# Michael Beyeler

Guthrie Hall, Box 351525
University of Washington
Seattle, WA 98195

Phone: (206) 543 - 3817
Email: mbeyeler@uw.edu
Web: faculty.washington.edu/mbeyeler

## EDUCATION

- **PhD in Computer Science** · Specialization in Computational Neuroscience — 2012 – 2016
  *University of California, Irvine*
  Dissertation: Cortical neural network models of visual motion perception for decision-making and reactive navigation, May 2016. Advisors: JL Krichmar, N Dutt
- **MS in Biomedical Engineering** · Focus on Bioelectronics — 2009 – 2011
  *ETH Zurich, Switzerland*
- **BS in Electrical Engineering** · Major in Micro- and Optoelectronics — 2005 – 2009
  *ETH Zurich, Switzerland*

## ACADEMIC APPOINTMENTS

- **Postdoctoral Fellow** · Psychology · Institute for Neuroengineering · eScience Institute — 2016 – present
  *University of Washington*
- **Research Assistant** · Brain-Inspired Computing Group — 2015
  *IBM Research–Almaden*
- **Research Assistant** · Robots & Assistive Systems — 2013
  *Fraunhofer Institute IPA, Stuttgart, Germany*
- **Graduate Student Researcher** · Computer Science — 2012 – 2016
  *University of California, Irvine*
- **Junior Specialist** · Cognitive Sciences — 2011 – 2012
  *University of California, Irvine*
- **Research Assistant** · Institute for Biomedical Engineering — 2010
  *ETH Zurich, Switzerland*

## HONORS & AWARDS

- NIH K99 Pathway to Independence Award: *National Eye Institute (NEI)* — 2018 – present
- Attendee: Computational Neuroscience–Vision, *Cold Spring Harbor Laboratory (CSHL)* — 2018
- Platform Presenter: *Eye & Chip World Congress on Artificial Vision* — 2017
- Presenter's Travel Award: *Computational & Systems Neuroscience (COSYNE)* — 2017
- Innovation in Neuroengineering & Data Science Postdoctoral Fellowship: *Gordon & Betty Moore Foundation, Alfred P. Sloan Foundation, Washington Research Foundation (WRF)* — 2016 – 2018
- Best Student Talk Award: Neurorobotics workshop, *IEEE ICRA* — 2014
- Chair's Fellowship for Outstanding PhD Applicants: *University of California, Irvine* — 2012 – 2016

## MENTEE AWARDS

**Graduate Students**

- Ezgi I. Yücel (UW): Innovation in Neuroengineering Graduate Fellowship, *WRF* — 2017 – present

**Undergraduate Students**

- Jon Luntzel (UW): Innovation in Neuroengineering Undergraduate Fellowship, *WRF* — 2019

## RESEARCH FUNDING

*Total: $256,682*

- NIH K99 EY-029329 Pathway to Independence Award, *NEI*. Role: PI ($244,882) 2018 – present
- Cloud Credits for Research, *Amazon Web Services (AWS)* ($10,000) 2017
- GPU Seed Grant, *NVIDIA Corporation* ($1,800) 2016, 2018

## ACADEMIC MENTORING

### Graduate Students

- Ezgi I. Yücel, PhD Student, Psychology, *University of Washington* 2017 – present

### Undergraduate Students

- Jon Luntzel, Research Assistant, Computer Science, *University of Washington* 2019 – present
- Ji Min Park, Research Assistant, Psychology, *University of Washington* 2017 – 2018
  thereafter: MD Student, *Pennsylvania State University Medical School*
- Saideep Gupta, Research Assistant, Cognitive Sciences, *University of California, Irvine* 2015 – 2016
  thereafter: Head of Web Development, *Wing AI*
- Stanislav Listopad, Research Assistant, Cognitive Sciences, *University of California, Irvine* 2014 – 2016
  thereafter: PhD Student, *University of California, Irvine*

## ACADEMIC ACTIVITIES

### University Committees

- Postdoctoral Representative: Research Advisory Board, *University of Washington* 2017 – 2019

### Editorial Boards

- Review Editor: *Frontiers in Neurorobotics* 2017 – present

### Workshops

- Co-organizer: Recent Computational Advances in Neuroengineering, *COSYNE* 2018

### Ad-Hoc Reviewing · Conferences

*publons.com/author/1188259/michael-beyeler*

Computational & Systems Neuroscience (COSYNE) · IEEE International Conference on Robotics and Automation (ICRA) · IEEE International Conference on Intelligent Robots and Systems (IROS) · IEEE International Symposium on Circuits and Systems (ISCAS) · Medical Image Computing and Computer Assisted Intervention (MICCAI) · Scientific Computing with Python (SciPy)

