Gert Cauwenberghs

Shu Chien-Gene Lay Department of Bioengineering
Jacobs School of Engineering
University of California, San Diego
La Jolla, CA 92093-0412

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Born July 30, 1965; Belgium. US Citizen.
Married to Langche Zeng; two children (Kalyani and Ginkgo).

Research Interests

Biomedical integrated circuits and systems, micropower analog VLSI, neuromorphic engineering, computational and systems neuroscience, neuron-silicon and brain-machine interfaces, learning and intelligent systems.

Education

Ph.D., Electrical Engineering, California Institute of Technology, 1994.
 Dissertation: Analog VLSI Autonomous Systems for Learning and Optimization.
 Advisor: Amnon Yariv

M.S., Electrical Engineering, California Institute of Technology, 1989.

Engineer's Degree, Applied Physics, University of Brussels, 1988.
 Thesis: Electro-Optic Effects in Stratified Media.

Academic Positions

Professor, Department of Bioengineering, Jacobs School of Engineering, University of California San Diego, La Jolla CA 92093, 2009-present.

Professor, Neurobiology Section, Division of Biological Sciences, University of California San Diego, La Jolla CA 92093, 2005-2009. Affiliate Professor, 2009-present.

Professor, Department of Electrical and Computer Engineering, Johns Hopkins University, Baltimore MD 21218, 2002-2005.

Visiting Professor, Center for Biological and Computational Learning, Department of Brain and Cognitive Science, Massachusetts Institute of Technology, Cambridge MA 02142, 1998-1999.

Associate Professor, Department of Electrical and Computer Engineering, Johns Hopkins University, Baltimore MD 21218, 1998-2002.

Assistant Professor, Department of Electrical and Computer Engineering, Johns Hopkins University, Baltimore MD 21218, 1994-1998.

Awards and Honors

Best Undergraduate Teacher of the Year Award, Shu Chien-Gene Lay Department of Bioengineering, Jacobs School of Engineering, UC San Diego, 2021-2022.

Fellow, American Institute for Medical and Biological Engineering (AIMBE), 2015.

Fellow, Institute of Electrical and Electronic Engineers (IEEE), 2011.

Presidential Early Career Award for Scientists and Engineers (PECASE), 2000.

Young Investigator Award, Office of Naval Research, 1999.

Career Award, National Science Foundation, 1997.

Francqui Fellow, Belgian American Educational Foundation, 1988.

Research Grants and Contracts

"Energy-Efficient High Dynamic Range Circuit Design," DARPA Massive Analog Cross-Correlation (MAX), Northrop Grumman Corporation (D. Nichols, PI), G. Cauwenberghs, A.G. Andreou, 7/2023-6/2027.

"Oversampled Analog Transform Orthogonal Filterbanks with Adiabatic Energy Recovery," DARPA Massive Analog Cross-Correlation (MAX), Raytheon Corporation (F. Adil, PI), G. Cauwenberghs, S. Joshi, 4/2023-3/2027.

"Scaling-Friendly, Analog Correlators Using Charge-based Margin Propagation," DARPA Massive Analog Cross-Correlation (MAX), Washington University at St Louis, A. Nagulu (PI), A. Natarajan, S. Chakrabartty, G. Cauwenberghs, 3/2023-2/2027.

"High-Density Hybridized CMOS-RRAM Integration and Low Noise Characterization of Large-Scale Neuromorphic Compute-in-Memory Arrays," Office of Naval Research Defense University Research Infrastructure Program (DURIP), G. Cauwenberghs, 1/2023-12/2023.

"Collaborative Research: FET: Medium: Energy-Efficient Persistent Learning-in-Memory with Quantum Tunneling Dynamic Synapses," National Science Foundation, CCF-2208771, G. Cauwenberghs (PI, UCSD), with S. Chakrabartty (PI, Washington Univ. St Louis), 10/2022-09/2025.

"Energy Efficient Integrated Electronics for Cryogenic Data Transmission," DARPA FENCE: Sparse Event Neuromorphic Technology for INfrarEd visuaLs (SENTINEL), Northrop Grumman Corporation (D. Nichols, PI), A.G. Andreou, K. Boahen, G. Cauwenberghs, 5/2021-4/2024.

"Power Efficient Computing and Chip Communications," Northrop Grumman Corporation, G. Cauwenberghs, 12/2020-12/2021.

"Ultra-Low Power, Massively Parallel Processing-in-Memory Integrated Hardware for Scalable Hyper-Dimensional Computing," DARPA HyDDENN: SpHyRE-Net, RAMLabs (D. Mumme, PI), G. Cauwenberghs, 8/2020-8/2021.

"Neural Circuit Computations for Visual Motion During Natural Primate Behaviors," National Institutes for Health (NIH/NINDS) BRAIN Initiative (NS-18-029) 1-U01-NS-116377-01, A. Huk (PD/PI), M. Hayhoe, L. Cormack, C. Miller, C. Niell, G. Cauwenberghs (MPI), and J. Matthis, 9/2020-8/2023.

"Visually-Guided Primate Predation: A Computational Neuroethology of Visual Search and Targeting in a Complex, Natural Environment," Air Force Office of Scientific Research (AFOSR) 19RT0316, A. Huk (PI), C. Miller, and G. Cauwenberghs (Co-PI), 6/2019-5/2022.

"Brain Inspired Next Generation Deep Learning: Efficient and Persistent Online Learning with Spikes," Office of Naval Research Science of AI, N00014-20-1-2405, G. Cauwenberghs (PI) and D. Kuzum, 5/2020-4/2023.

"Ambulary Stress Monitoring by Integrated Wearable Sensors for Blood Pressure, Electrocardiogram, and Heart Rate Variability," Air Force Research Laboratory/Semi NBMC, S. Xu (PI) and G. Cauwenberghs (Co-PI), 1/2020-6/2021.

"Flexible In-Ear Physiological Sensors for Low Noise, Low Power 24/7 Health Monitoring," UCSD Jacobs School of Engineering Center for Wearable Sensors, G. Cauwenberghs (PI), S. Xu, P. Mercier, and J. Wang, 5/2019-5/2020.

"Neuromorphic Hardware-Efficient Fault-Tolerant Inference," Western Digital Corporation, G. Cauwenberghs, 9/2019-8/2022.

"CRI: CI-NEW: Trainable Reconfigurable Development Platform for Large-Scale Neuromorphic Cognitive Computing," National Science Foundation CNS-1823366, G. Cauwenberghs (PI), E. Neftci, and A. Majumdar,

8/2018-7/2021.

"Flexible Wireless Non-Contact Sensing Systems for Monitoring Electrical Rhythms of the Brain, Heart, and Stomach," UCSD Jacobs School of Engineering Center for Wearable Sensors, T. Coleman (PI) and G. Cauwenberghs, 5/2018-5/2019.

"Unobtrusive Physiological Monitoring and Biofeedback for Healthy Aging," Catalyst Foundation, G.C. Temes, T.M. Hagen and G. Cauwenberghs, 7/2018-6/2021.

"Neuromorphic Cognitive Vision Systems for Aerial Navigation and Reconnaissance," Office of Naval Research N00014-18-1-2248, G. Cauwenberghs, 5/2018-4/2021.

"SNM: Scalable Nanomanufacturing of Fab Compatible High-Density Nanowire Arrays for High-Throughput Drug Screening," National Science Foundation CMMI-1728497, S. Dayeh (PI), K. Frazer, G. Cauwenberghs, and Y.H. Lo, 09/2017-8/2021.

"PFI:BIC - Unobtrusive Neurotechnology and Immersive Human-Computer Interface for Enhanced Learning," National Science Foundation IIP-1719130, G. Cauwenberghs (PI), T.P. Jung, S. Makeig, Y. Chi, and T. Mullen, 08/2017-07/2020.

"Miniaturized Dry-Contact Electrode In-Ear Electroencephalography," Starkey Hearing Technologies, G. Cauwenberghs, 10/2017-9/2018.

"Energy-Efficient Deep Learning in Scalable Hierarchical Event-Driven Neuromorphic Algorithms and Architecture," Fujitsu Laboratories of America, G. Cauwenberghs, 1/2017-12/2017.

"Microdevice Mediated Functional Brain Imaging with High Temporal and Spatial Resolution," National Institutes of Health (National Eye Institute) 1-R21-EY027609-01, with Eric Wong (PI), 9/2016-7/2018.

"E2CDA: Type I: EXtremely Energy Efficient Collective ELectronics (EXCEL)," National Science Foundation and Semiconductor Research Corporation NSF/SRC CCF-1640081, with Suman Datta (PI, Notre Dame), 9/2016-8/2019.

"Scalable Event-driven Neuromorphic Learning Machines for Human-Centric Computing," Intel Strategic Research Alliance on Neuromorphic Architectures for Mainstream Computing, Intel Corporation, G. Cauwenberghs, 9/2015-8/2018.

"Integrated Power and Data Telemetry for Nano-engineered Retinal Prostheses," Nanovision Biosciences, G. Cauwenberghs, 7/2015-12/2016.

"Memory Prosthetics," UC Multicampus Research Programs and Initiatives (MRPI), with Bruce McNaughton (PI, UCI), 1/2015 - 12/2018.

"Algorithms and Architectures for Efficient Event-Driven Implementation of Long Short-Term Memory Spiking Neural Systems," Fujitsu Laboratories of America, G. Cauwenberghs, 11/2014-12/2016.

"Collaborative Research: Visual Cortex on Silicon," National Science Foundation CCF-1317407, G. Cauwenberghs, 10/2013-9/2018.

"Dynamics of Multifunction Brain Networks," Office of Naval Research MURI N00014-13-1-0205, with H. Abarbanel (PI), 12/2012-6/2017.

"Event-driven Sensory Analog Processing," Texas Instruments, G. Cauwenberghs, 6/2012-5/2017.

"Micropower Analog VLSI Signal Separation and Classification," SAIC/Leidos (D. Braunreiter, PI), DARPA CLASIC Program, G. Cauwenberghs, 10/2011-9/2014.

"EFRI-M3C: Distributed Brain Dynamics in Human Motor Control," National Science Foundation EFRI-1137279, G. Cauwenberghs (PI), K. Kreutz-Delgado, S. Makeig, H. Poizner, and T.J. Sejnowski, 9/2011-8/2015.

"Neuromorphic Synapse Arrays," Qualcomm Inc., G. Cauwenberghs, 5/2010-4/2012.

"Neuromorphic Modular and Evolvable Vision Systems," Evolved Machines (P. Rhodes, PI), DARPA Neovision2 Program, G. Cauwenberghs and T. Sejnowski, 3/2010-12/2011.

"Capacitive ECG Sensor Systems and Unobtrusive ECG Sensors," National Semiconductor, G. Cauwenberghs, 11/2009-11/2010.

"SGER: Wireless EEG Brain Interface for Extended Interactive Learning," NSF SBE-0847752, G. Cauwenberghs (PI) and T. Sejnowski, 10/2008-9/2010.

"CRCNS: Imaging and Modeling of Cortical Microvascular Dynamics," NIH/NIA 1R01AG029681, G. Cauwenberghs (PI), D. Kleinfeld, T. Sejnowski and N. Thakor, 9/2006-8/2010.

"High-Density, Wearable Dry-Electrode EEG Recording System Incorporating Online Artifact Rejection and Data Reduction," T.P. Jung (PI), S. Makeig, G. Cauwenberghs and I. Galton, DARPA, 6/2006-6/2007.

"High-Density Integrated Adaptive Wavefront Control," G. Cauwenberghs (PI) and P. Yu, US Army Research Office, 6/2006-6/2007.

"Laser Speckle Field Target-in-the-Loop Identification and Tracking," G. Cauwenberghs, SPAWAR and DARPA, 9/2005-11/2006

"Acoustic Target Identification and Localization," G. Cauwenberghs (PI), A.G. Andreou, C.P. Diehl and J.E. West, Defense Intelligence Agency, and National Science Foundation, IIS-0434161, 8/2004-7/2006.

"SST: Minimally-Attended Integrated Visual Surveillance Network," R. Etienne-Cummings (PI) and G. Cauwenberghs, National Science Foundation, ECS-0428042, 10/2004-9/2007.

"Integrated Multi-Signal Adaptive Microphone," G. Cauwenberghs (PI), L. Degertekin and G. Zweig, The Catalyst Foundation, 9/2003-8/2007.

