

IEEE
Bi+CAS 2021 Berlin
Biomedical Circuits and Systems Conference
Virtual Conference | October 6-9, 2021

2021
CONFERENCE
PROGRAM

Please visit website for more information!
www.2021.ieee-biocas.org



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WELCOME MESSAGE FROM THE GENERAL CHAIR

Dear Friends and Colleagues:

On behalf of the entire Organization Committee, we cordially welcome you to the 2021 IEEE BioCAS conference. Two years ago, we planned to meet for the conference – of course on-site! - in Berlin, given the current Covid circumstances we will now hold our meeting virtually. In any case, let us as a community keep connected and enjoy the exchange of latest and exciting research results in the biomedical circuits and system domain during this conference!

The conference topic in 2021 is “Restoring Vital Functions by Electronics – Achievements, Limitations, Opportunities, and Challenges”. We will have three invited keynote presentations as well as three tutorials from well-known and outstanding experts in their area on hot topics in our field, as well as a combination of oral and poster sessions. Whereas the regular paper and poster contributions are pre-recorded, in all cases we will have the opportunity to virtually meet the authors and have a live discussion with them using the interactive avatar-based platform Gather.town. The conference theme will be addressed contents-wise by considering contributions from transistor-level circuit design over systems to algorithms, and topics from point-of-care and lab-on-chip technologies, flexible and wearable devices for health monitoring, implantable systems for restoring lost senses, to artificial intelligence and machine learning for supporting the envisioned goals.

In line with past BioCAS conferences and IEEE guidelines – and of course given the special circumstances having a fully virtual conference - conference program and proceedings are available in electronic format only. Given that this year conference attendees will not travel and not adopt to the local time zone, we slightly changed the conference format in order to make following the conference not too inconvenient for attendees outside from Europe: All sessions are held during Central European Time afternoon slots, and compared to former BioCAS conferences the conference is extended by one day. Moreover, whereas BioCAS usually has been a single-track conference, this year regular oral presentations are organized in a double-track format. All details can be found on the website [here](#).

On behalf of the entire Organization Committee, we invite you to follow this year’s program, to contribute to the discussions, and enjoy the scientific and technical exchange!

All the very best to you and your families, stay healthy,
yours,

Roland Thewes
(General Chair IEEE BioCAS 2021)

PROGRAM AT A GLANCE

Wednesday, October 6, 2021		
12:30-14:00		
13:30	OPENING SESSION	
13:45		
14:00-15:30		
14:00	KEYNOTE Arum Han <i>Dielectrophoretic Force For Cell Manipulation In High-Throughput Microfluidic Systems</i>	
14:35		
14:30		
14:45		
15:00		
15:35		
15:30		
15:45-17:00		
15:45	Neuromorphic Systems & Quality of Life Technologies	Energy Harvesting & Closed-Loop Systems
16:00		
16:15		
16:30		
16:45		
17:00		
17:15-18:00		
17:15	Biosensor Devices & Interface Circuits	Electronics for Neuroscience
17:30		
17:45		
18:00		
18:35		
18:30		
18:45		
Thursday, October 7, 2021		
12:00-14:15		
12:00	POSTER SESSION Biomedical Circuits & Systems I (In Gather.Town)	
12:15		
12:30		
12:45		
14:00		
14:35		
14:15-15:45		
14:30	TUTORIAL Sameer Sonkusale <i>Flexible Bioelectronics On Thread And Textile Substrates</i>	
14:45		
15:00		
15:35		
15:30		
15:45		
16:00-17:30		
16:00	KEYNOTE Zheng Yuanjin <i>Emerging Electromagnetic-Acoustic Sensing and Imaging for in-vivo Healthcare Monitoring</i>	
16:15		
16:30		
16:45		
17:00		
17:15		
17:15-19:00		
17:30	Sensor Networks & Wearable Health Monitoring	Implantable Medical Electronics
17:35		
17:50		
17:45		
18:00		
18:35		
18:30		
18:45		
19:00		

Friday, October 8, 2021

13:00-14:15		
13:00	<p align="center">POSTER SESSION Biomedical Circuits & Systems II (In Gather.Town)</p>	
13:15		
13:30		
13:45		
14:00		
14:15		
14:15-15:45		
14:30	<p align="center">KEYNOTE Refet Firat Yazicioglu <i>Bioelectronics - Where Technology Meets Biology</i></p>	
14:45		
15:00		
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15:45		
16:00-17:30		
16:00	<p align="center">TUTORIAL Michiel Pertijs <i>Circuits And Systems For Next-Generation Ultrasound Imaging Devices</i></p>	
16:15		
16:30		
16:45		
17:00		
17:15		
17:30-19:00		
17:30	<p align="center">Point-of-Care Technologies & Biomedical Image Processing</p>	<p align="center">Biosignal Recording, Processing, & Machine Learning</p>
17:45		
18:00		
18:15		
18:30		
18:45		
19:00		

