

David Mayerich

CONTACT INFORMATION

Assistant Professor
Department of Electrical and Computer Engineering
University of Houston
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RESEARCH INTERESTS

My work focuses on high-performance computing and biomedical imaging. Maps describing tissue structure and composition are critical for understanding biological functions. This data is particularly important for research in complex phenotypes, such as the brain tissue and tumor biopsies. However, whole organ imaging is impractical with existing instrumentation and data processing algorithms. My research enables three-dimensional whole organ phenotyping by developing methods for exploring large biological samples at sub-micrometer resolution. I focus on developing new instrumentation and utilizing high-performance computing to create large-scale multi-dimensional and hyperspectral data sets that will enable advances in disease research, diagnosis, and precision medicine.

EDUCATION

Texas A&M University, College Station, TX, USA
Ph.D., Computer Science and Engineering, August 2009
M.S., Computer Science and Engineering, August 2003

Southwestern Oklahoma State University, Weatherford, OK, USA
B.S., Computer Science, June 2000 (Cum Laude)

ACADEMIC APPOINTMENTS

Assistant Professor **September 2014 - present**
Department of Electrical and Computer Engineering
University of Houston

Beckman Postdoctoral Fellowship **July 2009 - September 2014**
Beckman Institute
University of Illinois at Urbana-Champaign

Research Assistant **September 2004 to June 2009**
Department of Computer Science and Engineering
Texas A&M University

PROFESSIONAL MEMBERSHIPS

Senior Member, Institute of Electrical and Electronics Engineers (**IEEE**)
Association for Computing Machinery (**ACM**)
Society for Applied Spectroscopy (**SAS**)
Coblentz Society
Society for Neuroscience (**SfN**)
Optical Society of America (**OSA**)
Society of Photo-Optical Instrumentation Engineers (**SPIE**)

HONORS AND AWARDS

Research

3 rd Place Student Presentation Competition, 13 th Annual GRC (with Jiabing Li)	2017
Urvish Medh Best Poster Presentation, 12 th Annual GRC (with Rupali Mankar)	2016
3 rd Place – David Kuck Poster Competition, CSE Annual Meeting, Urbana, IL	2013
Graduate Assistance in Areas of National Need (GAANN) Fellowship	2006

Teaching

Teaching Excellence Award – Computer Graphics (<i>awarded to one TA/year</i>)	2004
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SERVICE

University
ECE Seminar Committee **2015--**

ECE Admissions Committee	2015--
ECE Faculty Search Committee	2015-2016
Chinese Scholarship Council Graduate Student Recruitment Fair, Beijing	2015
Summer Research Advising, Harmony Public Schools	2015-2016

Professional

Section Editor, Encyclopedia of Neuroscience, Elsevier	2018--
Academic Editor, PLoS ONE	2018--
Review Editor, Frontiers in Physics and Optics	2014--
Organizer, ECE Distinguished Lecture Series	2016-2017
Symposium Organizer, Microscopy and Microanalysis	2015-2016
Organizer, Beckman Graduate Seminar	2011-2012
Scientific Reviewer, Wellcome Trust	2011
Review Panelist, NIH/National Library of Medicine ITK A2-D2	2010
Co-Organizer, Computer Game Design Competition, Texas A&M University	2007
Co-Organizer, Seminar Series on Molecular and Biological Networks	2005

Postdoctoral Advising

Camille Artur (Raman Spectroscopy, Expansion Microscopy)
 Sebastian Berisha (Hyperspectral Analysis, Convolutional Neural Networks)

Ph.D. Committee Chair (2 graduated)

Rupali Mankar (2019), Leila Saadatfard (2019), Pavel Govyadinov (2019)

M.S. Committee Chair (2 graduated)

Daver Daeinejad (2017), Srijaani Mukherjee (2017)