"Trainable Visual Aids for Object Detection and Identification," G. Cauwenberghs (PI), T. Poggio, G. Dagnelie, and A. Verri, National Science Foundation, IIS-0209289, 10/2002-8/2005.

"Microscale Adaptive Optical Wavefront Correction," G. Cauwenberghs (PI), A. Andreou, R. Etienne-Cummings, M. Vorontsov and R. Reedy, National Science Foundation, ECS-0010026, 7/2001-6/2004.

"Development of SVM-Based VLSI Processor for Real-Time Face Detection and Recognition," G. Cauwenberghs, WatchVision, Korea, 9/2001-8/2002.

"Reconfigurable VLSI Systems for Real-Time Biosonar Signal Processing," G. Cauwenberghs (PI) and R.T. Edwards, Office of Naval Research, 1/2001-12/2002.

"MEMS Acoustic Sensors and Adaptive VLSI Signal Processing," G. Cauwenberghs, A.G. Andreou and R. Etienne-Cummings, subcontract from University of Maryland (S. Shamma, PI), ONR/DARPA, 6/2000-5/2003.

"Neuromorphic Autoadaptive Systems and Independent Component Analysis," G. Cauwenberghs, Office of Naval Research Young Investigator Award, and Presidential Early Career Award for Scientists and Engineers, 3/1999-3/2004.

"Low-Power Biosonar Signal Processor for Buried Target Detection," G. Cauwenberghs (PI), R.T. Edwards and F. Pineda, Office of Naval Research, 4/1999-9/2000.

"Micropower Analog VLSI Continuous Speech Recognition," G. Cauwenberghs (PI), H. Bourlard and Jayadeva, The Catalyst Foundation, 6/1999-5/2004.

"VLSI Image Sensor for Nonlinear Optical Information Processing," G. Cauwenberghs (PI) and A. Andreou, Army Research Office, 5/1998-5/1999.

"CAREER: Engineering Research and Education in Analog VLSI Parallel Computational Systems," G. Cauwenberghs, National Science Foundation, 6/1997-5/2001.

"Algorithms and Architectures for VLSI Neuromorphic Systems," A. Andreou and G. Cauwenberghs, ONR/DARPA MURI with Boston University (Stephen Grossberg, PI), 3/1995-2/2000.

"VLSI for A/D Conversion," G. Cauwenberghs, Maryland Industrial Partership Program (MIPS) and Northrop Grumman, 2/1997-2/1999.

"Smart Silicon Controller for Optical Phase Distortion Suppression," G. Cauwenberghs, Army Research Office, 2/1997-1/1998.

"CRI: Neuromorphic VLSI Modelling of Attention-Based Visual Search," E. Niebur, M. Steinmetz and G. Cauwenberghs (co-PI), National Science Foundation, 2/1997-1/1998.

"Low-Power Integrated Acoustic Classifiers/Recognizers," G. Cauwenberghs (PI) and F. Pineda, APL/WSE Collaborative R&D Initiative, 9/1995-8/1996.

"Smart Focal Plane Arrays," A. Andreou and G. Cauwenberghs (co-PI), DCS Corporation, 9/1994-11/1997.

"Neuromimetic Microelectronic Systems for Sensory Information Processing," A. Andreou, F. Pineda, and K. Strohbehn, G. Cauwenberghs (co-PI), Army Research Laboratory, 9/1995-4/1996.

Graduate, Postgraduate and Sabbatical Research Advisees

Sabbatical Fellows and Visiting Scholars:

Pedro Julian, Electrical and Computer Engineering, Johns Hopkins University (2003-2004, with Andreas Andreou).
   Currently at: Universidad Nacional del Sur, Bahia Blanca, Argentina (Professor).
Muhammad T. Akhtar, Institute for Neural Computation, UC San Diego (2010-2011).
   Currently at: University of Electro-Communications, Tokyo, Japan (Associate Professor).
Akinori Ueno, Department of Bioengineering, UC San Diego (2013-2014).
   Currently at: Tokyo Denki University, Tokyo, Japan (Professor).
Steven Levitan, Institute for Neural Computation, UC San Diego (2014-2015).
   Previously at: University of Pittsburgh, PA (Professor; deceased 2016).
Snorre Aunet, Institute for Neural Computation, UC San Diego (2015-2016).
   Currently at: Norwegian University of Science and Technology, Trondheim, Norway (Professor).
Seung-Tak Ryu, Department of Bioengineering, UC San Diego (2017-2018).
   Currently at: Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea (Professor).
Yasufumi Sakai, Institute for Neural Computation, UC San Diego (2017-2018).
   Currently at: Fujitsu, Toronto Canada (Research Scientist).
Seong-Jin Kim, Department of Bioengineering, UC San Diego (2022-2023).
   Currently at: Ulsan National Institute of Science and Technology, Korea (Professor).
Young-Seok Choi, Institute for Neural Computation, UC San Diego (2022-2023).
   Currently at: Kwangwoon University, Seoul, Korea (Professor).
Jung-Hoon Chun, Department of Bioengineering, UC San Diego (2023-2024).
   Currently at: Sungkyunkwan University, Seoul, Korea (Professor).
Chul Kim, Department of Bioengineering, UC San Diego (2023-2024).
   Currently at: Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea (Professor).
Hyun Jae Baek, Department of Bioengineering, UC San Diego (2024-2025).
   Currently at: Soonchunhyang University, Asan, Korea (Assistant Professor).

Postdoctoral Fellows:

Tim Horiuchi, Mind-Brain Institute, Johns Hopkins University (1997-1999, with Ernst Niebur).
   Currently at: ECE Dept., University of Maryland, College Park (Associate Professor).
Tom Sullivan, Biological Sciences, UC San Diego (2006-2007).
   Currently at: Apple, Cupertino CA.
Dimitrios Loizos, Biological Sciences, UC San Diego (2007-2008).
   Currently at: nusemi inc, San Jose CA (Senior Member of Technical Staff).
Massoud L. Khraiche, Bioengineering, UC San Diego (with Gabriel Silva, Yuhwa Lo and Deli Wang, 2009-2012).

Currently at: American University, Beirut, Lebanon (Assistant Professor).

Frederic Broccard, Institute for Neural Computation, UC San Diego (2010-2014).
    Currently at: Brain Vision Solutions (Associate Scientific Consultant).

Christoph Maier, Institute for Neural Computation, UC San Diego (2011-2016).

Emre Neftci, Institute for Neural Computation, UC San Diego (2012-2015).
    Currently at: Forschungszentrum Jülich (Institute Director) and RWTH Aachen (Full Professor).

Sadique Sheik, BioCircuits Institute, UC San Diego (2014-2018).
    Currently at: aiCorTeX (Senior R&D Engineer).

Hesham Mostafa, Institute for Neural Computation, UC San Diego (2016-2019).
    Currently at: Intel Corporation Artificial Intelligence (Research Scientist).

Bruno Pedroni, Institute for Neural Computation, UC San Diego (2018-2021).
    Currently at: Agilent (Principal Engineer).

Sheng-hsiou (Shawn) Hsu, Institute for Neural Computation, UC San Diego (2019-2020).
    Currently at: Arctop (Director of Data Science).

Yuchen Xu, Bioengineering, UC San Diego (2019-2023).
    Currently at: Aizip (Research Scientist and Business Manager).

Ph.D. Students:

Robert Timothy Edwards, Ph.D. Degree (Johns Hopkins University Electrical and Computer Engineering), June 1999.
    Thesis: Time-Frequency Acoustic Processing and Recognition: Analysis and Analog VLSI Implementations
    Currently at: efabless, San Jose CA (Senior Vice President).

Kai He, Ph.D. Degree (JHU ECE), June 2000.
    Thesis: Analog VLSI Decoding for Digital Communications and High-Performance Data Conversion
    Currently at: Octillion Communications, San Jose CA.

Marc Cohen, Ph.D. Degree (JHU ECE), June 2001.
    Thesis: Analog VLSI Adaptive Systems for Active Optics and Imaging
    Currently at: ErgonometriX, Rockville MD (CTO and co-founder).

Roman Genov, Ph.D. Degree (JHU ECE), August 2002.
    Thesis: Massively Parallel Mixed-Signal VLSI Kernel Machines
    Currently at: ECE Dept., University of Toronto, Canada (Full Professor).

Shantanu Chakrabartty, Ph.D. Degree (JHU ECE), August 2004.
    Thesis: Design and Implementation of Ultra-Low Power Pattern and Sequence Decoders
    Currently at: McKelvey School of Engineering, Washington University Saint Louis, MO
    (Clifford Murphy Endowed Chair Professor).

Milutin Stanacevic, Ph.D. Degree (JHU ECE), August 2005.
    Thesis: Mixed-Signal Micropower VLSI Systems for Biomedical Array Signal Processing
    Currently at: ECE Dept., State University of New York, Stony Brook NY (Full Professor).

Yunbin Deng, Ph.D. Degree (JHU ECE), May 2006.
    Thesis: Analog VLSI Systems for Robust Time-Frequency Processing
    Currently at: BAE Systems, Boston MA.

Dimitrios Loizos, Ph.D. Degree (JHU ECE), July 2007.
    Thesis: Multi-Dithering Sub-Microsecond Controller: Analysis and SiGe BiCMOS Implementation
    Currently at: nusemi inc, San Jose CA (Senior Member of Technical Staff).

Barry Jacobson, Ph.D. Degree, Harvard-MIT Division of Health Sciences and Technology, June 2008.
    Thesis: Instantaneous Frequency Analysis for Audio Source Separation Based on Comodulation
    Currently at: Yale School of Medicine (Postdoctoral Fellow).

Kartik Murari, Ph.D. Degree (JHU Biomedical Engineering, with Nitish Thakor), May 2010.
    Thesis: Optical Methods and Integrated Systems for Brain Imaging in Awake, Untethered Animals
    Currently at: ECE Department, University of Calgary, Canada (Associate Professor).
Mike Chi, Ph.D. Degree (UC San Diego Electrical and Computer Engineering), May 2011.
    Thesis: Non-contact Biopotential Sensing
    Currently at: Cognionics Inc., San Diego CA (CEO and co-founder).
Mohsen Mollazadeh, Ph.D. Degree (JHU Biomedical Engineering, with Nitish Thakor), Sept. 2011.
    Thesis: Integrated Neural Systems and Algorithms for Analysis of Population Activity during Dexterous Hand Movements
    Currently at: Apple, Cupertino CA.
Jonathan Driscoll, Ph.D. Degree (UCSD Physics, with David Kleinfeld), Nov. 2011.
    Thesis: Techniques in Two Photon Microscopy for Neuroscience
    Currently at: Acutus Medical Inc., San Diego CA.
Theodore Yu, Ph.D. Degree (UCSD Electrical and Computer Engineering), June 2012.
    Thesis: Biophysical Neuron and Synapse Circuits in Reconfigurable and Scalable Analog VLSI
    Currently at: Apple, Cupertino CA.
Paxon Frady, Ph.D. Degree (UCSD Neurosciences, with Bill Kristan), May 2014.
    Thesis: Scalable Mapping of Neural Activity and Circuitry Using Voltage-Sensitive Dyes Reveals Canonical Networks in the Leech
    Currently at: UCSD Division of Biological Sciences, La Jolla CA (Postdoctoral Fellow).
Omer Tal, Ph.D. Degree (UCSD Bioengineering, with Thomas Liu), May 2014.
    Thesis: Resting State Magnetoencephalography: Methods and Applications
Jongkil Park, Ph.D. Degree (UCSD Electrical and Computer Engineering), Oct. 2014.
    Thesis: Large Scale Asynchronous Low-power VLSI Systems for Event-driven Sensory and Neural Processing
    Currently at: ETRI, Korea (Research Scientist).
Chris Thomas, Ph.D. Degree (UCSD Electrical and Computer Engineering, with Larry Larson/Jim Buckwalter), May 2015.
    Thesis: Advances in N-path Filtering for Broadband Tunable and Interference Robust Reception
    Currently at: MaXentric (Senior Engineer).
Sohmyung Ha, Ph.D. Degree (UCSD Bioengineering), May 2016.
    Thesis: Silicon Integrated High-density Electrocortical Interfaces
    Currently at: New York University, Abu Dhabi, UAE (Associate Professor).
Espoir Kyubwa, combined M.D.-Ph.D. Degree (Bioengineering, with Ed Callaway, Salk Institute), Ph.D. May 2016.
    Thesis: Optogenetic Dissection of Cell Types and Circuits in Mouse Visual Cortex
Siddharth Joshi, Ph.D. Degree (UCSD Electrical and Computer Engineering), March 2017.
    Thesis: High-Fidelity Spatial Signal Processing in Low-Power Mixed-Signal VLSI Arrays
    Currently at: University of Notre Dame, Notre Dame IN (Assistant Professor).
Chul Kim, Ph.D. Degree (UCSD Bioengineering), Oct. 2017.
    Thesis: Energy-Efficient Integrated Biomedical Circuits and Systems for Unobtrusive Neural Recording and Wireless Body-Area Networks
    Currently at: Department of Bioengineering, KAIST, Korea (Associate Professor).
Chun-Shu Wei, Ph.D. Degree (UCSD Bioengineering, with Tzyy-Ping Jung), Oct. 2017.
    Thesis: Towards Brain Decoding for Real-World Drowsiness Detection
    Currently at: Department of Neurosciences, Stanford University (Postdoctoral Fellow).
Cory Stevenson, Ph.D. Degree (UCSD Bioengineering), Dec. 2017.
    Thesis: Investigating Human Movement and Vision in 3-Dimensional Space
    Currently at: National Chiao Tung University, Taiwan (Postdoctoral Scholar).

