

# Michael Beyeler

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## EDUCATION

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- **PhD in Computer Science** · Specialization in Computational Neuroscience 2012 – 2016  
*University of California, Irvine (UCI)*  
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

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- **Postdoctoral Fellow** · Psychology · Institute for Neuroengineering · eScience Institute 2016 – present  
*University of Washington (UW)*
- **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 (UCI)*
- **Junior Specialist** · Cognitive Sciences 2011 – 2012  
*University of California, Irvine (UCI)*
- **Research Assistant** · Institute for Biomedical Engineering 2010  
*ETH Zurich, Switzerland*

## HONORS & AWARDS

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### Major Honors & Awards

- NIH K99 Pathway to Independence Award: *National Eye Institute (NEI)* 2018

### Best Paper Award Nominations

- Best Student Paper Nominee: *IEEE International Joint Conference on Neural Networks (IJCNN)* 2018
- Best Student Paper Nominee: *IEEE Biomedical Circuits & Systems Conference (BioCAS)* 2010

### Fellowships & Selected Travel Awards

- CSHL Computational Neuroscience–Vision summer course, *Helmsley Charitable Trust* 2018
- 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
- Chair's Fellowship for Outstanding PhD Applicants: *UCI* 2012

### Other Academic Awards

- Finalist: Postdoc Mentoring Award, *UW* 2019

## MENTEE HONORS & AWARDS

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### Graduate Students

- Ezgi I. Yücel: Innovation in Neuroengineering Graduate Fellowship, *WRF* 2017

### Undergraduate Students

- Jon Luntzel: Innovation in Neuroengineering Undergraduate Fellowship, *WRF* 2019

## RESEARCH FUNDING

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Total: \$257,282

- NIH K99 EY-029329: Virtual prototyping for retinal prosthesis patients. M Beyeler, PI. *National Eye Institute (NEI)*. (\$244,882) 2018 – present
- Cloud Credits for Research, *Amazon Web Services (AWS)*. (\$10,000) 2017
- GPU Seed Grant, *NVIDIA Corporation*. (2 × \$1,200) 2016, 2018

## ACADEMIC MENTORING

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### Graduate Students

- Ezgi I. Yücel, PhD Student, Psychology, *UW* 2017 – present

### Undergraduate Students

- Jon Luntzel, Research Assistant, Computer Science, *UW* 2019
- Saideep Gupta, Research Assistant, Cognitive Sciences, *UCI* 2015 – 2016
- Stanislav Listopad, Research Assistant, Cognitive Sciences, *UCI* 2014 – 2016

## ACADEMIC SERVICE

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### University Committees

- Postdoctoral Representative: Research Advisory Board, *UW* 2017 – 2019

### Conference Program Committees

- Session Chair: Neuroscience, *Scientific Computing with Python (SciPy)* 2017

### Conference Workshops

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

### Editorial Boards

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

### Ad-Hoc Reviewing · Conferences

2017, 2018 Computational & Systems Neuroscience (COSYNE) · 2015 IEEE International Conference on Intelligent Robots & Systems (IROS) · 2014 IEEE International Conference on Robotics & Automation (ICRA) · 2014 IEEE International Symposium on Circuits & Systems (ISCAS) · 2019 Medical Image Computing & Computer Assisted Intervention (MICCAI) · 2017 Scientific Computing with Python (SciPy)

### Ad-Hoc Reviewing · Journals

[publons.com/researcher/1188259/michael-beyeler](https://publons.com/researcher/1188259/michael-beyeler)

1x ACM Journal on Emerging Technologies in Computing Systems (JETC) · 5x Frontiers in Neurorobotics · 3x Frontiers in Neuroscience · 5x IEEE Transactions on Cybernetics · 8x IEEE Transactions on Neural Networks & Learning Systems (TNNLS) · 1x Journal of Computational Neuroscience (JCNS) · 5x Journal of Neural Engineering · 1x Journal of Neuroscience · 2x Journal of Vision · 5x Neural Networks · 1x Neurocomputing · 2x PLoS Computational Biology · 3x PLoS ONE · 1x Sensors · 1x Vision Research

### Ad-Hoc Reviewing · Books

Bertham Science · Packt Publishing

## PUBLICATIONS

[scholar.google.com/citations?user=1CDDZSIAAAA](https://scholar.google.com/citations?user=1CDDZSIAAAA)

Note that in many areas of computer science, *conferences* are the primary venue for peer-reviewed publications.