Saturday, October 9, 2021

13:30-15:00		
13:30	<p align="center">TUTORIAL Herming Chiueh <i>Wearable And Implantable Circuits And Systems For Real-Time Seizure Detections, Seizure Predictions, And Closed-Loop Methods For Seizure Suppression In Epilepsy</i></p>	
13:45		
14:00		
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14:45		
15:00-17:00		
15:00	<p align="center">Live Demos</p>	
15:15		
15:30		
15:45		
16:00		
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16:30		
16:45		
17:00-17:45		
17:15	<p align="center">CLOSING SESSION</p>	
17:30		
17:45		

IEEE BIOCAS 2021 COMMITTEE

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Pantelis Georgiou
Sara Ghoreishizadeh
Makito Haruta
Chung-Chih Hung
Yaoyao Jiang
Shuenn-Yuh Lee
Yongfu Li
Yan Liu
Paolo Motto Ros
Kiyotaka Sasagawa
Kea-Tiong (Samuel) Tang
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Maurizio Valle
Guoxing Wang
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IEEE Circuits and Systems Society - The mission of the IEEE CASS is to foster CASS members across disciplines to address humanity's grand challenges by conceiving and pioneering solutions to fundamental and applied problems in circuits and systems.



IEEE Engineering in Medicine and Biology Society (EMBS) is the world's largest international society of biomedical engineers. The organization's 11,000 members reside in some 97 countries around the world. EMBS provides its members with access to the people, practices, information, ideas and opinions that are shaping one of the fastest growing fields in science.



IEEE Solid-State Circuits Society - The mission of the IEEE SSCS is to serve our members through education, communication, recognition, leadership opportunities and networking.

KEYNOTE SPEAKERS

Wednesday, October 6th

Arum Han, Texas A&M University, USA

“Dielectrophoretic Force For Cell Manipulation In High-Throughput Microfluidic Systems”



Dr. Han is a Professor of the Department of Electrical and Computer Engineering, and a Presidential Impact Fellow of the Texas A&M University. He also holds joint appointment in the Department of Biomedical Engineering, and is a Graduate Faculty of the Texas A&M Health Science Center and Faculty of the Texas A&M Institute for Neuroscience. His research focuses on development of microfluidic, lab-on-a-chip, and organ-on-a-chip systems that enable unique biological experiments at high throughput and high accuracy that can then be readily adopted by the broad bio/medical science community. He has pioneered the area of high-throughput microfluidics for microbiology applications, and have been applying these technologies for synthetic biology, host-pathogen interactions, infectious disease, and microbial bioproduction. He is an extremely prolific

multidisciplinary researcher, with more than 150 peer-reviewed publications and 10 patents/patent applications, and has been leading and co-leading numerous multi-disciplinary projects supported by the US federal government. He is also the director of the AggieFab Nanofabrication Facility, a campus-wide core user facility. He has trained many graduate students and postdoctoral researchers, of which 8 hold faculty positions throughout the world.

Thursday, October 7th

Zheng Yuanjin, Nanyang Technological University, Singapore

“Emerging Electromagnetic-Acoustic Sensing and Imaging for in-vivo Healthcare Monitoring”



Dr. Yuanjin Zheng received his B.Eng. from Xian Jiaotong University, P. R. China in 1993 with the honor of the first class, M. Eng. from Xian Jiaotong University, P. R. China in 1996 with the honor of the best graduate student thesis award, and Ph.D. from Nanyang Technological University, Singapore in 2001. From July 1996 to April 1998, he worked at the national key lab of optical communication technology, university of electronic science and technology of china. He joined Institute of Microelectronics, A*STAR on 2001 and developed as a group technical manager. Since then, he has led in developing various wireless systems and CMOS integrated circuits, such as Bluetooth, WLAN, WCDMA, UWB, RF SAW/MEMS, Radar, and wireless implant sensor and wearable interface circuits etc. Since July 2009, he joined Nanyang Technological University, and now become a director for VIRTUS, IC design center of excellence, working on various radar system development and hybrid circuit and device (GaN, SAW, MEMS) designs, and flexible noninvasive sensor circuits and system for the applications etc. He has

authored and coauthored over 400 international journal and conference papers, 26 patents filed, and 5 book chapters. He is currently an associate editor for three journals and has been organizing several IEEE conferences as TPC Chairs and Session chairs. He was also a lead guest editor for a special Issue TBioCAS2019, and best paper award of CAS Life Science and Biomedical Circuits track in 2018 ISCAS.