Sheng-Hsiou (Shawn) Hsu, Ph.D. Degree (UCSD Bioengineering, with Tzyy-Ping Jung), Jan. 2018.
Thesis: Tracking the Dynamic Brain: Modeling Nonstationarity in Human Electroencephalography
Currently at: Google X (Research Scientist).

Mieko Hirabayashi, Ph.D. Degree (UCSD-SDSU Joint Doctoral Program in Bioengineering, with Sam Kassegne), Apr. 2018.
Thesis: Glassy Carbon Neural Probes for Cortical and Spinal Electrochemical and Electrophysiological Sensing and Stimulation
Currently at: Invoy, Aliso Viejo CA (Senior Engineer and Clinical Analyst).

Bruno Pedroni, Ph.D. Degree (UCSD Bioengineering), Febr. 2019.
Thesis: Boltzmann Energetics and Temporal Dynamics of Learning Neuromorphic Systems
Currently at: UC San Diego (Postdoctoral Fellow).

Alessio Paolo Buccino, Ph.D. Degree (University of Oslo-Simula-UCSD joint SUURPh program, with Philip Häfliger), Jan. 2019.
Thesis: A Computationally-Assisted Approach to Extracellular Neural Electrophysiology with Multi-Electrode Arrays
Currently at: ETH Zurich, Switzerland (Postdoctoral Fellow).

Jun Wang, Ph.D. Degree (UCSD Bioengineering), Dec. 2019.
Thesis: Silicon Integrated Neuromorphic Neural Interfaces
Currently at: Harvard University (Postdoctoral Fellow).

Samir Damle, Ph.D. Degree (UCSD Bioengineering, with Yu-Hwa Lo and Todd Coleman), March 2020.
Thesis: Design of a High Density Optoelectronic Retinal Neural Interface
Currently at: UC San Diego (Postdoctoral Fellow).

Rajkumar Chinnakonda Kubendran, Ph.D. Degree (UCSD Electrical and Computer Engineering), June 2020.
Thesis: Energy-Efficient Event-Based Vision Sensors and Compute-in-Memory Architectures for Neuro-morphic and Machine Learning Applications
Currently at: University of Pittsburgh, PA (Assistant Professor).

Vishwajith Ramesh, Ph.D. Degree (UCSD Bioengineering, with Nadir Weibel), June 2020.
Thesis: Human-Centered Machine Learning in Healthcare: Examples in Neurology and Pulmonology
Currently at: UC San Diego (Postdoctoral Fellow).

Abraham Akinin, Ph.D. Degree (UCSD Bioengineering), June 2020.
Thesis: Energy-Efficient Integrated Neural Interfaces for Retinal Prostheses
Currently at: Lawrence Livermore National Laboratory (Postdoctoral Fellow).

Weier Wan, Ph.D. Degree (Stanford Electrical Engineering, with Philip Wong and Priyanka Raina), October 2021.
Thesis: Fully-Integrated RRAM Compute-in-Memory Hardware for Efficient and Versatile Edge Intelligence
Currently at: Aizip (Co-founder and Processing-in-Memory Lead).

Shukai Chen, Ph.D. Degree (UCSD Bioengineering, with Timothy Gentner), August 2022.
Thesis: From Production to Perception: Computational and Behavioral Characterization of Songbird Vocalizations
Currently at: Nuvasive (Technical Staff).

Chi-Yuan Chang, Ph.D. Degree (UCSD Bioengineering, with Tzyy-Ping Jung), December 2022.
Thesis: Brain-computer Interfaces for Online Mental Stress Monitoring in the Real World
Currently at: NCTU (Postdoctoral Fellow).

Akshay Paul, Ph.D. Degree (UCSD Bioengineering), June 2023.
Thesis: Biosensing In-Ear Systems: Expanding Opportunities for Mobile Health Monitoring and Brain-Computer Interfaces
Currently at: NextSense (Sr Staff Engineer).

Margot Wagner, candidate for Ph.D. Degree (UCSD Bioengineering, with Terrence Sejnowski), August 2023.

Thesis: Multiscale Spatiotemporal Probabilistic Graph Models for Neuropsychiatry Applications: Scaling Theoretical Frameworks to Data-Driven Diagnostics from Molecules to Minds

Currently at: UCSD (Postdoctoral Fellow).

Pablo Marcos Tostado, Ph.D. Degree (UCSD Bioengineering, with Vikash Gilja and Timothy Gentner), November 2023.

Thesis: A Songbird Model for Vocal Prostheses: Multi-Region Neural Population Dynamics of Vocal Production

Currently at: UCSD (Postdoctoral Fellow).

Samir Saidi, candidate for Ph.D. Degree (UCSD Bioengineering, with Matthew Shtrahman).

Soumil Jain, candidate for Ph.D. Degree (UCSD Bioengineering, with Terrence Sejnowski).

Jiajia Wu, candidate for Ph.D. Degree (UCSD Electrical and Computer Engineering, with Patrick Mercier).

Preston Fowler, candidate for Ph.D. Degree (UCSD Bioengineering).

Ivan Vikram Rajen, candidate for Ph.D. Degree (UCSD Bioengineering, with Terrence Sejnowski).

Samantha Russman, candidate for Ph.D. Degree (UCSD Bioengineering, with Shadi Dayeh).

Gopabandhu Hota, candidate for Ph.D. Degree (UCSD Electrical and Computer Engineering, with Duygu Kuzum).

Julia Gorman, candidate for Ph.D. Degree (UCSD Neurosciences, with Cory Miller).

Gwenevere Frank, candidate for Ph.D. Degree (UCSD Electrical and Computer Engineering).

Omowuyi Olajide, candidate for Ph.D. Degree (UCSD Bioengineering).

Samira Sebt, candidate for Ph.D. Degree (UCSD Bioengineering).

Abhinav Uppal, candidate for Ph.D. Degree (UCSD Bioengineering).

Min Suk Lee, candidate for Ph.D. Degree (UCSD Bioengineering).

Jeonghoon Kim, candidate for Ph.D. Degree (UCSD Bioengineering, with Duygu Kuzum).

Devansh Agarwal, candidate for Ph.D. Degree (UCSD Bioengineering, with Karl Wahlin).

Shivani Shukla, candidate for Ph.D. Degree (UCSD Bioengineering, with Zeinab Jahed).

Will Sharpless, candidate for Ph.D. Degree (UCSD Bioengineering, with Sylvia Herbert).

Tyler Bodily, candidate for Ph.D. Degree (UCSD Bioengineering, with Ratnesh Lal).

Adyant Balaji, candidate for Ph.D. Degree (UCSD Bioengineering).

Shashank Bansal, candidate for Ph.D. Degree (UCSD Bioengineering).

Zhaoyi (Louis) Liu, candidate for Ph.D. Degree (UCSD Electrical and Computer Engineering).

Chun-Ju Chou, candidate for Ph.D. Degree (UCSD Bioengineering, with Chi-Hua Chen).

Omeed Djassemi, candidate for Ph.D. Degree (UCSD Bioengineering, with Joseph Wang).

Adrián Miguel Llop Recha, candidate for Ph.D. Degree (University of Oslo-Simula-UCSD joint SUURPh program, with Dag Wisland).

Master's Students:

Andrew Arluk, M.S.E. Degree (Electrical and Computer Engineering, Johns Hopkins University), Spring 1995.

James Waskiewicz, M.S.E. Degree (ECE, JHU), Fall 1997.

Srinadh Madhavapeddi, M.S.E. Degree (ECE, JHU), Fall 1998.

Rajagopalan Rangarajan, M.S.E. Degree (Biomedical Engineering, JHU, with Nitish Thakor), Fall 1999.

Jeremy Lubkin, M.S.E. Degree (ECE, JHU), Spring 1999.

Grant Mulliken, M.S.E. Degree (BME, JHU, with Nitish Thakor), Summer 2002.

Adam Sutker, M.S.E. Degree (ECE, JHU), Fall 2003.

Christian Sauer, M.S.E. Degree (BME, JHU, with Nitish Thakor), Spring 2005.

Adeel Abbas, M.S.E. Degree (ECE, JHU), Spring 2005.

Abdullah Celik, M.S.E. Degree (ECE, JHU), Spring 2005.

Andrew Heiberg, M.S. Degree (CSE, UCSD), Spring 2013.

Clement Lee, M.S. Degree (Bioengineering, UCSD, with Scott Makeig), Spring 2016.

Hristos Courellis, M.S. Degree (Bioengineering, UCSD), Spring 2018.
Akshay Paul, M.S. Degree (Bioengineering, UCSD), Fall 2018.
Michael Wiest, M.S. Degree (Bioengineering, UCSD), Spring 2019.
Alice Yepremyan, M.S. Degree (Bioengineering, UCSD), Summer 2019.
Preston Fowler, M.S. Degree (Bioengineering, UCSD), Winter 2023.
Jonathan Somayajulu, M.S. Degree (Bioengineering, UCSD), Fall 2023.

External Thesis Committees:

Constantine Papageorgiou, Ph.D., Massachusetts Institute of Technology, 1999 (advisor: Tomaso Poggio).
Jerry Huang, MSE, University of Sydney, Australia, 1999 (advisor: Marwan Jabri).
Matthew Partridge, Ph.D., University of Sydney, Australia, 2000 (advisor: Marwan Jabri).
Bahram Zand, Ph.D., University of Toronto, Canada, 2001 (advisor: David Johns).
Ricardo A. Carmona Galán, Ph.D., University of Sevilla, Spain, 2002 (advisor: Angel Rodriguez-Vazquez).
Wenjie Hu, Ph.D., Nanyang Technological University, Singapore, 2002 (advisor: Qing Song).
Kwong Kin Tommy Tsang, MSE, McGill University, Montreal Canada, 2002 (advisor: Mourad El-Gamal).
Peter Stepien, Ph.D., University of Sydney, Australia, 2004 (advisor: Richard Coggins).
Vu Cao, Ph.D. Degree, University of Oslo, Norway, 2012 (advisors: Dag Wisland and Tor Sverre Lande).
Sudip Nag, Ph.D. Degree, IIT Bombay, India, 2014 (advisors: Dinesh Sharma and V. Ramgopal Rao).
Hesham Mostafa, Ph.D., University of Zurich, Switzerland, 2016 (advisor: Giacomo Indiveri).
Hamid Soleimani, Ph.D. Degree, Imperial College London, UK, 2019 (advisor: Emmanuel Drakakis).
Luka Ribar, Ph.D. Degree, Cambridge University, UK, 2020 (advisor: Rodolphe Sepulchre).
Chang Gao, Ph.D. Degree, University of Zurich, Switzerland, 2021 (advisor: Shih-Chii Liu).
Kumudu Geethan Karunaratne, Ph.D. Degree, ETH Zurich, Switzerland, 2023 (advisor: Luca Benini).