PEER-REVIEWED
 JOURNAL
 PUBLICATIONS

- [1] **Mahsa Lotfollahi, Sebastian Berisha, Leila Saadatfard**, Laura Montier, Jokubas Ziburkus, **David Mayerich**, "Three-Dimensional GPU-Accelerated Active Contours for Automated Localization of Cells in Large Images," PLoS ONE, (in press)
- [2] **Mahsa Lotfollahi, Sebastian Berisha, Davar Daeinejad, David Mayerich**, "Digital Staining of High-Definition FTIR Images Using Deep Learning," *Applied Spectroscopy*, (in press)
- [3] **Pavel Govyadinov**, Tasha Womack, Jason Eriksen, Guoning Chen, **David Mayerich**, "Robust Tracing and Visualization of Heterogeneous Microvascular Networks," *IEEE Transactions on Visualization and Computer Graphics*, 25(4):1760-1773 (April 2019)
- [4] **Sebastian Berisha, Mahsa Lotfollahi**, Jahandar Jahanipour, Ilker Gurcan, Michael Walsh, Rohit Bhargava, Hien Van Nguyen, and **David Mayerich**, "Deep learning for FTIR histology: leveraging spatial and spectral features with convolutional neural networks," *Analytst*, 144:1642-1653 (February 2019)
- [5] **Jiaming Guo**, Keely A. Keller, **Pavel Govyadinov**, Paul Ruchhoeft, John. H. Slater, and **David Mayerich**, "Accurate flow in augmented networks (AFAN): An approach to generating three-dimensional biomimetic microfluidic networks with controlled flow," *Analytical Methods*, 11:8-16 (2019)
- [6] Hengyang Lu, **Jiabin Li**, Melisa Martinez Paniagua, Irfan Bandey, Amit Amritkar, Harjeet Singh, **David Mayerich**, Navin Varadarajan, Badrinath Roysam, "TIMING 2.0: High-throughput single-cell profiling of dynamic cell-cell interactions by time-lapse imaging microscopy in nanowell grids," *Bioinformatics*, 35(4):706-708 (February 2019)
- [7] Feng Lin, Guang Yang, Chao Niu, Yanan Wang, Zhuan Zhu, Haokun Luo, Chong Dai, Yandi Hu, Xufeng Zhou, Zhaoping Liu, Jonathan Hu, Zhiming Wang, **David Mayerich**, Jiming Bao, "Planar Alignment of Graphene Sheets by a Rotating Magnetic Field for Full Exploitation of Graphene as a 2D Material," *Advanced Functional Materials*, 28(46) (November 2018)
- [8] Susanne Pahlow, Karina Weber, Jurgen Popp, Bayden R. Wood, Kamila Kochan, Anja Ruther, David Perez-Guaita, Philip Heraud, Nick Stone, Alex Dudgeon, Ben Gardner, Rohigh Reddy, **David Mayerich**, and Rohit Bhargava, "Application of Vibrational