### Ad-Hoc Reviewing · Journals

ACM Journal on Emerging Technologies in Computing Systems (JETC) · Frontiers in Neurorobotics · Frontiers in Neuroscience · IEEE Transactions on Cybernetics · IEEE Transactions on Neural Networks and Learning Systems (TNNLS) · Journal of Computational Neuroscience (JCNS) · Journal of Neural Engineering · Journal of Vision · Neural Networks · Neurocomputing · PLoS Computational Biology · PLoS ONE · Sensors · Vision Research

### Ad-Hoc Reviewing · Books

Bertham Science · Packt Publishing

## PUBLICATIONS

*scholar.google.com/citations?user=1CDDZSIAAAAJ*

Note that in many areas of computer science, *conferences* are the primary venue for peer-reviewed publications. Contributions indicated as follows: [•] equal contribution

### Conference Publications

C6 **M Beyeler** (2019). Biophysical model of axonal stimulation in epiretinal visual prostheses. *IEEE EMBS Conference on Neural Engineering (NER)*, San Francisco, CA.

C5 T-S Chou[•], HJ Kashyap[•], J Xing, S Listopad, EL Rounds, **M Beyeler**, N Dutt, JL Krichmar (2018). CARLsim 4: An open source library for large scale, biologically detailed spiking neural network simulations using heterogeneous clusters. *IEEE International Joint Conference on Neural Networks (IJCNN)*, Rio de Janeiro, Brazil. [Code] **Best Student Paper Nominee.**

C4 **M Beyeler**, GM Boynton, I Fine, A Rokem (2017). pulse2percept: A Python-based simulation framework for bionic vision. *Scientific Computing with Python Conference (SciPy)*, p.81–88. [Code]

C3 **M Beyeler**[•], KD Carlson[•], T-S Chou[•], N Dutt, JL Krichmar (2015). CARLsim 3: A user-friendly and highly optimized library for the creation of neurobiologically detailed spiking neural networks. *IEEE International Joint Conference on Neural Networks (IJCNN)*, Killarney, Ireland. [Code]

C2 **M Beyeler**, F Mirus, A Verl (2014). Vision-based robust road lane detection in urban environments. *IEEE International Conference on Robotics and Automation (ICRA)*, Hong Kong, China.

C1 **M Beyeler**[•], F Stefanini[•], H Proske, CG Galizia, E Chicca (2010). Exploring olfactory sensory networks: simulations and hardware emulation. *IEEE Biomedical Circuits and Systems conference (BioCAS)*, Paphos, Cyprus. **Best Student Paper Nominee.**

### Journal Articles

J4 **M Beyeler**, N Dutt, JL Krichmar (2016). 3D visual response properties of MSTd emerge from an efficient, sparse population code. *Journal of Neuroscience* 36(32): 8399–8415.

J3 **M Beyeler**, N Oros, N Dutt, JL Krichmar (2015). A GPU-accelerated cortical neural network model for visually guided robot navigation. *Neural Networks* 72: 75–87.

J2 **M Beyeler**, M Richert, ND Dutt, JL Krichmar (2014). Efficient spiking neural network model of pattern motion selectivity in visual cortex. *Neuroinformatics*, 1–20.

J1 **M Beyeler**, ND Dutt, JL Krichmar (2013). Categorization and decision-making in a neurobiologically plausible spiking network using a STDP-like learning rule. *Neural Networks* 48C: 109–124.

### Reviews and Perspectives

R2 **M Beyeler**[•], EL Rounds[•], KD Carlson, N Dutt, JL Krichmar (in press). Neural correlates of sparse coding and dimensionality reduction. *PLOS Computational Biology*.

R1 **M Beyeler**, A Rokem, GM Boynton, I Fine (2017). Learning to see again: Biological constraints on cortical plasticity and the implications for sight restoration technologies. *Journal of Neural Engineering* 14(5). **Featured cover article.**

### Invited Publications (non-refereed)

I1 KD Carlson, **M Beyeler**, N Dutt, JL Krichmar (2014). GPGPU accelerated simulation and parameter tuning for neuromorphic applications. *Asia and South Pacific Design Automation Conference (ASP-DAC)*, Suntec, Singapore.