Teaching

UC San Diego:

"Neuromorphic Integrated Bioelectronics," BENG 207 (2021), BENG 216 (2023-present).
"Biosystems and Control," BENG 122A (2020-present).
"Principles of Bioinstrumentation Design," BENG 186B (2010-present).
"Design Development/Implementation in Bioinstrumentation/Neural Engineering/Molecular Systems," BENG 179A-B, 147A-B, 127A-B (2010-present).
"Mathematical Methods in Bioengineering," BENG 221 (2009-2018).
"Neural Prostheses," BISP 194 (2008, 2009).
"Neurodynamics," BENG 260/BGGN 260/PHYS 279 (2006-present).

Johns Hopkins University:

"Integrated Electronics," 520.325/326 (1995, 1997, 1999-2002).
"Electronics Design Laboratory," 520.348 (1996, 1998).
"Analog and Digital VLSI Systems and Architecture," 520.490 (1994-97, 1999-2003).
"Mixed-Signal VLSI Systems," 520.492 (2005).
"VLSI Design and Prototyping Workshop," 520.496-497 (2004-05).
"Senior Design Project," 520.498-499 (2000-05).
"Medical Microsystems," 520/580.725 (2004).
"Advanced Integrated Circuits," 520.771-772 (1996, 1997).
"Seminar on Large-Scale Analog Computation," 520.761 (1997, 1998).

"Kernel Machine Learning," 520/600.774 (2001, 2003).
"Learning on Silicon," 520.776 (2002, 2004).

Massachusetts Institute of Technology:

"Computational Laboratory in Cognitive and Brain Science," 9.39/390 (1999).

Invited Presentations

"Event-Driven Sensory Analog Processing and Massively Parallel Mixed-Signal In-Memory Computing for Distributed Adaptive Intelligence at the Edge," *Forum on Intelligent Sensing*, IEEE Int. Solid-State Circuits Conf. (ISSCC'2024), Febr. 22, 2024.

"Towards Extreme Efficiency and Resilience in Large-Scale Reconfigurable Neuromorphic Computing," *Workshop on Next Generation Processing in Extreme Environments*, Army Research Laboratory, Adelphi MD, Dec. 15, 2023.

"In-Ear Electrophysiological Health Monitoring," Google, San Diego CA, Dec. 7, 2023.

" 'Earables' for Unobtrusive Brain-Body Health Monitoring and Auditory Neuromodulation," *Day of Learning*, Microsoft Research, Redding WA, Oct. 27, 2023

"Efficiency, Resilience, and Versatility in Memristive Neuromorphic Systems for AI on the Edge," Keynote, *IEEE 15th Int. Conf. ASIC (ASICON'2023)*, Nanjing, China, Oct. 25, 2023.

"Stochastic Modulation and Resonant Adiabatic Energy Recycling in Compute-in-Memory Arrays for Highly Efficient AI on the Edge," *University Research Symposium,* Northrop Grumman Corporation, Linthicum, MD, Oct. 2, 2023.

"Unobtrusive In-Ear Electrophysiology for Integrative Brain-Body Health and Wellness," *Neural Engineering Seminar Series,* Carnegie Mellon University, Sept. 26, 2023.

"Thermodynamic Limits of Low-Energy Neuromorphic Computing," Keynote, *IEEE 2023 Int. Symp. Roadmapping Devices and Systems (ISRDS)*, May 4, 2023.

"Versatility, Efficiency, and Resilience in Large-Scale Neuromorphic Intelligence at the Edge," Keynote, *2023 Neuro-Inspired Computing Elements (NICE 2023)*, San Antonio TX, April 16, 2023.

"Ultra-Low Power Integrated Silicon and Memristive Neuromorphic Microelectronics for Engineered Natural Intelligence at the Edge," *AI-Enhanced Co-Design for Next Generation Microelectronics (AICOM)*, Sandia National Laboratory, April 4, 2023.

"Neuromorphic Accelerators and Silicon Models of Neural Circuit," *Functional Logic of Neural Circuits: Diamonds in the Rough*, NSF Workshop Phase III, San Juan, Puerto Rico, Febr. 23, 2023.

"Thermodynamic Limits of Low-Energy Neuromorphic Computing," *IEEE Int. Conf. Rebooting Computing (ICRC'2022)*, San Francisco CA, Dec. 8, 2022.

"Efficiency and Resilience in Large-Scale Neuromorphic Intelligence at the Edge," *COINFLIPS Seminar,* Sandia National Laboratories, Nov. 8, 2022.

"Towards 'Greener' AI on the Edge: Energy-Efficient Neuromorphic Learning and Inference," *TinyML Forum on Neuromorphic Engineering,* Sept. 27, 2022.

"Efficient and Versatile Neuromorphic Computing in Resistive Random-Access Memory," Google, San Diego CA, Sept. 2, 2022.

"Neuromorphic Technology Soul-Searching," *Forum on Future Directions for Neuromorphic Engineering*, 2022 Telluride Neuromorphic Cognition Engineering Workshop, Telluride CO, July 2, 2022.

"Energy-Efficient Neuromorphic Computing-in-Memory," *Next Generation Computing - Neuromorphic, In-memory, Quantum and Photonics Forum*, IEEE Custom-Integrated Circuits Conf. (CICC'2022), April 26,

2022.

"High-Density Integrated Silicon Neural Interfaces," Keynote Lecture, *7th Advanced Technology Workshop on Advanced Packaging for Medical Microelectronics,* San Diego CA, March 31, 2022.

"Towards Extreme Energy Efficiency in Neuromorphic Computing at Scale," *CSL Seminar*, Yale University, March 18, 2022.

"Efficiency and Robustness in Large-Scale Neuromorphic Computing," *Workshop on Robustness and Safe Software 2.0 (RSS2)*, ACM ASPLOS'2022, Febr. 28, 2022.

"A Case for Neural Diversity from a Neuromorphic Systems Perspective," *Functional Logic of Neural Circuits: Diamonds in the Rough*, NSF Workshop Phase II, San Juan, Puerto Rico, Febr. 23, 2022.

"Towards Extreme Energy Efficiency in Large-Scale Neuromorphic Systems for 'Greener' Cognitive Computing," *NEUROTECH Educational Tutorial Series*, Institute of Neuroinformatics, ETH Zurich, Febr. 17, 2022.

"Energy Efficient Computing and Communication," *Northrop Grumman University Research Symposium*, Oct. 21, 2021.

"Silicon Integrated Circuits and Systems for Neuromorphic Intelligence," Keynote Lecture, *International Symposium on Integrated Circuits and Systems (ISICAS 2021)*, Singapore, Sept. 2, 2021.

"Large-Scale Integrated Compute-in-Memory Arrays for Reconfigurable Neuromorphic Learning and Inference," Seminar, Xilinx Corporation, July 22, 2021.

"High-Efficiency Integrated Bioelectronics for Unobtrusive Electrophysiology and Neuromodulation," *Electrical Engineering-Biomedical Seminar Series*, KAIST, Korea, July 14, 2021.

"High-density Integrated Neural Interfaces," *Neural Engineering VIII: Artificial Retina*, Society for Brain Mapping and Therapeutics (SBMT) Neuroengineering Conf. 2021, Los Angeles CA, July 9, 2021.

"Unobtrusive In-Ear Electrophysiology," *Neural Engineering I: Addressing Challenges in Cochlear Implants*, Society for Brain Mapping and Therapeutics (SBMT) Neuroengineering Conf. 2021, Los Angeles CA, July 11, 2021.

"Large-Scale Integrated Compute-in-Memory Arrays for Reconfigurable Neuromorphic Learning and Inference," *Functional Logic of Neural Circuits: Diamonds in the Rough*, NSF Workshop Phase I, June 11, 2021.

"High-Density Integrated Silicon Neural Interfaces," *IEEE SSCS Beijing Chapter Seminar*, Beijing, China, June 9, 2021.

"Scaling of Efficiency and Resilience in Neuromorphic Compute-in-Memory Architectures," *New Directions in Computing*, 2021 International Symposium on Roadmapping Devices and Systems (ISRDS'2021), May 27, 2021.

"Towards Efficient Neuromorphic Learning and Inference at Scale," *CogniGron Seminar*, University of Groningen, Netherlands, Jan. 13, 2021.

"An Optically-Addressed Nanowire-Based Retinal Prosthesis," *Engineering in Ophthalmology Workshop*, Univ. Michigan, Dec. 16, 2020.

"Towards Efficient Neuromorphic Learning and Inference at Scale," *ONR MURI Winter School on Sleep, Memory, and Learning*, La Jolla CA, Dec. 14, 2020.

"Towards Efficient Neuromorphic Learning and Inference at Scale," *NSF Workshop on Machine Learning Hardware*, Univ. Washington St Louis, Nov. 11, 2020.

"Neuromorphic Silicon Neural Interfaces," IEEE Brain Special Session, *Magnetism and Magnetic Materials Virtual Conf. (MMM'2020)*, Nov. 4, 2020.

"VLSI Circuits and Systems for Neuromorphic Learning and Inference," VLSI Summer School, IIT Kharagpur, India, August 14, 2020.

"Towards Efficient Neuromorphic Learning and Inference at Scale," Keynote Lecture, *International Conference on*

Neuromorphic Systems (ICONS'2020), Oak Ridge National Laboratory, July 29, 2020.

"Towards Efficient Neuromorphic Learning and Inference at Scale," *DAC 2020 Workshop on Neuromorphic Computing: Opportunities, Challenges, and Perspectives*, July 19, 2020.

"Complexity, Efficiency, and Resilience in Large-Scale Neuromorphic Computing," Keynote Lecture, *2020 Workshop on Navy Applications of Machine Learning (NAML'2020)*, Naval Information Warfare Center Pacific, San Diego CA, Feb. 24, 2020.

"High-Density Neural Interfaces for Pervasive Human-Machine Interaction," *Semiconductor Research Corporation Decadal Plan for Semiconductors Workshop on New Trajectories for Analog Electronics*, IBM Almaden CA, Dec. 12-13, 2019.

"Neuromorphic Computing on the Edge: Micropower Event-Driven Learning Machines," *2019 Industry-University Workshop on Sensors and Machine Learning (SensMACH-2019)*, SEMI MSEC 2019, Coronado CA, Oct. 22, 2019.

"Memory-Efficient Neuromorphic Learning and Inference," *2019 Telluride Neuromorphic Cognition Workshop*, Telluride CO, July 10, 2019.

"Memory-Efficient Neuromorphic Learning and Inference," *Joint Symposium on Neural Computation (JSNC'2019)*, University of Southern California, Los Angeles CA, June 1, 2019.

"Memory-Efficient Neuromorphic Learning and Inference," Forum on Alternative Computing Models using Analog/MS Computational Substrates, *IEEE Custom Integrated Circuits Conf. (CICC'2019)*, Austin TX, Apr. 17, 2019.

"Neuromorphic Silicon Learning Machines," Colloquium, Naval Research Laboratory, Washington DC, April 1, 2019.

"Silicon Integrated High-Density Neural Interfaces," Lawrence Livermore National Laboratory, Livermore CA, Febr. 25, 2019.

"Memory-Efficient Neuromorphic Learning and Inference," 2018 Workshop on Hardware and Algorithms for Learning On-a-chip (HALO), *IEEE Int. Conf. Computer Aided Design (ICCAD'2018)*, San Diego CA, Nov. 8, 2018.

"Energy Efficient Neuromorphic Learning and Inference at Nanoscale," IEEE CEDA Distinguished Speaker Luncheon at *2018 IEEE/ACM Design Automation Conference (DAC 2018)*, San Francisco CA, June 26, 2018.

"Complexity and Efficiency in Large-Scale Neuromorphic Computing," 2017 Workshop on Hardware and Algorithms for Learning On-a-chip (HALO), *IEEE Int. Conf. Computer Aided Design (ICCAD'2017)*, Irvine CA, Nov. 16, 2017.

"Scalable Silicon Neuromorphic Learning Machines with Hierarchical Reconfigurable Synaptic Connectivity and Plasticity," 2017 Workshop on Non-conventional Approaches to Hard Optimization (NAHO), *IEEE Int. Conf. Computer Aided Design (ICCAD'2017)*, Irvine CA, Nov. 16, 2017.

"Neuromorphic Event-Driven Multi-Scale Synaptic Connectivity and Plasticity," Special Session on Asynchronous and Neural Computation, *2017 Asilomar Conference on Signals, Systems, and Computers*, Pacific Grove CA, Oct. 29 - Nov. 1, 2017.