- Spectroscopy and Imaging to Point-of-Care Medicine: A Review,” *Applied Spectroscopy*, 72(1_suppl):52-84 (September 2018)
- [9] **Leila Saadatifard**, Louise C. Abbott, Laura Montier, Jokubas Ziburkus, **David Mayerich**, “Robust Cell Detection for Large-Scale 3D Microscopy Using GPU-Accelerated Iterative Voting,” *Frontiers in Neuroanatomy*, 12:28 (2018)
- [10] **Shihao Ran**, **Sebastian Berisha**, **Rupali Mankar**, Wei-Chuan Shih, **David Mayerich**, “Mitigating Fringing in Discrete Frequency Infrared Imaging Using Time-Delayed Integration,” *Biomedical Optics Express*, 9(2): 832-843 (February 2018)
- [11] **Rupali Mankar**, Michael Walsh, Rohit Bhargava, Saurabh Prasad, and **David Mayerich**, “Selecting optimal features from Fourier transform infrared spectroscopy for discrete-frequency imaging,” *Analyst*, 143:1147-1156 (2018)
- [12] **Camille Artur**, Tasha Womack, Fusheng Zhao, Jason Eriksen, **David Mayerich**, and Wei-Chuan Shih, “Plasmonic nanoparticle-based expansion microscopy with surface-enhanced Raman and dark-field spectroscopic imaging,” *Biomedical Optics Express*, 9(2): 603-615 (2018)
- [13] Chen Wu, Henry Le, **Shihao Ran**, Manmohan Singh, Irina V. Larina, **David Mayerich**, Mary E. Dickinson, Kirill V. Larin, “Comparison and combination of rotational imaging optical coherence tomography and selective plane illumination microscopy for embryonic study,” *Biomedical Optics Express*, 8(10): 4629-4639 (2017)
- [14] **Sebastian Berisha**, Thomas van Dijk, Rohit Bhargava, P. Scott Carney, **David Mayerich** “BIM-Sim: Interactive Simulation of Broadband Imaging Using Mie Theory,” *Frontiers in Physics: Optics and Biophotonics*, 5 (January 2017)
- [15] **Sebastian Berisha**, **Shengyuan C.**, **Sam Saki**, **Davar Daeinejad**, **Ziqi He**, **Rupali Mankar**, **David Mayerich** “SIproc: an open-source biomedical data processing platform for large hyperspectral images,” *Analyst*, 142(8):1350-1357 (April 2017)
- [16] Keely Heintz, **David Mayerich**, John Slater, “Image-Guided, Laser-Based Fabrication of Vascular-Derived Microfluidic Networks,” *Journal of Visualized Experiments* (119), e55101 (January 2017)
- [17] Bradley Deutsch, Rohith Reddy, **David Mayerich**, R. Bhargava, Carney, P.S., “Compositional prior information in computed infrared spectroscopic imaging,” *Journal of the Optical Society of America A*, 32(6): 1126-1131 (June 2015)
- [18] L. Suzanne Leslie, Tomas Wrobel, **David Mayerich**, Bindra, S., Emmadi, R., Rohit Bhargava, “High Definition Infrared Spectroscopic Imaging for Lymph Node Histopathology,” *PLoS ONE* (June 2015)
- [19] **David Mayerich**, Michael Walsh, Andre Kadjacsy-Balla, Partha Ray, Stephen Hewitt, Rohit Bhargava, “Stain-less Staining for Computed Histopathology,” *Technology*, 3(1): 27-31 (March 2015)
- [20] **David Mayerich**, Thomas van Dijk, Michael Walsh, Matthew Schulmerich, P. Scott Carney, Rohit Bhargava, “On the importance of image formation optics in the design of infrared spectroscopic imaging systems,” *The Analyst*, 139, 16, 4031–4036 (Aug. 2014)
- [21] Thomas van Dijk, **David Mayerich**, Rohit Bhargava, and P. Scott Carney, “Rapid spectral-domain localization,” *Optics Express*, 21, 10, 12822–12830 (May 2013)
- [22] Thomas van Dijk, **David Mayerich**, P. Scott Carney, Rohit Bhargava, “Recovery of absorption spectra from Fourier transform infrared (FT-IR) microspectroscopic measurements of intact spheres,” *Applied Spectroscopy*, 67, 5, 546–552 (May 2013)
- [23] **David Mayerich**, Michael Walsh, Matthew Schulmerich, Rohit Bhargava, “Real-time interactive data mining for chemical imaging information: application to automated histopathology,” *BMC bioinformatics*, 14, 156 (2013)
- [24] **David Mayerich**, Christopher Bjornsson, Jonathan Taylor, and Badrinath Roysam, “NetMets: software for quantifying and visualizing errors in biological network segmentation,” *BMC bioinformatics*, 13 Suppl 8, S7 (2012)
- Appeared in IEEE Symposium on Biomedical Data Visualization (BioVis 2012)