### US Patent Applications

P2 R Appuswamy, **M Beyeler**, P Datta, MD Flickner, DS Modha (2018). Long short-term memory (LSTM) on spiking neuromorphic hardware. US Patent App 15/434,672.

P1 **M Beyeler**, ND Dutt, JL Krichmar (2017). Sparse and efficient neuromorphic population coding. US Patent App 15/417,626.

**Manuscripts Under Review**

M4 **M Beyeler**, GM Boynton, I Fine, A Rokem (under review, *MICCAI 2019*). Model-based surgical recommendations for optimal placement of epiretinal implants.

M3 BW Brunton, **M Beyeler** (under review, *Curr Op Neurobiol*). Data-driven models in human neuroscience and neuroengineering.

M2 **M Beyeler** (under review, *Front Neurosci*). On the potential role of retinal sheet transplants for sight restoration. *OSF Preprints*.

M1 **M Beyeler**, D Nanduri, JD Weiland, A Rokem, GM Boynton, I Fine (in revision, *Sci Rep*). A model of ganglion axon pathways accounts for percepts elicited by retinal implants. *bioRxiv* 453035. [Code] [Data]

**Contributed Presentations and Abstracts**

A29 **M Beyeler** (2019). Biophysical model of axonal stimulation in epiretinal visual prostheses. *NER'19*, San Francisco, CA. (poster)

A28 **M Beyeler**, D Nanduri, JD Weiland, A Rokem, GM Boynton, I Fine (2018). Optimizing stimulation protocols for prosthetic vision based on retinal anatomy. *OCNS'18*, Seattle, WA. (poster)

A27 **M Beyeler**, EL Rounds, KD Carlson, N Dutt, JL Krichmar (2018). Sparse coding and dimensionality reduction in the brain. *OCNS'18*, Seattle, WA. (poster)

A26 T-S Chou, HJ Kashyap, J Xing, S Listopad, EL Rounds, **M Beyeler**, N Dutt, JL Krichmar (2018). CARLsim 4: An open source library for large scale, biologically detailed spiking neural network simulation using heterogeneous clusters. *OCNS'18*, Seattle, WA. (oral)

A25 **M Beyeler**, D Nanduri, JD Weiland, A Rokem, GM Boynton, I Fine (2018). Optimizing stimulation protocols for prosthetic vision based on retinal anatomy. *VSS'18*, St. Pete's Beach, FL. (poster)

A24 **M Beyeler**, EI Yucel, A Rokem, GM Boynton, I Fine (2018). Optimizing stimulation protocols for prosthetic vision based on retinal anatomy. *COSYNE'18*, Breckenridge, CO. (oral)

A23 **M Beyeler**, A Rokem, GM Boynton, I Fine (2018). Modeling the perceptual experience of retinal prosthesis patients. *UWIN NCEC'18*, Seattle, WA. (oral)

A22 EL Rounds, **M Beyeler**, KD Carlson, N Dutt, JL Krichmar (2017). Sparse coding and dimensionality reduction in cortex. *SfN'17*, Washington, DC. (poster)

A21 HJ Kashyap, T-S Chou, EL Rounds, S Listopad, **M Beyeler**, N Dutt, JL Krichmar (2017). CARLsim4: A C++ library for the design, simulation, and parameter tuning of biologically detailed spiking neural networks on high performance clusters. *SfN'17*, Washington, DC. (poster)

A20 **M Beyeler**, A Rokem, GM Boynton, I Fine (2017). Reverse-engineering optimized stimulation protocols in epiretinal prosthesis patients. *The Eye & the Chip '17*, Detroit, MI. (oral, **Platform Presentation**)

A19 GM Boynton, A Rokem, **M Beyeler**, J Dorn, NC Sinclair, MN Shivdasani, MA Petoe, R Hornig, I Fine (2017). Efficient and scalable measurements of sensitivity for high resolution electrode arrays. *The Eye & the Chip '17*, Detroit, MI. (poster, **Best Poster Award**)

A18 **M Beyeler**, N Dutt, JL Krichmar (2017). A sparse coding model of MST can account for human heading perception in the presence of eye movements. *ECVP'17*, Berlin, Germany. (poster)

A17 **M Beyeler**, GM Boynton, I Fine, A Rokem (2017). pulse2percept: A Python-based simulation framework for bionic vision. *SciPy'17*, Austin, TX. (oral, **youtube.com/watch?v=KxsNAa-P2X4**)