"Energy Efficient Neuromorphic Learning and Inference at Nanoscale," ARL/UCSD Workshop on Neuro-Inspired Computing using Nanoelectronic Devices, UCSD Qualcomm Institute, La Jolla CA, Oct. 25, 2017.

"Energy Efficiency in Adaptive Neural Circuits," 5th Berkeley Symposium on E3S and Steep Transistors, Berkeley CA, Oct. 20, 2017.

"Neuromorphic Silicon Learning Machines," VLSI Summer School, IIT Kharagpur, India, June 22, 2017.

"Unobtrusive Brain-Machine Interfaces," Brain Health Panel, *Bio. Int. Conv. (BIO'2017)*, San Diego CA, June 20, 2017.

"Advances in Multiscale Integrated Neural Interfaces," Keynote, Annual Retreat, IGERT Neuroengineering Training Program, University of Minnesota, Bakken Museum, Minneapolis MN, May 16, 2017.

"Neuromorphic Silicon Learning Machines," NSCI Seminar, NIST, Boulder CO, April 11, 2017.

"Advances in Silicon Integrated High-Density Neural Interfaces," Global Healthcare Forum, Harvard University, Cambridge MA, March 25-26, 2017.

"Neuromorphic Silicon Learning Machines," Qualcomm QRC, San Diego CA, Jan. 27, 2017.

"Reverse Engineering the Cognitive Brain in Silicon," *ONR MURI Winter School and Workshop on Dynamics of Multifunction Brain Networks*, UC San Diego, La Jolla CA, Jan. 13, 2017.

"Reverse Engineering the Cognitive Brain in Silicon," *Frontier Tech Forum: RoboUniverse*, San Diego, Dec. 14, 2016.

"Advances in Unobtrusive Brain-Machine-Body Interfaces," Fujitsu Laboratories of America, Sunnyvale CA, Dec. 5, 2016.

"Silicon Integrated High-Density Neural Interfaces," *International IEEE EMBS Workshop on Advanced NeuroTechnologies for BRAIN Initiatives (ANTBI)*, Nov. 10-11, San Diego, 2016.

"Towards High-Resolution Retinal Neural Interfaces," UCSD-UST Bilateral Symposium, San Diego CA, Nov. 18, 2016.

"Mixed-Signal Arrays for Neuromorphic Cognitive Computing," *IRDS NanoCrossbar Workshop*, Sandia National Laboratories, Albuquerque NM, July 15, 2016.

"Reverse Engineering the Cognitive Brain in Silicon," VLSI Summer School, IIT Kharagpur, India, May 27, 2016.

"High-Density Integrated Neural Interfaces," Dept. of Bioengineering, Texas A&M University, College Station TX, April 13, 2016.

"Reverse Engineering the Cognitive Brain in Silicon," *2016 Neuro-Inspired Computational Elements Workshop (NICE)*, Berkeley CA, March 9, 2016.

"Harnessing Energy in Single-Chip Biomedical Implants," *MedTechWorld MD&M West*, Anaheim CA, Feb. 9, 2016.

"Neuromorphic Silicon Learning Machines," *ICCAD HALO Workshop*, Austin TX, Nov. 5, 2015.

"Neuromorphic Silicon Learning Machines," Department of Electrical Engineering, University of Southern California, Los Angeles CA, Oct. 16, 2015.

"Silicon Integrated High-Density Neural Interfaces," *SD BRAIN Symposium*, Sanford Consortium, San Diego CA, Sept. 19, 2015.

"Large-scale silicon models of cortical sensorimotor systems," Sandia, Albuquerque, NM, August 4, 2015

"Neuromorphic Silicon Learning Machines," *Stanford SystemX Alliance Headlights Workshop*, Palo Alto CA, April 22, 2015.

"Neuromorphic Silicon Learning Machines," Department of Electrical Engineering, UCLA, Los Angeles CA, April 20, 2015.

"Neuromorphic Silicon Learning Machines," Intel Corporation, Beaverton OR, March 6, 2015.

"Boltzmann Energetics of Neuromorphic Systems," *2014 IEEE S3S Conference*, San Francisco CA, Oct. 7, 2014.

"Advances in Unobtrusive Brain-Machine-Body Interfaces," *Sensors Showcase 2014,* UCSD Extension, San Diego CA, Sept. 18, 2014.

"Reverse Engineering the Cognitive Brain in Silicon," *Int. IEEE EMBS Workshop on Advanced NeuroTechnologies for BRAIN Initiatives (ANTBI)*, Chicago IL, Aug. 26, 2014.

"Wireless and Unobtrusive Brain-Machine Interfaces," *Frontiers of Neurotechnology: Innovations and Translation,* International Neurotechnology Consortium Workshop, Chicago IL, Aug. 26, 2014.

"Efficiency and Specificity in Event Coding for Sensory Analog Signal Processing," *Silicon Valley Labs NVSEL Seminar,* Texas Instruments Kilby Labs, Santa Clara, CA, June 10, 2014.

"Biological and Silicon Adaptive Neural Systems," *ONR MURI Winter School on Neuromorphic Engineering: Dynamics of Multifunction Brain Networks*, San Diego CA, Jan. 7, 2014.

"Brain Dynamics of Human Motor Control: Neuromorphic Modeling and Brain-Machine-Body Interfaces," *Symposium on Neural Informatics and Modeling,* IEEE Neural Engineering Conference (NER'2013), San Diego CA, Nov. 6, 2013.

"Nanoscale Integrated Neuromorphic Systems Engineering," *DARPA/MTO Hardware Aspects of the Cortical Processor Workshop*, San Francisco CA, Sept. 18, 2013.

"Event-driven Sensory Adaptive Analog Processing," *Silicon Valley Labs NVSEL Seminar,* Texas Instruments, Santa Clara, CA, March 26, 2013.

"Wireless Integrated Brain-Machine-Body Interfaces," *San Diego IEEE MTT/AP/ED/SSC/CAS Chapter Lecture*, San Diego CA, Oct. 31, 2012.

"Event-Driven Neural Synchrony and Coincidence Detection," *Computational Neuroscience Minisymposium*, Workshop on Neuromorphic Cognitive Engineering, Telluride CO, July 9, 2012.

"Wireless Integrated Brain-Machine Interfaces," *IEEE EMBS Chapter Lecture*, Cal Lutheran Univ., Thousand Oaks CA, March 21, 2012.

"Analog VLSI Adaptive Neural Systems," *Silicon Valley Labs NVSEL Seminar,* Texas Instruments, Santa Clara, CA, March 5, 2012.

"To spike or not to spike: a neuromorphic perspective," *Computational Neuroscience Minisymposium*, Workshop on Neuromorphic Cognitive Engineering, Telluride CO, July 6, 2011.

"Large-Scale Silicon Models of Cortical Sensorimotor Systems," *NSF ERC in Sensorimotor Neural Engineering Seminar,* San Diego State University, San Diego CA, Febr. 6, 2011.

"Wireless Integrated Brain Interfaces," *NYMU-UCSD Brain and Neuroscience Symposium,* UCSD, La Jolla CA, Dec. 9, 2010.

"Silicon Integrated Brain Interfaces," *Texas Analog Center of Excellence (TxACE) Seminar*, UT Dallas, and Texas Instruments, Houston TX, Dec. 7, 2010.

"Silicon and Biological Adaptive Neural Circuits," *BME Department Seminar Series*, University of Southern California, Los Angeles CA, Oct. 11, 2010.

"Silicon and Biological Adaptive Neural Circuits," *JPL Seminar*, Caltech/NASA Jet Propulsion Laboratory, La Cañada CA, July 28, 2010.

"Humans, Machines, Spikes, and Dopamine in Sequential Games," *Computational Neuroscience Minisymposium*, Workshop on Neuromorphic Cognitive Engineering, Telluride CO, July 5, 2010.

"Wireless Brain Interfaces," *Beyond Brain Machine Interface Workshop*, Neural Interfaces Conference, Long Beach CA, June 20, 2010.

"Silicon and Biological Adaptive Neural Circuits," Plenary talk, *US-Europe Workshop on Reverse Engineering of the Human Brain* (European Science Foundation, National Science Foundation, and Air Force Office of Scientific Research), Dubrovnik, Croatia, May 24, 2010.

"Reverse Engineering the Visual System in Neuromorphic Silicon," *Neurosciences Seminar*, University of California Riverside, Apr. 27, 2010.

"Auditory Neuroengineering for Intelligent Hearing Aids," *TATRC Acoustic Trauma Workshop*, Del Mar CA, Febr. 10, 2010.

"Neuromorphic Adaptive Microsystems for Visual Reconnaissance," *Bio-Inspired Computing Seminar*, Air Force Research Laboratory, Wright-Patterson OH, Feb. 2, 2010.

"Highly Efficient Adaptive Neuromorphic Vision Systems," *DARPA NeoVision 2 Workshop*, La Jolla CA, April 8, 2009.

"Neuromorphic Cognitive Engineering: Large-Scale Silicon Neural Systems," *4th Decade of the Mind Conf.*, Albuquerque NM, Jan. 15, 2009.

"Biopotential Sensing and Analog Signal Processing for Health Monitoring and Brain Interfaces," *NSVL Distinguished Faculty Seminar,* National Semiconductor Corporation, Santa Clara CA, Aug. 28, 2008.

"Scalable Neuromorphic Spike-Based Learning Systems," *Woods Hole Workshop on Computational Neuroscience*, and *Workshop on Neuromorphic Cognitive Engineering*, Telluride CO, July 7, 2008.

"Scalable Neuromorphic Cortical Systems," *Joint Symposium on Neural Computation*, Irvine CA, May 2008.

"Design and Calibration of EEG Electrode Arrays for Wearable BCI," *VLSI Test Symposium (VTS)*, Hot Topic: Biomedical Devices - New Test Challenges, San Diego CA, April 30, 2008.

"Reconfigurable and Adaptive Mixed-Signal Microsystems," *DARPA/DSRC eStemCells workshop*, Stanford University, Stanford CA, March 28, 2008.

"Silicon Learning Machines," *IEEE Computational Intelligence Society Seminar*, Lockheed Martin, San Diego CA, Dec. 12, 2007.

"Scalable Adaptive Neuromorphic Systems," *DARPA Electronic Cortex Workshop*, Arlington VA, August 1, 2007.

"Adaptive Electronics– A Neuromorphic Perspective," *DSRC/DARPA 2007 Adaptive Electronics 2020*, Santa Cruz CA, July 18, 2007.

"Kernel Learning Machines," *Artificial Intelligence Seminar*, UC San Diego, Apr. 9, 2007.

"Analog VLSI Auditory Separation and Localization," *Computation and Neural Systems Seminar*, California Institute of Technology, March 19, 2007.

"Micropower Adaptive Vector Processing in Analog VLSI," *DARPA Chip-Scale Avionics Workshop*, Orlando FL, Feb. 20, 2007.

"Silicon and Neural Adaptive VLSI Microsystems," *Defense Science and Research Council Workshop*, Arlington VA, Nov. 28, 2006.

"Auditory Separation and Localization in aVLSI," *Institute of Neuroscience Seminar, University of Oregon*, Eugene OR, Sept. 28, 2006.

"aVLSI Auditory Separation and Localization," *Joint Symposium on Neural Computation*, La Jolla CA, May 20, 2006.

"Measuring Human Responses," *Neuroscience and Health Care Architecture Workshop,* Woodshole MA, Aug. 16, 2005.

"Microscale Integrated Acoustic Source Separation and Localization," *CISL Seminar Series,* Columbia University, New York, Oct. 15, 2004.

"Micropower Adaptive VLSI Systems for Acoustic Source Separation," *Fourth McMaster-Gennum Workshop on Intelligent Hearing Instruments*, Kimberley, ON, Sept. 15, 2003.

"Kernel Machines for Pattern Classification and Sequence Decoding," *Center for Language and Speech Processing Seminar Series,* Johns Hopkins University, Febr. 11, 2003.

"Gradient Flow Adaptive Beamforming and Signal Separation," *Third McMaster-Gennum Workshop on Intelligent Hearing Instruments*, Kimberley, ON, Oct. 1, 2002.