- [25] Ji Ryang Chung, Chul Sung, **David Mayerich**, Jaerock Kwon, Daniel E. Miller, Todd Huffman, John Keyser, Louise C. Abbott, Yoonsuck Choe, "Multiscale Exploration of Mouse Brain Microstructures Using the Knife-Edge Scanning Microscope Brain Atlas," *Frontiers in Neuroinformatics*, 5 (Nov. 2011)
- [26] **David Mayerich**, Jaerock Kwon, Chul Sung, Louise C. Abbott, John Keyser, Yoonsuck Choe, "Fast macro-scale transmission imaging of microvascular networks using KESM," *Biomedical Optics Express*, 2, 1, 2888–2896 (Oct. 2011)
- [27] Ji Ryang Chung, Chul Sung, **David Mayerich**, Jaerock Kwon, Daniel Miller, Todd Huffman, John Keyser, Louise C. Abbott, Yoonsuck Choe, "Multiscale exploration of mouse brain microstructures using the knife-edge scanning microscope brain atlas," *Frontiers in Neuroinformatics*, 5, 29 (2011)
- [28] Yoonsuck Choe, **David Mayerich**, Jaerock Kwon, D.E. Miller, Chul Sung, Ji Ryang Chung, T. Huffman, John Keyser, and Louise C. Abbott, "Specimen preparation, imaging, and analysis protocols for knife-edge scanning microscopy," *Journal of Visualized Experiments: JoVE*. 58 (2011)
- [29] **David Mayerich**, and John Keyser, "Hardware Accelerated Segmentation of Complex Volumetric Filament Networks," *IEEE Transactions on Visualization and Computer Graphics*, 15(4):670–681 (July 2009)
- [30] **David Mayerich**, Louise C. Abbott, Bruce H. McCormick, "Knife-Edge Scanning Microscopy for Imaging and Reconstruction of Three-Dimensional Anatomical Structures of the Mouse Brain," *Journal of Microscopy*, 231(1): 134-143 (July 2008) (cover image)
- [31] **David Mayerich**, Louise C. Abbott, John Keyser, "Visualization of Cellular and Microvascular Relationships," *IEEE Transactions on Visualization and Computer Graphics*, 14(6): 1611-1618, (Dec. 2008)
- Appeared in Proceedings of IEEE Visualization
- [32] Zeki Melek, **David Mayerich**, Cem Yuksel, John Keyser, "Visualization of Fibrous and Thread-Like Data," *IEEE Transactions on Visualization and Computer Graphics*, 12(5): 1165-1172 (Oct. 2006)
- Appeared in Proceedings of IEEE Visualization
- [33] Bruce H. McCormick, W. Koh, Yoonsuck Choe, Louise C. Abbott, **David Mayerich**, Zeki Melek, P. Doddapaneni, "Construction of Anatomically Correct Models of Mouse Brain Networks," *Neurocomputing*, 58-60: 670-681 (June 2004)
- [1] **Pavel Govyadinov**, Tasha Womack, Jason Eriksen, **David Mayerich**, Guoning Chen, "Graph-assisted Visualization of Microvascular Networks," *IEEE Conference on Visualization*, Short Paper (Oct. 2019)
- [2] **Mahsa Lotfollahi**, **Davar Daeinejad**, **Sebastian Berisha**, **David Mayerich**, "Digital Staining of High-Resolution FTIR Spectroscopic Images," *6th IEEE Global Conference on Signal and Information Processing (GlobalSIP)*, Anaheim, California (November 2018)
- [3] **David Mayerich**, John C. Hart, "Volume Visualization of Serial Electron Microscopy Images Using Local Variance," *IEEE Symposium on Biological Data Visualization (BioVis 2013)*, pp. 9-16 (Oct. 2012)
- [4] Rohith Reddy, **David Mayerich**, Michael Walsh, M. Schulmerich, P. Scott Carney, R. Bhargava, "Optimizing the Design of FT-IR Spectroscopic Imaging Instruments to Obtain Increased Spatial Resolution of Chemical Species," *IEEE International Symposium on Biomedical Imaging (ISBI 2012)* (May 2012)
- [5] Rohith Reddy, **David Mayerich**, Michael Walsh, P. Scott Carney, R. Bhargava, "Rigorous Electromagnetic Model of FT-IR Spectroscopic Imaging Applied to Automated Histology of Prostate Tissue Specimens," *International Conference on Optics, Lasers and Spectroscopy (ICOLS 2012)* (March 2012)
- [6] **David Mayerich**, Christopher Bjornsson, J. Taylor, Badrinath Roysam "Metrics for Comparing Explicit Representations of Interconnected Biological Networks," *IEEE Symposium on Biological Data Visualization (BioVis)*, pp. 79-86 (Oct. 2011)