A16 **M Beyeler**, A Rokem, GM Boynton, I Fine (2017). Modeling the perceptual experience of retinal prosthesis patients. *VSS'17*, St. Pete's Beach, FL. (oral)

A15 **M Beyeler**, A Rokem, GM Boynton, I Fine (2017). Modeling the perceptual experience of retinal prosthesis patients. *COSYNE'17*, Salt Lake City, UT. (poster)

A14 **M Beyeler**, M Richert, N Oros, N Dutt, JL Krichmar (2016). GPU-accelerated real-time simulation of information processing in early visual cortex. *UWIN NCEC'16*, University of Washington, Seattle, WA. (poster)

A13 **M Beyeler**, N Dutt, JL Krichmar (2016). Efficient coding of optic flow can account for MSTd visual response properties. *SfN'16*, San Diego, CA. (poster)

A12 **M Beyeler**, M Richert, N Oros, N Dutt, JL Krichmar (2016). GPU-accelerated real-time simulation of information processing in early visual cortex. *The Eye & the Chip '16*, Dearborn, MI. (poster)

A11 **M Beyeler**, M Richert, N Oros, N Dutt, JL Krichmar (2016). A cortical neural network model of visual motion perception for decision-making and navigation. *JSNC'16*, Los Angeles, CA. (poster)

A10 **M Beyeler**, M Richert, N Oros, N Dutt, JL Krichmar (2016). A cortical neural network model of visual motion perception for decision-making and navigation. *COSYNE'16*, Salt Lake City, UT. (poster)

A9 **M Beyeler**, KD Carlson, T-S Chou, N Dutt, JL Krichmar (2015). An optimized library for the design, simulation, and parameter tuning of biologically detailed spiking neural networks. *SfN'15*, Chicago, IL. (poster)

A8 **M Beyeler**, KD Carlson, T-S Chou, N Dutt, JL Krichmar (2015). CARLsim 3: A user-friendly and highly optimized library for the creation of neurobiologically detailed spiking neural networks. *IJCNN'15*, Killarney, Ireland. (oral)

A7 **M Beyeler**, KD Carlson, T-S Chou, N Dutt, JL Krichmar (2015). CARLsim 3: A user-friendly and highly optimized library for the creation of neurobiologically detailed spiking neural networks. *JSNC'15*, Los Angeles, CA. (poster)

A6 **M Beyeler**, M Richert, N Oros, N Dutt, JL Krichmar (2014). A cortical spiking neural network model for visually guided robot navigation. Neurobiologically Inspired Robotics workshop, *ICRA'14*, Hong Kong, China. (oral, **Best Student Talk Award**).

A5 **M Beyeler**, F Mirus, A Verl (2014). Vision-based robust road lane detection in urban environments. *ICRA'14*, Hong Kong, China. (oral)

A4 **M Beyeler**, M Richert, JM Nageswaran, ND Dutt, JL Krichmar (2014). Large-scale spiking neural network model of visual motion processing. *JSNC'14*, Irvine, CA. (poster)

A3 **M Beyeler**, M Richert, JM Nageswaran, ND Dutt, JL Krichmar (2014). Large-scale spiking neural network model of visual motion processing. *Dynamics of Multifunction Brain Networks MURI Winter School*, San Diego, CA. (oral)

A2 **M Beyeler**, M Richert, JM Nageswaran, ND Dutt, JL Krichmar (2013). Large-scale spiking neural network model of visual motion processing. *SfN'13*, San Diego, CA. (poster)

A1 **M Beyeler**, ND Dutt, JL Krichmar (2013). Spiking neural network model of visual pattern recognition and decision-making using a stochastic STDP learning rule. *JSNC'13*, Pasadena, CA. (poster)

## INVITED TALKS & PRESENTATIONS

**Scheduled**

T12 14th Conference on Learning & Memory: Cellular and Systemic Views, *University of Magdeburg, Germany* — Mar 2020

T11 Department of Cognitive Sciences, *University of California, Irvine, CA* — Apr 2019

**Past**

T10 Department of Computer Science, *Duke University, Durham, NC* — Mar 2019

T9 Department of Computer Science, *University of California, Santa Barbara, CA* — Jan 2019

T8 Center for Applied and Translational Sensory Science (CATSS), *University of Minnesota, Minneapolis, MN* — Feb 2018