"Low-Power Mixed-Signal VLSI Array for Template-Based Pattern Recognition," *Spring Meeting of the Baltimore Chapter of the IEEE Electron Devices and Solid-State Circuits Societies,* Linthicum MD, May 20, 2002.

"Low-Power Analog VLSI Array Processors for Pattern Recognition," *IEEE SSCS Workshop on Low-Power Circuits,* Arlington VA, Oct. 11, 2001.

"Gradient Flow Sub-Wavelength Beamforming and Independent Component Analysis," *Second McMaster-*

Gennum Workshop on Intelligent Hearing Instruments, Niagara-on-the-Lake, ON, Oct. 1, 2001.

"Kernel Learning Machines," RTDC seminar, Applied Physics Laboratory, Laurel MD, Sept. 18, 2001.

"Vapnik, Bayes, and Silicon," lecture at *2001 NSF Workshop on Neuromorphic Engineering,* Telluride CO, July 14, 2001.

"Analog VLSI Adaptive Systems for Vision and Imaging," seminar, Hungarian Academy of Science, Budapest, Hungary, June 7, 2001.

"Kernel 'Machine' Learning," lecture at *2000 NSF Workshop on Neuromorphic Engineering,* Telluride CO, July 8, 2000.

"Monaural Separation of Acoustical Independent Components," and "Single-Mixture Blind Source Separation," NIPS*99 workshop, Breckenridge CO, Dec. 2-4, 1999.

"Adaptive Neuromorphic VLSI and Auditory Signal Processing," DARPA Resonant Biomimicry Sensor Workshop, Houston TX, Jan. 14, 1999.

"Analog VLSI Neuromorphic Engineering: Silicon Models of Vision and Cognition," CAS/CNS Colloquium Series, Boston University, Sept. 11, 1998.

"Analog VLSI Neuromorphic Systems," British Telecom International Workshop on Robot Cognition, Lavenham, UK, April 24, 1998.

"Large-Scale Neuromorphic Learning Systems," Seminar, Center for Biological and Computational Learning, Department of Brain and Cognitive Science, Massachusetts Institute of Technology, Febr. 4, 1998.

"VLSI Cellular Array of Coupled Delta-Sigma Modulators for Random Analog Vector Generation," *31st Asilomar Conf. on Signals, Systems and Computers,* Asilomar CA, Nov. 2-5, 1997.

"Parallel and Adaptive VLSI Architectures for Delta-Sigma Modulation," seminar, Electrical and Computer Engineering Dept., Michigan State Univ., East Lansing MI, Oct. 24, 1997.

"Reinforcement Learning in Analog VLSI," lecture at *1997 NSF Workshop on Neuromorphic Engineering,* Telluride CO, July 2, 1997.

"Adaptation, Learning and Storage in Analog VLSI," *Ninth Annual IEEE International ASIC Conference,* Rochester NY, Sept. 25, 1996.

"Analog VLSI Adaptive Computational Systems," G. Cauwenberghs, WSE Junior Faculty Seminar, Computer Science Department, Johns Hopkins University, Febr. 1, 1996.

"On-Line Learning of Recurrent Continuous-Time Dynamics in Analog VLSI," seminar at the Naval Research Laboratory, Washington DC, May 11, 1995.

"On-Line Learning of Recurrent Continuous-Time Dynamics in Analog VLSI," Seminar Series, Center of Language and Speech Processing, Johns Hopkins University, Oct. 27, 1994.

"Learning Networks," lecture at *1994 NSF Workshop on Neuromorphic Engineering,* Telluride CO, July 9, 1994.

"A Learning Analog Neural Network Chip with Continuous-Time Recurrent Dynamics," Applied Physics Laboratory, Laurel MD, Febr. 18, 1994.

"Learning and Storage in Analog VLSI," NIPS*93 workshop, Vail CO, Dec. 3-6, 1993.

Professional Activity and Service

Society memberships: Institute of Electrical and Electronic Engineers (IEEE, Fellow); American Institute for Medical and Biological Engineering (AIMBE, Fellow); Biomedical Engineering Society (BMES); Society for Neuroscience (SfN); International Neural Network Society (INNS); American Association for the Advancement of Science (AAAS).

Committees:

Steering Committee, IEEE Brain, 2021-present.

Vice President Elect of Technical Activities, Executive Committee, IEEE Engineering in Medicine and Biology Society, 2023.

Technical committees, IEEE Circuits and Systems Society: Analog Signal Processing (Chair, 2000-2001, and Vice chair, 1999-2000); Biomedical Circuits and Systems; Cellular Neural Networks and Array Computing; Neural Systems and Applications; Sensory Systems.

Editorial boards:

Editor-in-Chief, IEEE Transactions on Biomedical Circuits and Systems (http://ieee.org/tbiocas), 2011-2015. Steering Committee, 2023-present.

Senior Editor, IEEE Journal on Emerging and Selected Topics in Circuits and Systems, 2011-2012.

Senior Editor, IEEE Sensors Journal, 2008-2012.

Editorial Board Member, IOP Neuromorphic Computing and Engineering, 2023-present.

Editorial Board Member, Proceedings of the IEEE, 2020-present.

Editorial Board Member, IEEE Transactions on Biomedical Engineering, 2013-present.

Associate Editor, Neuromorphic Engineering, Frontiers in Neuroscience, 2010-present.

Associate Editor, IEEE Trans. Biomedical Circuits and Systems, 2007-2010.

Associate Editor, IEEE Trans. Neural Systems and Rehabilitation Engineering, 2006-2010.

Associate Editor, IEEE Trans. Circuits and Systems I: Regular Papers, 2004-2007.

Associate Editor, IEEE Sensors Journal, 2000-2004.

Associate Editor, IEEE Trans. Circuits and Systems II: Analog and Digital Signal Processing, 1999-2003.

Guest Editor, with R. Etienne-Cummings, R. Newcomb and M. Zaghloul, Special issue on "Integrated Multisensor Systems and Signal Processing, "IEEE Sensors Journal, Dec. 2002.

Guest Editor, with K. Jenkins and F. Salam, Special section on the MWSCAS'2000 Student Paper Award Contest, IEEE Trans. Circuits and Systems II: Analog and Digital Signal Processing, Oct. 2001.

Guest Editor, with M. Bayoumi and E. Sanchez-Sinencio, Special issue on "Learning on Silicon," Int. J. Analog Integrated Circuits and Signal Processing, March 1999.

Conference program and organizing committees:

General chair and co-organizer, 2025 12th Int. IEEE/EMBS Conf. on Neural Engineering (NER'2025), La Jolla CA, Nov. 10-13, 2025.

Co-chair and co-organizer, Neuro Inspired Computational Elements Conference (NICE'2023), La Jolla CA, Apr. 23-26, 2024.

Co-chair and co-organizer, IEEE Brain Discovery Neurotechnology Workshop Brain Mind Body Cognitive Engineering for Health and Wellness, La Jolla CA, Nov. 10-11, 2022.

Co-chair and co-organizer, IEEE EMBS Symposium and Workshop on Brain, Mind, and Body: Cognitive Neuroengineering for Health and Wellness, La Jolla CA, Dec. 15-16, 2021.

Co-organizer, National Science Foundation CISE Workshop on Electronic Design Automation, Dec. 14-16, 2020.

Co-chair and co-organizer, IEEE EMBS Symposium and Workshop on Brain, Mind, and Body: Cognitive Neuroengineering for Health and Wellness, La Jolla CA, Dec. 19-20, 2019.

Special sessions co-chair, IEEE Biomedical Circuits and Systems Conference (BioCAS 2019), Nara Japan, Oct. 17-19, 2019.

International liaison, IEEE Biomedical Circuits and Systems Conference (BioCAS 2016), Shanghai China, Oct. 17-19, 2016.

Program chair, with S. Carrara and J. Hasler, IEEE Biomedical Circuits and Systems Conference (BioCAS 2015), Atlanta GA, Oct. 22-24, 2015.

Program chair, with M. Ghovanloo and P. Georgiou, IEEE Biomedical Circuits and Systems Conference (BioCAS 2014), Lausanne Switzerland, Oct. 22-24, 2014.

Program co-chair, with J. Weiland, IEEE Engineering in Medicine and Biology Conference (EMBC 2012), San Diego CA, Aug. 29-Sept. 2, 2012.

General chair, with A. Mason, IEEE Biomedical Circuits and Systems Conference (BioCAS 2011), San Diego CA, Nov. 10-12, 2011.

Program chair, ISSNIP Biosignals and Biorobotics Conference 2011, Vitoria, Brazil, Jan. 6-8, 2011.

Program chair, ISSNIP Biosignals and Biorobotics Conference 2010, Vitoria, Brazil, Jan. 4-6, 2010.

Program co-chair, with V. Pedroni, 20th Symp. Integrated Circuits and Systems Design (SBCC'2007), Rio de Janeiro, Brazil, Sept. 3-6, 2007.

Invited sessions track co-chair, IEEE Int. Symp. Circuits and Systems (ISCAS'2003), Bangkok, Thailand, May 25-28, 2003.

Track chair, Analog Circuits and Signal Processing, IEEE Int. Symp. Circuits and Systems (ISCAS'2002), Phoenix, AZ, May 26-29, 2002.

Track chair, Implementations (2001) and Emerging Technologies (2002), IEEE Conf. Neural Information Processing Systems (NIPS), Vancouver BC, Canada.

Publication chair, IEEE Midwest Symp. Circuits and Systems, Lansing MI, Aug. 8-11, 2000.

Other program committees: ISCAS 1996-present, MicroNeuro 1999, MWSCAS 2000, SVM 2002, Bio-CAS 2004-present, BIOSTEC-2008 (BIOSIGNALS, and BIODEVICES), INSSPEC 2007, BSN 2009-present, SPIE Biosensing II (OP106) 2008-present, ESSCIRC 2010-present, Wireless Health 2010, IEEE International Solid-State Circuits Conference (ISSCC) Imagers, Medical, MEMS and Displays (IMMD) Subcommittee, 2017-present.

Conference special and invited sessions:

Co-organizer, and co-chair, with J. Arthur and Y. Xie, invited session on "Industrial-strength Accelerators for Machine Learning and Artificial Intelligence," DAC Designer Track, IEEE/ACM DAC2018, San Francisco CA, 2018.

Co-chair, with R. Newcomb and M. Zaghloul, special session on "MEMS multisensor systems and signal processing," IEEE Int. Symp. Circuits and Systems (ISCAS'2001), Sydney, Australia, 2001.

Co-chair, with F. Salam, special session on "Neuromorphic signal decomposition and blind source separation," IEEE Int. Symp. Circuits and Systems (ISCAS'99), Orlando FL, 1999.

Chair, invited special session on "VLSI neuromorphic learning systems," 7th Int. Conf. Microelectronics for Neural, Fuzzy and Bio-inspired Systems (MicroNeuro'99) Granada Spain, 1999.

Co-chair, with F. Salam and P. Hasler, special session on "Memory, adaptation, and learning," IEEE Int. Symp. Circuits and Systems (ISCAS'98), Monterey CA, 1998.

Co-chair, with M. Bayoumi and E. Sanchez-Sinencio, special session on "Learning on Silicon," IEEE Int. Symp. Circuits and Systems (ISCAS'97), Hong Kong, 1997.

Short courses and tutorials:

Co-chair and co-organizer, with S. Chakrabartty and A.G. Andreou, Topic Area "Quantum-Inspired Neuromorphic Systems," NSF Workshop on Neuromorphic Engineering, Telluride CO, June 25-July 14, 2023.

Co-chair and co-organizer, with B. Rueckauer, Y. Sandamirskaya, and T. Sejnowski, Topic Area "Lifelong Learning at Scale: From Neuroscience Theory to Robotic Applications," NSF Workshop on Neuromor-

phic Engineering, Telluride CO, June 26-July 15, 2022.

Co-chair and co-organizer, with R. Sepulchre, Topic Area "Neuromodulation Control," NSF Workshop on Neuromorphic Engineering, Telluride CO, June 27-July 16, 2021.

Co-organizer, with H. Abarbanel, K. Lindenberg, and E. Neftci, "Neuromorphic Engineering: Dynamics of Multifunction Brain Networks," ONR MURI Winter School and Workshop, UC San Diego, La Jolla CA, Jan. 7-10, 2014.