- [7] Yoonsuck Choe, **David Mayerich**, Jaerock Kwon, Daniel Miller, Ji Ryang Chung, Chul Sung, John Keyser, Louise C. Abbott “Knife-Edge Scanning Microscopy for Connectomics Research,” *IEEE World Congress on Computational Intelligence: International Joint Conference on Neural Networks (IJCNN 2011)* (July 2012)
- [8] **David Mayerich**, Jaerock Kwon, A. Panchal, John Keyser, Yoonsuck Choe, “Fast Cell Detection in High-Throughput Imagery Using GPU-Accelerated Machine Learning,” *IEEE International Symposium on Biomedical Imaging (ISBI 2011)*, pp. 719-723 (March 2011)
- [9] Jaerock Kwon, **David Mayerich**, Choe, Y, “Automated Cropping and Artifact Removal for Knife-Edge Scanning Microscopy,” *IEEE International Symposium on Biomedical Imaging (ISBI 2011)*, pp. 1366-1369 (March 2011)
- [10] **David Mayerich**, Michael Walsh, R. Bhargava, “Designing Transfer Functions for Exploring Hyperspectral Images,” *Proceedings of IEEE Visualization (IEEE Vis) (2011)*
- [11] **David Mayerich**, John Keyser, “GPU-based Dynamic Tubular Grids for Sparse Volume Rendering,” *Proceedings of IEEE Visualization (Vis 2010) (2010)*
- [12] Yoonsuck Choe, Louise C. Abbott, G. Ponte, John Keyser, Jaerock Kwon, **David Mayerich**, Daniel Miller, D. Han, A. Grimaldi, G. Fiorito, D. Edelman, J. McKinstry, “Charting Out the Octopus Connectome at Submicron Resolution Using the Knife-Edge Scanning Microscope,” *BMC Neuroscience*, 11(Suppl 1):P136 (2010)
- [13] **David Mayerich**, Jaerock Kwon, Yoonsuck Choe, Louise C. Abbott, John Keyser, “Constructing High-Resolution Microvascular Models,” *Microscopic Image Analysis with Applications in Biology (MIAAB 2008)* (Sep. 2008)
- Images appeared in “Portraits of the Mind: Visualizing the Brain from Antiquity to the 21st Century,” C. Schoonover (ed.), 2010
- [14] Jaerock Kwon, **David Mayerich**, Yoonsuck Choe, Bruce H. McCormick “Automated Lateral Sectioning for Knife-Edge Scanning Microscopy,” *IEEE International Symposium on Biomedical Imaging (ISBI 2008)*, pp. 1371-1374 (May 2008)
- [15] **David Mayerich**, John Keyser, “Filament Tracking and Encoding for Complex Biological Networks,” *Proceedings of the ACM Symposium on Solid and Physical Modeling (2008)*
- [16] **David Mayerich**, Bruce H. McCormick, John Keyser, “Noise and Artifact Removal in Knife-Edge Scanning Microscopy,” *IEEE International Symposium on Biomedical Imaging (ISBI 2007)*, pp. 556-559 (April 2007)
- [17] Bruce H. McCormick, P. Doddapaneni, **David Mayerich**, Zeki Melek, John Keyser, “Compression, Segmentation, and Modeling of Large-Scale Filamentary Volumetric Data,” *Proceedings of IEEE Visualization (2004)*
- [1] **David Mayerich**, Yoonsuck Choe, John Keyser, Jaerock Kwon, Louise C. Abbott “Comparing the MOST Technique to KESM,” *Science E-Letters* (2011)
- [1] **Sebastian Berisha**, **Farideh Foroozandeh**, **David Mayerich**, Saurabh Prasad, “Deep Learning for Hyperspectral Imaging, Part I: Theory and Algorithms,” *Hyperspectral Image Analysis – Advances in Machine Learning and Signal Processing*, Springer, Editors: Saurabh Prasad and Jocelyn Chanussot (in press)
- [2] **Farideh Foroozandeh**, **Sebastian Berisha**, **Mahsa Lotfollahi**, **David Mayerich**, Saurabh Prasad, “Deep Learning for Hyperspectral Imaging Part II: Applications for Remote Sensing and Biomedicine,” *Hyperspectral Image Analysis – Advances in Machine Learning and Signal Processing*, Springer, Editors: Saurabh Prasad and Jocelyn Chanussot (in press)
- [3] **David Mayerich**, “Numerical Methods in Practice: An Engineer’s Guide to Numerical Computing Using C/C++ and Python,” University of Houston, Alternative Textbook Incentive Program (2019)
- [4] **David Mayerich**, Yoonsuck Choe, John Keyser, “Reconstruction, Techniques, and Validation,” *Encyclopedia of Computational Neuroscience*, Springer, Editors: J. Dieter and J. Ranu (2014)

REFEREED
LETTERS

BOOK CHAPTERS

- [5] Yoonsuck Choe, Jaerock Kwon, **David Mayerich**, Louise C. Abbott, "Connectome, mouse," *Encyclopedia of Computational Neuroscience*, Editors: J. Dieter and J. Ranu (2014)
- [6] Yoonsuck Choe, Louise C. Abbott, D. Han, P. Huang, John Keyser, Jaerock Kwon,, **David Mayerich**, Zeki Melek, Bruce H. McCormick, "Knife-Edge Scanning Microscopy: High-Throughput Imaging and Analysis of Massive Volumes of Biological Microstructures," *High-Throughput Image Reconstruction and Analysis: Intelligent Microscopy Applications*, Series on Bioinformatics and Biomedical Imaging, Artech House Publishers, pp. 11-34 (2009)
- PATENTS
- [1] David Mayerich, Jason Eriksen. "Milling with Ultraviolet Excitation (MUVE)" (pending)
- [2] **David Mayerich**, Jason Eriksen. WO2018160629A1, "Surface Ablation Lathe Tomography (SALT) Systems and Methods for Whole Organ Phenotyping," (February 2017)
- [3] Thomas van Dijk, **David Mayerich**, R. Bhargava, P. Scott Carney. US8599388B1, "Coherent Optical Mapping of Particles," (November 2012)

PROFESSIONAL
DEVELOPMENT

Legal Issues in Higher Education Workshop (1/15/2015); Faculty Senate Assistant Professor Forum (1/22/2015); Cullen College of Engineering CAREER Workshop (1/30/2015)