Legend: <sup>o</sup> equal contribution, <sup>(i)</sup> invited publication

### Refereed Conference Publications

- C8 **M Beyeler**, GM Boynton, I Fine, A Rokem (accepted). Model-based recommendations for optimal surgical placement of epiretinal implants. *Medical Image Computing & Computer Assisted Intervention (MICCAI)*, Shenzhen, China.
- C7 **M Beyeler** (2019). Biophysical model of axonal stimulation in epiretinal visual prostheses. *IEEE EMBS Conference on Neural Engineering (NER)*, San Francisco, CA.
- C6 T-S Chou<sup>o</sup>, HJ Kashyap<sup>o</sup>, 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. **Best Student Paper Nominee**. [Code]
- C5 **M Beyeler**, GM Boynton, I Fine, A Rokem (2017). pulse2percept: A Python-based simulation framework for bionic vision. *Scientific Computing with Python (SciPy)*, p.81–88. [Code]
- C4 **M Beyeler**<sup>o</sup>, KD Carlson<sup>o</sup>, T-S Chou<sup>o</sup>, 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]
- C3 KD Carlson, **M Beyeler**, N Dutt, JL Krichmar (2014). GPGPU-accelerated simulation and parameter tuning for neuromorphic applications<sup>(i)</sup>. *Asia and South Pacific Design Automation Conference (ASP-DAC)*, Suntec, Singapore.
- C2 **M Beyeler**, F Mirus, A Verl (2014). Vision-based robust road lane detection in urban environments. *IEEE International Conference on Robotics & Automation (ICRA)*, Hong Kong, China.
- C1 **M Beyeler**<sup>o</sup>, F Stefanini<sup>o</sup>, H Proske, CG Galizia, E Chicca (2010). Exploring olfactory sensory networks: simulations and hardware emulation. *IEEE Biomedical Circuits & Systems Conference (BioCAS)*, Paphos, Cyprus. **Best Student Paper Nominee**.

### Refereed Journal Articles

- J5 **M Beyeler**, D Nanduri, JD Weiland, A Rokem, GM Boynton, I Fine (2019). A model of ganglion axon pathways accounts for percepts elicited by retinal implants. *Scientific Reports* 9(1):9199. [Code] [Data]
- 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.

### Refereed Reviews & Perspectives

- R4 BW Brunton, **M Beyeler** (2019). Data-driven models in human neuroscience and neuroengineering<sup>(i)</sup>. *Current Opinion in Neurobiology* 58: 21–29.
- R3 **M Beyeler** (2019). Commentary: Detailed visual cortical responses generated by retinal sheet transplants in rats with severe retinal degeneration. *Frontiers in Neuroscience* 13: 471.
- R2 **M Beyeler**<sup>o</sup>, EL Rounds<sup>o</sup>, KD Carlson, N Dutt, JL Krichmar (2019). Neural correlates of sparse coding and dimensionality reduction. *PLoS Computational Biology* 15(6):e1006908.
- 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**.

### 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.

### Contributed Presentations & Abstracts

- A30 **M Beyeler**, A Rokem, GM Boynton, I Fine (2019). Interpretable machine-learning predictions of perceptual sensitivity in retinal implant users. *Northwest Data Science Summit*, Seattle, WA. (oral)
- A29 **M Beyeler** (2019). Biophysical model of axonal stimulation in epiretinal visual prostheses. *NER'19*, San Francisco, CA. (poster)
- A28 **M Beyeler**, EL Rounds, KD Carlson, N Dutt, JL Krichmar (2018). Sparse coding and dimensionality reduction in the brain. *OCNS'18*, Seattle, WA. (poster)
- A27 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)
- A26 **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)
- A25 **M Beyeler**, El Yucel, A Rokem, GM Boynton, I Fine (2018). Optimizing stimulation protocols for prosthetic vision based on retinal anatomy. *COSYNE'18*, Breckenridge, CO. (oral)
- A24 **M Beyeler**, A Rokem, GM Boynton, I Fine (2018). Modeling the perceptual experience of retinal prosthesis patients. *UWIN NCEC'18*, Seattle, WA. (oral)
- A23 EL Rounds, **M Beyeler**, KD Carlson, N Dutt, JL Krichmar (2017). Sparse coding and dimensionality reduction in cortex. *Sfn'17*, Washington, DC. (poster)
- A22 **M Beyeler**, A Rokem, GM Boynton, I Fine (2017). Improving retinal prostheses using the "virtual patient". *OSA Fall Vision '17*, Washington, DC. (oral)
- 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](https://www.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*, 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 & SEMINARS

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### Scheduled

- T14 14th Conference on Learning & Memory: Cellular and Systemic Views (plenary), *University of Magdeburg, Germany* Mar 2020