Lecturer, Topic Area "Neuromorphic Engineering," q-bio Summer School, San Diego Center for Systems Biology, La Jolla CA, 2012-2013 (July 21-August 4, 2013; July 22-August 3, 2012).

Chair, with co-chairs M. Ghovanloo and J. del R. Millan, "IEEE EMB/CAS/SMC Workshop on Brain-Machine-Body Interfaces," San Diego CA, August 27, 2012.

Co-chair, with G. Indiveri, Topic Area "Learning and Computational Intelligence in Neuromorphic Cognitive Systems," NSF Workshop on Neuromorphic Engineering, Telluride CO, July 1-21, 2012.

Distinguished Lecturer, IEEE Circuits and Systems Society, 2003-2004.

Co-chair, with P. Bartlett and A. Smola, tutorial short course on "Support vector machines and statistical learning theory," IEEE Int. Symp. Circuits and Systems (ISCAS'2001), Sydney, Australia, May 6, 2001.

Co-chair, with F. Salam and R.W. Liu, tutorial short course on "Neural algorithms for blind signal separation and recovery," IEEE Int. Symp. Circuits and Systems (ISCAS'99), Orlando FL, May 30, 1999.

Co-chair, with R. Etienne-Cummings and M. Jabri, workshop on "Learning chips and neurobots," IEEE Neural Information Processing Systems Conf. (NIPS'98), Breckenridge CO, 1998.

Co-chair, with M. Jabri, workgroup on "aVLSI Learning Systems," NSF Workshop on Neuromorphic Engineering, Telluride CO, June 23-July 13, 1997.

Review service:

Journals: IEEE Electronic Device Lett., IEEE Journal of Solid-State Circuits, IEEE Sensors Journal, IEEE Trans. Biomedical Engineering, IEEE Trans. Biomedical Circuits and Systems, IEEE Trans. Circuits and Systems I and II, IEEE Trans. Circuits and Systems for Video Technology, IEEE Trans. Neural Networks, IEEE Trans. Signal Processing, IEEE Trans. VLSI Systems, Int. J. Analog Integrated Circuits and Signal Processing, Int. J. Electronics, Int. J. Circuit Theory and Applications, J. Circuits Systems and Computers, Measurement Science and Technology, Nature Biotechnology, Nature Communications, Neural Computation, Pattern Recognition Letters, Science Advances, Science.

Conference program committees: Int. Conf. Pattern Recognition (ICPR), IEEE Biomedical Circuits and Systems (BioCAS), IEEE Body Sensor Networks (BSN), IEEE Engineering in Medicine and Biology (EMBC), IEEE International (Joint) Conference on Neural Networks (ICNN & IJCNN), IEEE International Solid-State Circuits Conference (ISSCC), IEEE International Symposium on Circuits and Systems (ISCAS), IEEE Midwest Symposium on Circuits and Systems (MWSCAS), IEEE MicroNeuro, Joint Symposium on Neural Computation, Neural Information Processing Systems (NIPS), Wireless Health.

Book proposals: Kluwer Academic/Springer Verlag, MIT Press, Wiley.

Research funding proposal panels: Australian Research Council, Future Emerging Technologies (FET Open, Europe), Hong Kong University Grants Committee, National Aeronautics and Space Administration (NASA), National Science Foundation (NSF), National Institutes of Health (NIH), Swiss National Science Foundation, UC Discovery iLink, UK Engineering and Physical Sciences Research Council (EPSRC).

University service:

Co-director (with Terrence Sejnowski), Institute for Neural Computation, University of California San Diego, La Jolla CA 92093, 2008-present.

UCSD Academic Senate, Senate Council, 2021-2022.

UCSD Academic Senate, Committee on Research: Vice Chair, 2020-2021; Chair, 2021-2022. UCSD Representative on UC-Wide Committee on Research Policy (UCORP), 2022-2023. UCORP Representative on Academic Council Special Committee on Lab Issues (ACSCOLI), 2022-2023.

UCSD Academic Senate, Committee on Academic Personnel, 2018-2020.

UCSD Academic Senate, Bioengineering Representative, Representative Assembly, 2017-2019.

UCSD Academic Senate, Graduate Student Council, 2013-2017.

UCSD Jacobs School of Engineering: Dean's Executive Faculty Committee, 2018-present.

UCSD Shu Chien-Gene Lay Department of Bioengineering: Graduate Admissions Committee (Chair), 2021-present; PhD Qualifier Exam Committee, 2022-present; Space Committee, 2018-2020; Undergraduate Studies Committee, 2009-present; Biosystems Engineering Program Committee, 2009-present.

UCSD School of Public Health Executive Council, 2018-present.

UCSD Institute of Engineering in Medicine-Altman Clinical Translation Research Institute (IEM-ACTRI) Galvanizing Engineering in Medicine (GEM) Award Selection Committee, 2017-present.

UCSD Neurosciences Graduate Program, Computational Neuroscience Specialization: Executive committee, 2006-present; Chair, admissions committee, 2006-2007; Minor proposition committee, 2007-present.

UCSD Center for Engineered Natural Intelligence (CENI), Jacobs School of Engineering, Co-founder (with Gabriel Silva, Henry Abarbanel, and Timothy Gentner), 2016-present.

UCSD Division of Biological Sciences: Faculty Advisory Committee, Saltman Quarterly, 2009; Computer committee, 2006-2009.

UCSD Institute for Neural Computation: Executive committee, Space committee, Academic personnel committee, 2006-present.

UCSD California Institute of Telecommunications and Information Technology (CalIT2): Neuroscience for architecture and navigation committee, 2006-2011.

University of California Industry-University Partnerships: UC Discovery Grants Selection Committee, 2006; UC Discovery iLink Committee, 2011.

JHU Whiting School of Engineering, JHU: Information technology committee, 2001-present.

JHU Computer Engineering Program, JHU: Program committee, 1996-2005; Search committee, 1998-2005.

JHU Department of Electrical and Computer Engineering, JHU: ABET committee, 1997-98; Curriculum committee, 1997-98, 2002-2005; Joint appointments committee, 2001-2005; Graduate admissions committee, 1994-97, 2000.

Corporate Advisory Boards:

Chair, Scientific Advisory Board, and co-founder, Cognionics Inc., San Diego CA, 2011-present.

Advisor, NextSense Inc., Mountain View CA, 2021-present.

Scientific Advisory Board, Powell Mansfield Inc., San Diego CA, 2021-present.

Scientific Advisory Board, BrainChip Inc., Irvine CA, 2015-2017.

Technical Advisory Board, GTronix Inc., Fremont CA, 2006-2010 (acquired by National Semiconductor/Texas Instruments, 2010).

Other:

Invited participant, National Academy of Engineering Frontiers in Engineering Symposium, Irvine CA, Sept. 14-16, 2000.

Publications

Journal Publications

"In-Ear Integrated Sensor Array for the Continuous Monitoring of Brain Activity and of Lactate in Sweat," Y. Xu, E. De la Paz, A. Paul, K. Mahato, J.R. Sempionatto, M. Lee, G. Hota, N. Tostado, M. Lin, A. Uppal, W. Chen, S. Dua, L. Yin, B.L. Wuerstle, S. Deiss, P. Mercier, S. Xu, J. Wang, and G. Cauwenberghs, *Nature Biomedical Engineering*, vol. **7** (10), pp. 1307-1320, Oct. 2023.

"A 22-pJ/Spike 73-Mspikes/s 130k-Compartment Neural Array Transceiver with Conductance-Based Synaptic and Membrane Dynamics," J. Park, S. Ha, T. Yu, E. Neftci, and G. Cauwenberghs, *Frontiers in Neuroscience* vol. **17**, pp. 1198306:1-18, 10.3389/fnins.2023.1198306, 2023.

"A Versatile In-Ear Biosensing System and Body-Area Network for Unobtrusive Continuous Health Monitoring," A. Paul, M.S. Lee, Y. Xu, and G. Cauwenberghs, *IEEE Transactions on Biomedical Circuits and Systems*, vol. **17** (3), 2023.

"Micro/Nano Circuits and Systems Design and Design Automation: Challenges and Opportunities," G. Cauwenberghs, J. Cong, X.S. Hu, S. Joshi, S. Mitra, W. Porod, and H.S.P. Wong, *Proceedings of the IEEE*, vol. **111** (6), pp. 561-574, 2023.

"Stimulus Design for Visual Evoked Potential Based Brain-Computer Interfaces," H. Xu, S.-H. Hsu, M. Nakanishi, Y. Lin, T.-P. Jung, and G. Cauwenberghs, *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. **31**, pp. 2545-2551, 2023.

"A Compute-in-Memory Chip based on Resistive Random-Access Memory," W. Wan, R. Kubendran, C. Schaefer, S.B. Eryilmaz, W. Zhang, D. Wu, S. Deiss, P. Raina, H. Qian, B. Gao, S. Joshi, H. Wu, H.-S.P. Wong, and G. Cauwenberghs, *Nature,* vol. **608**, pp. 504-512, 2022.

"A Neuromorphic Brain Interface based on RRAM Crossbar Arrays for High Throughput Real-time Spike Sorting," Y. Shi, A. Ananthakrishnan, S. Oh, X. Liu, G. Hota, G. Cauwenberghs, and D. Kuzum, *IEEE Transactions on Electron Devices,* vol. **69** (4), pp. 2137-2144, 2022.

"Hierarchical Network Connectivity and Partitioning for Reconfigurable Large-Scale Neuromorphic Systems," N. Mysore, G. Hota, S.R. Deiss, B.U. Pedroni, and G. Cauwenberghs, *Frontiers in Neuroscience,* vol. **15**, pp. 797654:1-13, 10.3389/fnins.2021.797654, 2022.

"Characterization of Ag/AgCl Dry Electrodes for Wearable Electrophysiological Sensing," M.S. Lee, A. Paul, Y. Xu, W. D. Hairston, and G. Cauwenberghs, *Frontiers in Electronics,* Wearable Electronic Devices for Health Monitoring, vol. **2**, pp. 700363:1-9, 10.3389/felec.2021.700363, 2022.

"Markov Abstractions of Electrochemical Reaction-Diffusion in Synaptic Transmission for Neuromorphic Computing," M. Wagner, T.M. Bartol, T.J. Sejnowski, and G. Cauwenberghs, *Frontiers in Neuroscience*, vol. **15**, pp. 698635:1-12, 10.3389/fnins.2021.698635, 2021.

"An Optically Addressed Nanowire-Based Retinal Prosthesis with Wireless Stimulation Waveform Control and Charge Telemetering," A. Akinin, J.M. Ford, J. Wu, C. Kim, H.D. Thacker, P.P. Mercier, G. Cauwenberghs, *IEEE Journal of Solid-State Circuits*, vol. **56** (11), pp. 3263-3273, 2021.

"Neuromorphic Dynamical Synapses with Reconfigurable Voltage-Gated Kinetics," J. Wang, G. Cauwenberghs, and F. Broccard, *IEEE Transactions on Biomedical Engineering*, vol. **67** (7), pp. 1831-1840, 2020.

"A 3 mm × 3 mm Fully Integrated Wireless Power Receiver and Neural Interface System-on-Chip," C. Kim, J. Park, S. Ha, A. Akinin, R. Kubendran, P.P. Mercier, and G. Cauwenberghs, *IEEE Transactions on Biomedical Circuits and Systems*, vol. **13** (6), pp. 1736-1746, 2019.

"Spatial Encoding in Primate Hippocampus during Free Navigation," H.S. Courellis, S.U. Nummela, M. Metke, G.W. Diehl, R. Bussell, G. Cauwenberghs, and C.T. Miller, *PLoS Biology*, vol. **17** (12): e3000546, 2019.

"Dropout and DropConnect for Reliable Neuromorphic Inference under Communication Constraints in Network Connectivity," Y. Sakai, B.U. Pedroni, S. Joshi, S. Tanabe, A. Akinin, and G. Cauwenberghs, *IEEE Journal on Emerging and Selected Topics in Circuits and Systems (JETCAS),* vol. **9** (4), pp. 658-667, 2019.

"Digitally Adaptive High-Fidelity Analog Array Signal Processing Resilient to Capacitive Multiplying DAC Inter-Stage Gain Error," S. Joshi, C. Kim, C.M. Thomas, and G. Cauwenberghs, *IEEE Transactions on Circuits and Systems I: Regular Papers*, vol. **66** (11), pp. 4095-4107, 2019.

