber
Bitbucket	https://bitbucket.org/suppechasper

Languages

German	Fluent	*Native speaker*
English	Fluent	*Lived 10+ years in the US*
French	Beginner	

References

Provided on request.

Publications

[1] Samuel Gerber and Marc Niethammer. Spatial component analysis to mitigate multiple testing in voxel–based analysis. In *International Conference on Medical Image Computing and Computer-Assisted Intervention*, page To be published. Springer, Cham, 2020.

[2] Hastings Greer, Sam Gerber, Marc Niethammer, Roland Kwitt, Matt McCormick, Deepak Chittajallu, Neal Siekierski, Matthew Oetgen, Kevin Cleary, and Stephen Aylward. Scoliosis screening and monitoring using self contained ultrasound and neural networks. In *Biomedical Imaging (ISBI 2018), 2018 IEEE 15th International Symposium on*, pages 1500–1503. IEEE, 2018.

[3] Samuel Gerber, Marc Niethammer, Martin Styner, and Stephen Aylward. Exploratory population analysis with unbalanced optimal transport. In *International Conference*

on Medical Image Computing and Computer-Assisted Intervention, pages 464–472. Springer, Cham, 2018.

[4] Deepak Roy Chittajallu, Neal Siekierski, Sanghoon Lee, Samuel Gerber, Jonathan Beezley, David Manthey, David Gutman, and Lee Cooper. Vectorized persistent homology representations for characterizing glandular architecture in histology images. In *Biomedical Imaging (ISBI 2018), 2018 IEEE 15th International Symposium on*, pages 232–235. IEEE, 2018.

[5] Deepak Chittajallu, Matthew McCormick, Samuel Gerber, Tomasz Czernuszewicz, Ryan Gessner, Monte Willis, Marc Niethammer, Roland Kwitt, and Stephen Aylward. Image-based methods for phase estimation, gating and temporal super-resolution of cardiac ultrasound. *IEEE Transactions on Biomedical Engineering*, 2018.

[6] Maeliss Jallais, Hastings Greer, Sam Gerber, Matt McCormick, Deepak Chittajallu, Neal Siekierski, and Stephen Aylward. Ultrasound augmentation: Rapid 3-d scanning for tracking and on-body display. In *Imaging for Patient-Customized Simulations and Systems for Point-of-Care Ultrasound*, pages 138–145. Springer, 2017.

[7] Samuel Gerber and Mauro Maggioni. Multiscale strategies for computing optimal transport. *Journal of Machine Learning Research*, 2017.

[8] Samuel Gerber, Maeliss Jallais, Hastings Greer, Matt McCormick, Sean Montgomery, Bradley Freeman, Deborah Kane, Deepak Chittajallu, Neal Siekierski, and Stephen Aylward. Automatic estimation of the optic nerve sheath diameter from ultrasound images. In *Imaging for Patient-Customized Simulations and Systems for Point-of-Care Ultrasound*, pages 113–120. Springer, Cham, 2017.

[9] Sean McKenna, Miriah Meyer, Christopher Gregg, and Samuel Gerber. s-corrplot: An interactive scatterplot for exploring correlation. *Journal of Computational and Graphical Statistics*, 25(2):445–463, 2016.

[10] Kristin Potter, Samuel Gerber, and Erik W Anderson. Visualization of uncertainty without a mean. *Visualization Viewpoints*, 2013.

[11] Samuel Gerber and Ross Whitaker. Regularization free principal curve estimation. *Journal of Machine Learning Research*, 2013.

[12] Samuel Gerber and Mauro Maggioni. Multiscale dictionaries, transforms, and learning in high-dimensions. In *Proc. of SPIE Vol*, volume 8858, pages 88581T–1, 2013.

[13] Samuel Gerber and Kristin Potter. Data analysis with the morse-smale complex: The msr package for r. *Journal of Statistical Software*, 2012.

[14] Samuel Gerber, Ruebel Oliver, Peer-Timo Bremer, Valerio Pascucci, and Ross T Whitaker. Morse-smale regression. *Journal of Computational and Graphical Statistics*, 2012.

[15] Samuel Gerber. *Nonparametric models for high-dimensional data analysis*. PhD thesis, The University of Utah, 2012.

[16] Peihong Zhu, Suyash P Awate, Samuel Gerber, and Ross Whitaker. Fast shape-based nearest-neighbor search for brain mris using hierarchical feature matching. In *International Conference on Medical Image Computing and Computer-Assisted Intervention*, pages 484–491. Springer, Berlin, Heidelberg, 2011.

[17] Daniel Rueckert, David Hawkes, Guido Gerig, Guang-Zhong Yang, Jihun Hamm, Dong Hye Ye, Ragini Verma, Christos Davatzikos, Samuel Gerber, Tolga Tasdizen, et al. Special issue on the 12th international conference on medical image computing and computer-assisted intervention (miccai) 2009, 2010.

[18] Samuel Gerber, Tolga Tasdizen, P Thomas Fletcher, Sarang Joshi, Ross Whitaker, Alzheimers Disease Neuroimaging Initiative, et al. Manifold modeling for brain population analysis. *Medical image analysis*, 14(5):643–653, 2010.

[19] Samuel Gerber, Peer-Timo Bremer, Valerio Pascucci, and Ross Whitaker. Visual exploration of high dimensional scalar functions. *IEEE transactions on visualization and computer graphics*, 16(6):1271, 2010.

[20] Arvind Agarwal, Hal Daume, and Samuel Gerber. Learning multiple tasks using manifold regularization. In *Advances in neural information processing systems*, pages 46–54, 2010.

[21] Ran Tao, P Thomas Fletcher, Samuel Gerber, and Ross T Whitaker. A variational image-based approach to the correction of susceptibility artifacts in the alignment of diffusion weighted and structural mri. In *International Conference on Information Processing in Medical Imaging*, pages 664–675. Springer, Berlin, Heidelberg, 2009.

[22] Samuel Gerber, Tolga Tasdizen, and Ross Whitaker. Dimensionality reduction and principal surfaces via kernel map manifolds. In *Computer Vision, 2009 IEEE 12th International Conference on*, pages 529–536. IEEE, 2009.

[23] Samuel Gerber, Tolga Tasdizen, Sarang Joshi, and Ross Whitaker. On the manifold structure of the space of brain images. In *International Conference on Medical Image Computing and Computer-Assisted Intervention*, pages 305–312. Springer, Berlin, Heidelberg, 2009.

[24] Matthias Fuchs and Samuel Gerber. Variational shape detection in microscope images based on joint shape and image feature statistics. In *Computer Vision and Pattern Recognition Workshops, 2008. CVPRW'08. IEEE Computer Society Conference on*, pages 1–8. IEEE, 2008.

[25] Samuel Gerber, Tolga Tasdizen, and Ross Whitaker. Robust non-linear dimensionality reduction using successive 1-dimensional laplacian eigenmaps. In *Proceedings of the 24th international conference on Machine learning*, pages 281–288. ACM, 2007.