### Past

- T13 Department of Cognitive Sciences, *University of California, Irvine, CA* Apr 2019
- T12 Department of Computer Science, *Duke University, Durham, NC* Mar 2019
- T11 Department of Computer Science, *University of California, Santa Barbara, CA* Jan 2019
- T10 COSYNE Workshop on Recent Advances in Neuroengineering, *Breckenridge, CO* Mar 2018
- T9 Center for Applied and Translational Sensory Science (CATSS), *University of Minnesota, Minneapolis, MN* Feb 2018
- T8 Eye & Chip World Congress on Artificial Vision (plenary), *Detroit Institute of Ophthalmology* Sep 2017
- 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

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### Tutorials at Conferences

TC1 Image processing and computer vision with scikit-image, *Neurohackademy* 2018

### Software Carpentry

SC2 Instructor: Unix shell, version control with git, Python/R, *UW eScience Institute* 2017 – present  
 SC1 Attendee: Instructor training workshop, *UW eScience Institute* 2017

### Selected Guest Lectures

GL5 PSYCH-508: Core Concepts in Perception, grad, *UW* SQ2019  
 GL4 BIOEN-460: Neural Engineering, undergrad, *UW* WQ2019  
 GL3 NRSC-490: Advanced Topics in Neuroscience, undergrad, *U Puget Sound* SQ2018  
 GL2 CS-171: Introduction to Artificial Intelligence, undergrad, *UCI* WQ2015  
 GL1 PSYCH-268A: Computational Neuroscience, undergrad, *UCI* FQ2015

### Teaching Assistant

TA3 CS-143A: Principles of Operating Systems, 186 students, undergrad, *UCI* SQ2015  
 TA2 CS-171: Introduction to Artificial Intelligence, 81 students, undergrad, *UCI* WQ2015  
 TA1 Networks & Circuits I & II, undergrad, *ETH Zurich, Switzerland* FS2009, SS2010

### Programming Books

PB3 **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]  
 PB2 J Howse, P Joshi, **M Beyeler** (2016). OpenCV: Computer Vision Projects with Python. *Packt Publishing Ltd.*, Birmingham, UK, 558 pages, ISBN 978-178712549-0.  
 PB1 **M Beyeler** (2015). OpenCV with Python Blueprints. *Packt Publishing Ltd.*, Birmingham, UK, 230 pages, ISBN 978-178528269-0. [Code]

## SCIENCE COMMUNICATION & PUBLIC OUTREACH

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### Media Coverage

MC1 Restoring vision with bionic eyes: no longer science fiction, *PCMag* 2019

### Panels

PA1 An Evening with Neuroscience, *University of Washington, Seattle, WA* 2019

### Documentary & Video Appearances

VA1 Made with Android, *Google Developers* 2015

### Community Involvement & Public Outreach

CI4 Outreach & fundraising: Lighthouse Foundation for the Blind, *Seattle, WA* 2018  
 CI3 Neuronline community leader, *Society for Neuroscience (SfN)* 2016 – 2017  
 CI2 Student volunteer, *IEEE Robotics & Automation Society (RAS)* 2014 – 2016  
 CI1 Lab tour leader: Mathobotix “Bytes and Bots” K-12 Summer Camp, *UCI* 2013, 2014

## PROFESSIONAL ASSOCIATIONS

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- Member: *IEEE Engineering in Medicine & Biology Society (EMBS)* 2019 – present
- Member: *Organization for Computational Neurosciences (OCNS)* 2018 – present
- Member: *Association for Research in Vision & Ophthalmology (ARVO)* 2018 – present
- Member: *Vision Sciences Society (VSS)* 2017 – present
- Member: *Society for Neuroscience (SfN)* 2013 – present

## REJECTIONS & FAILURES

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

Legend: TT tenure-track, PD postdoc, G grad

**Academic & Professional** *Success rate, TT: 3 % (n=31), PD: 100 % (n=2), G: 50 % (n=2)*

- Tenure-track positions (R1): 17 no answers, 12 explicit rejections, 1 rejection after interview 2019
- EPFL Neuroscience Graduate program: rejected 2013

**Grants** *Success rate, PD: 50 % (n=2)*

- Burroughs Wellcome Award at the Scientific Interface (CASI): invited for full proposal 2018

**Fellowships & Travel Awards** *Success rate, PD: 100 % (n=4), G: 44 % (n=9)*

- IJCNN Travel Award: not awarded 2015
- NVIDIA Graduate Fellowship: not awarded 2013, 2014, 2015
- Microsoft Research Fellowship: not awarded 2013

**Workshops** *Success rate, PD: 50 % (n=2)*

- VSS workshop proposal: rejected 2019

**Scientific Peer Review**

- J5, *Sci Rep*: desk-rejected from 5 journals 2018
- R3, *Front Neurosci*: desk-rejected from 1 journal 2018
- R2, *PLOS Comp Bio*: desk-rejected from 3 journals 2017
- COSYNE abstract: rejected 2015, 2018