"Memory-efficient Synaptic Connectivity for Spike-Timing-Dependent Plasticity," B.U. Pedroni, S. Joshi, S. Deiss, S. Sheik, G. Detorakis, S. Paul, C. Augustine, E.O. Neftci, and G. Cauwenberghs, *Frontiers in Neuroscience*, vol. **13**, pp. 357:1-18, 10.3389/fnins.2019.00357, 2019.

"Array Atomic Force Microscopy for Real-Time Multi-Parametric Analysis," Q. Yang, Q. Ma, K.M. Herum, C.Wang, N. Patel, J. Lee, S. Wang, T.M. Yen, J. Wang, H. Tang, Y.-H. Lo, B.P. Head, F. Azam, S. Xu, G. Cauwenberghs, A.D. McCulloch, S. John, Z. Liu, and R. Lal, *Proc. Nat. Acad. Sci. (PNAS)*, vol. **116** (13), pp. 5872-5877, 2019.

"How Does the Presence of Neural Probes Affect Extracellular Potentials?," A. Buccino, M. Kuchta, K. Jæger, T. Ness, P. Berthet, K.-A. Mardal, G. Cauwenberghs, and A. Tveito, *Journal of Neural Engineering*, vol. **16** (2), pp. 026030:1-18, 2019.

"A Fully Integrated RF-Powered Energy-Replenishing Current-Controlled Stimulator," S. Ha, C. Kim, J. Park, G. Cauwenberghs and P. Mercier, *IEEE Transactions on Biomedical Circuits and Systems*, vol. **13** (1), pp.191-202, 2019.

"Large-Scale Neuromorphic Spiking Array Processors: A Quest to Mimic the Brain," C.S. Thakur, J. Molin, G. Cauwenberghs, G. Indiveri, K. Kumar, N. Qiao, J. Schemmel, R. Wang, E. Chicca, J.O. Hasler, J.-S. Seo, S. Yu, Y. Cao, A. van Schaik, and R. Etienne-Cummings, *Frontiers in Neuroscience*, vol. **12**, pp. 891:1-37, 10.3389/fnins.2018.00891, 2018.

"In Vivo Photovoltaic Performance of a Silicon Nanowire Photodiode-Based Retinal Prosthesis," B. Bosse, S. Damle, A. Akinin, Y. Jing, D.-U. Bartsch, L. Cheng, N. Oesch, Y.-H. Lo, G. Cauwenberghs, and W.R. Freeman, *Investigative Ophthalmology & Visual Science (IOVS): Retina*, vol. **59**, pp. 5885-5892, doi:10.1167/iovs.18-24554, 2018.

"Sub-μVrms-Noise Sub-μW/Channel ADC-Direct Neural Recording With 200-mV/ms Transient Recovery Through Predictive Digital Autoranging," C. Kim, S. Joshi, H. Courellis, J. Wang, C. Miller and G. Cauwenberghs, *IEEE Journal of Solid-State Circuits*, vol. **53** (11), pp. 3101-3110, 2018.

"Combining Biophysical Modeling and Deep Learning for Multi-Electrode Array Neuron Localization and Classification," A. Buccino, M. Kordovan, T.B. Ness, B. Merkt, P. Häfliger, M. Fyhn, G. Cauwenberghs, S. Rotter, and G.T. Einevoll, *Journal of Neurophysiology*, vol. **120**, pp. 1212-1232, 2018.

"Deep Supervised Learning Using Local Errors," H. Mostafa, V. Ramesh, and G. Cauwenberghs, *Frontiers in Neuroscience,* vol. **12**, pp. 608:1-16, 10.3389/fnins.2018.00608, 2018.

"Neural and Synaptic Array Transceiver: A Brain-Inspired Computing Framework for Embedded Learning," G. Detorakis, S. Sheik, C. Augustine, S. Paul, B.U. Pedroni, N. Dutt, J. Krichmar, G. Cauwenberghs, and E. Neftci, *Frontiers in Neuroscience,* vol. **12**, pp. 583:1-19, 10.3389/fnins.2018.00583, 2018.

"A Learning Framework for Winner-Take-All Networks with Stochastic Synapses," H. Mostafa and G. Cauwenberghs, *Neural Computation*, vol. **30** (6), pp. 1542-1572, 2018.

"A 500-MHz Bandwidth 7.5-mVpp Ripple Power-Amplifier Supply Modulator for RF Polar Transmitters," C. Kim, C.S. Chae, Y.S. Yuk, C.M. Thomas, Y.G. Kim, J.K. Kwon, S. Ha, G. Cauwenberghs, and G.H. Cho, *IEEE Journal of Solid-State Circuits*, vol. **53** (6), pp. 1653-1665, 2018.

"Assimilation of Biophysical Neuronal Dynamics in Neuromorphic VLSI," J. Wang, D. Breen, A. Akinin, F. Broccard, H.D.I. Abarbanel, and G. Cauwenberghs, *IEEE Trans. Biomedical Circuits and Systems*, vol. **11** (6), pp.

1258-1270, 2017.

"A 144-MHz Fully Integrated Resonant Regulating Rectifier With Hybrid Pulse Modulation for mm-Sized Implants," C. Kim, S. Ha, J. Park, A. Akinin, P.P. Mercier, and G. Cauwenberghs, *IEEE Journal of Solid-State Circuits*, vol. **52** (11), pp. 3043-3055, 2017.

"Hierarchical Address Event Routing for Reconfigurable Large-Scale Neuromorphic Systems," J. Park, T. Yu, S. Joshi, C. Maier, and G. Cauwenberghs, *IEEE Transactions on Neural Networks and Learning Systems*, vol. 28 (10), pp. 2408-2422, 2017.

"Hardware-Efficient On-line Learning through Pipelined Truncated-Error Backpropagation in Binary-State Networks," H. Mostafa, B. Pedroni, S. Sheik, and G. Cauwenberghs, *Frontiers in Neuroscience*, vol. **11**, pp. 496:1-15, 10.3389/fnins.2017.00496, 2017.

"Neuromorphic Neural Interfaces: From Neurophysiological Inspiration to Biohybrid Coupling with Nervous Systems," F.D. Broccard, S. Joshi, J. Wang and G. Cauwenberghs, *Journal of Neural Engineering*, vol. **14** (4), pp. 041002:1-26, 2017.

"EEG-Based Quantification of Cortical Current Density and Dynamic Causal Connectivity Generalized across Subjects Performing BCI-Monitored Cognitive Tasks ," H. Courellis, T. Mullen, H. Poizner, G. Cauwenberghs, and J.R. Iversen, *Frontiers in Neuroscience,* doi: 10.3389/fnins.2017.00180, vol. **11**, pp. 180:1-17, 2017.

"A CMOS Current Steering Neurostimulation Array with Integrated DAC Calibration and Charge Balancing," E. Greenwald, C. Maier, Q. Wang, R. Beaulieu, R. Etienne-Cummings, G. Cauwenberghs, and N. Thakor, *IEEE Transactions on Biomedical Circuits and Systems*, vol. **11** (2), pp. 324-335, 2017.

"Capacitively Coupled Arrays of Multiplexed Flexible Silicon Transistors for Long-Term Cardiac Electrophysiology," H. Fang, K.J. Yu, C. Gloschat, Z. Yang, C.-H. Chiang, J. Zhao, S.M. Won, S. Xu, M. Trumpis, Y. Zhong, E. Song, S.W. Han, Y. Xue, D. Xu, Gert Cauwenberghs, M. Kay, Y. Huang, J. Viventi, I.R. Efimov, and J.A. Rogers, *Nature Biomedical Engineering*, vol. **1**, 0038, doi: 10.1038/s41551-017-0038, 2017.

"Silicon-Integrated High-Density Electrocortical Interfaces," S. Ha, A. Akinin, J. Park, C. Kim, H. Wang, C. Maier, P. P. Mercier, and G. Cauwenberghs, *Proceedings of the IEEE*, vol. **105** (1), pp. 11-33, 2017.

"A 6.5-μW/MHz Charge Buffer With 7-fF Input Capacitance in 65-nm CMOS for Noncontact Electropotential Sensing," S. Joshi, C. Kim and G. Cauwenberghs, *IEEE Transactions on Circuits and Systems II: Express Briefs*, vol. **63** (12), pp. 1161-1165, 2016.

"Training a Probabilistic Graphical Model With Resistive Switching Electronic Synapses," S.B. Eryilmaz, E. Neftci, S. Joshi, S. Kim, M. BrightSky, H.-L. Lung, C. Lam, G. Cauwenberghs, H.-S. P. Wong, *IEEE Transactions on Electron Devices*, vol. **63** (12), pp. 5004-5011, 2016.

"Energy Recycling Telemetry IC With Simultaneous 11.5 mW Power and 6.78 Mb/s Backward Data Delivery Over a Single 13.56 MHz Inductive Link," S. Ha, C. Kim, J. Park, S. Joshi and G. Cauwenberghs, *IEEE Journal of Solid-State Circuits*, vol. **51** (11), pp. 2664-2678, 2016.

"A Bidirectional Neural Interface IC With Chopper Stabilized BioADC Array and Charge Balanced Stimulator," E. Greenwald, E. So, Q. Wang, M. Mollazadeh, C. Maier, R. Etienne-Cummings, G. Cauwenberghs, and N. Thakor, *IEEE Transactions on Biomedical Circuits and Systems*, vol. **10** (5), pp. 990-1002, 2016.

"Memristor-based Neural Networks: Synaptic versus Neuronal Stochasticity," R. Naous, M. Al-Shevidat, E. Neftci, G. Cauwenberghs, and K.N. Salama, *AIP Advances*, doi: 10.1063/1.4967352, vol. **6**, 111304, 2016.

"Towards High-Resolution Retinal Prostheses with Direct Optical Addressing and Inductive Telemetry," S. Ha, M.L. Khraiche, A. Akinin, Y. Jing, S. Damle, Y. Kuang, S. Bauchner, Y.-H. Lo, W.R. Freeman, G.A. Silva, and G. Cauwenberghs, *Journal of Neural Engineering*, vol. **13** (5), pp. 056008:1-19, 2016.

"Micropower Mixed-Signal VLSI Independent Component Analysis for Gradient Flow Acoustic Source Separation," M. Stanacevic, S. Li, G. Cauwenberghs, *IEEE Transactions on Circuits and Systems I: Regular Papers*, vol. **63** (7), pp. 972-981, 2016.

"Mapping Generative Models onto a Network of Digital Spiking Neurons," B.U. Pedroni, S. Das, J.V. Arthur, P.A. Merolla, B.L. Jackson, D.S. Modha, K. Kreutz-Delgado, and G. Cauwenberghs, *IEEE Transactions on Biomedical Circuits and Systems*, vol. **10** (4), pp. 837-854, 2016.

"Stochastic Synapses Enable Efficient Brain-Inspired Learning Machines," E.O. Neftci, B.U. Pedroni, S. Joshi, M. Al-Shedivat, and G. Cauwenberghs, *Frontiers in Neuroscience*, doi: 10.3389/fnins.2016.00241, vol. **10**, pp. 241:1-16, 2016.

"A Correlation-based Framework for Evaluating Postural Control Stochastic Dynamics," M. Hernandez, J. Snider, C. Stevenson, G. Cauwenberghs, and H. Poizner, *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. **24** (5), pp. 551-561, 2016.

"A 1.3 mW 48 MHz 4 Channel MIMO Baseband Receiver With 65 dB Harmonic Rejection and 48.5 dB Spatial Signal Separation," C. Kim, S. Joshi, C.M. Thomas, S. Ha, L.E. Larson and G. Cauwenberghs, *IEEE Journal of Solid-State Circuits*, vol. **51** (4), pp. 832-844, 2016.

"Real-Time Adaptive EEG Source Separation Using Online Recursive Independent Component Analysis," S.H. Hsu, T.R. Mullen, T.P. Jung and G. Cauwenberghs, *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. **24** (3), pp. 309-319, 2016.

"Real-Time Neuroimaging and Cognitive Monitoring Using Wearable Dry EEG," T.R. Mullen, C.A.E. Kothe, Y.M. Chi, A. Ojeda, T. Kerth, S. Makeig, T. Jung, and G. Cauwenberghs, *IEEE Transactions on Biomedical Engineering*, vol. **62** (11), pp. 2553-2577, 2015.

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