T7 Cluster of Excellence in Cognitive Interaction Technology (CITEC), *Bielefeld University, Germany* — Aug 2017

T6 Center for Perceptual Systems, *University of Texas, Austin, TX* — Jul 2017

T5 UW Medicine Eye Institute, *University of Washington, Seattle, WA* — Feb 2017

T4 *Second Sight Medical Products Inc., Sylmar, CA* — Nov 2016

T3 Department of Psychology, *University of Washington, Seattle, WA* — Dec 2015

T2 *IBM Research, San Jose, CA* — Aug 2015

T1 *Qualcomm Technologies Incorporated, San Diego, CA* — Nov 2014

## TEACHING ACTIVITIES

**Selected Guest Lectures** 2015 – present

- BIOEN-460: Neural Engineering, *undergraduate* (UW)
- CS-171 Introduction to Artificial Intelligence, *undergraduate* (UC Irvine)
- Neurohackademy 2018: Image processing & computer vision with scikit-image, *all levels* (UW)
- NRSC-490 Advanced Topics in Neuroscience, *undergraduate* (U Pouget Sound)
- PSYCH-268A Computational Neuroscience, *undergraduate* (UC Irvine)
- PSYCH-508: Core Concepts in Perception, *graduate* (UW)

**Certified Software Carpentry Instructor** 2017 – present
*eScience Institute, University of Washington* *Seattle, WA*

- Teaching Python, shell, Git, and software engineering skills to scientists and engineers (all levels) at bootcamps and in online sessions. Developing new instructional content.

**Teaching Assistant** 2015 – 2016
*Department of Computer Science, UC Irvine* *Irvine, CA*

- CS-143A: Principles of Operating Systems, *undergraduate*
- CS-171: Introduction to Artificial Intelligence, *undergraduate*

**Programming Books**

B3 **M Beyeler** (2017). Machine Learning for OpenCV. *Packt Publishing Ltd.*, Birmingham, UK, 382 pages, ISBN 978-178398028-4. **Also available in Korean, Japanese, and as a video course.** [Code]

B2 J Howse, P Joshi, **M Beyeler** (2016). OpenCV: Computer Vision Projects with Python. *Packt Publishing Ltd.*, Birmingham, UK, 558 pages, ISBN 978-178712549-0.

B1 **M Beyeler** (2015). OpenCV with Python Blueprints. *Packt Publishing Ltd.*, Birmingham, UK, 230 pages, ISBN 978-178528269-0. [Code]

## PUBLIC OUTREACH & SCIENCE COMMUNICATION

**Panels**

P1 An Evening with Neuroscience, *University of Washington, Seattle, WA* Apr 2019

**Volunteer Work**

V2 Administrative Assistant: *Lighthouse Foundation for the Blind, Inc.* 2018 – present

V1 Lab tour leader: *Mathobotix "Bytes and Bots" K-12 Summer Camp* 2013 – 2014

## PROFESSIONAL ASSOCIATIONS

- Member: *IEEE Engineering in Medicine & Biology Society (EMBS)* 2019 – present
- Member: *Organization for Computational Neurosciences (OCNS)* 2018 – present
- Member: *Vision Sciences Society (VSS)* 2017 – present
- Member: *IEEE Robotics and Automation Society (RAS)* 2014 – 2016
  - Student Volunteer, 2014 – 2016
- Member: *Society for Neuroscience (SfN)* 2013 – present
  - Neuronline Community Leader, 2016 – 2017

## REJECTIONS & FAILURES

Inspired by: Melanie Stefan (2010), A CV of Failures. *Nature* 468(467).

### Academic & Professional

- Tenure-track positions (R1): 21 no answers, 8 explicit rejections, 1 rejection after interview 2019
- EPFL Neuroscience Graduate program: rejected 2013

### Grants & Awards

- Burroughs Wellcome Award at the Scientific Interface (CASI): semifinalist 2018
- IJCNN Travel Award: not awarded 2015
- NVIDIA Graduate Fellowship: not awarded 2013, 2014, 2015
- Microsoft Research Fellowship: not awarded 2013

### Workshops

- VSS workshop proposal: rejected 2019

### Scientific Peer Review

- M2, *OSF Preprints*: desk-rejected from 1 journal 2019
- J7, *Sci Rep*: desk-rejected from 5 journals 2018
- R2, *PLOS Comp Bio*: desk-rejected from 3 journals 2017
- COSYNE abstract: rejected 2015, 2018