Friday, October 8th

Refet Firat Yazicioglu, Galvani Bioelectronics

“Bioelectronics - Where Technology Meets Biology”



Firat brings pioneering our miniaturised Bioelectronic devices to reality. He is serving as Vice President of Translational Sciences and Engineering at Galvani Bioelectronics, a joint venture between GSK (GlaxoSmithKline) and Verily (former Google Lifesciences). He joined GSK Bioelectronics in 2015 after spending 13 years at imec, Europe’s largest independent research centre in microelectronics and nanoelectronics. He has developed medical devices and technologies for wearable and implantable applications.

With a Ph.D. from KU Leuven in Belgium, Firat has authored more than 100 peer-reviewed publications along with 20 patents, including a book on low-power biomedical microsystems. He has served on the technical program committees of European Solid State Circuits Conf (ESSCIRC), International Solid State Circuits Conf (ISSCC), and Biomedical Circuits and Systems Conf (BioCAS) and remains Associate Editor for IEEE Trans. of Biomedical Circuits and Systems

TUTORIAL SPEAKERS

Thursday, October 7th

Sameer Sonkusale

“Flexible Bioelectronics On Thread And Textile Substrates”



Sameer Sonkusale is currently a Professor of Electrical and Computer Engineering at Tufts University with a joint appointment in the department of Biomedical Engineering and also Chemical and Biological Engineering. For 2011-2012 and again in 2018-2019, He held a visiting appointment at the Brigham and Women’s Hospital, Harvard Medical School and the Wyss Institute at Harvard University. At Tufts University, Dr. Sonkusale directs an interdisciplinary research group Nano Lab with research focus on flexible bioelectronics, biomedical devices circuits and systems, micro- and nano-fabrication, and point of care diagnostics.

Dr. Sonkusale received his MS and PhD in Electrical Engineering from the University of Pennsylvania. He has received several awards including the National Science Foundation CAREER award in 2010. He is an alumnus of the National Academy of Engineering US Frontiers of Engineering in 2015, and the National Academy of Sciences Arab-America Frontiers in 2014 and 2016. He received the best paper award, and highly cited paper award from the journal Microsystems and Nanoengineering in 2020. Dr. Sonkusale is or has been on the editorial boards of Scientific Reports (Nature), IEEE Transactions on Biomedical Circuits and Systems (past), IEEE Transaction on Circuits and Systems -1 (past), Journal of Low Power Electronics and Application, and Electronic Letters. He is a senior member of the IEEE, and a member of OSA, MRS, BMES and AAAS.

Friday, October 8th

Michiel Pertijs

“Circuits And Systems For Next-Generation Ultrasound Imaging Devices”



Michiel Pertijs received the M.Sc. and Ph.D. degrees in electrical engineering (both cum laude) from Delft University of Technology, Delft, The Netherlands, in 2000 and 2005, respectively. From 2005 to 2008, he was with National Semiconductor, Delft, where he designed precision operational amplifiers and instrumentation amplifiers. From 2008 to 2009, he was a Senior Researcher with imec / Holst Centre, Eindhoven, The Netherlands. In 2009, he joined the Electronic Instrumentation Laboratory of Delft University of Technology, where he is now an Associate Professor. He heads a research group focusing on integrated circuits for medical ultrasound. He has authored or co-authored two books, four book chapters, 15 patents, and over 120 technical papers.

Dr. Pertijs is a member of the technical program committee the European Solid-State Circuits Conference (ESSCIRC), and also served on the program committees of the International Solid-State Circuits Conference (ISSCC) and the IEEE Sensors Conference. He served as an Associate Editor (AE) for the IEEE Open Journal of Solid-State Circuits (O-JSSC) and the IEEE Journal of Solid-State Circuits (JSSC). He received the ISSCC 2005 Jack Kilby Award for Outstanding Student Paper and the JSSC 2005 Best Paper Award. For his Ph.D. research on high-accuracy CMOS smart temperature sensors, he received the 2006 Simon Stevin Gezel Award from the Dutch Technology Foundation STW. In 2014, he was elected Best Teacher of the EE program at Delft University of Technology.

Saturday, October 9th

Herming Chiueh

“Wearable And Implantable Circuits And Systems For Real-Time Seizure Detections, Seizure Predictions, And Closed-Loop Methods For Seizure Suppression In Epilepsy”



Herming Chiueh (Member, IEEE) received the B.S. degree in electrophysics from National Chiao Tung University, Hsinchu, Taiwan, in 1992, and the M.S. and Ph.D. degrees in electrical engineering from the University of Southern California, Los Angeles, CA, USA, in 1995 and 2002, respectively. From 1996 to 2002, he was with the Information Sciences Institute, University of Southern California, Marina del Rey, CA. He is currently an Associate Professor with the Department of Electrical and Computer Engineering, National Yang Ming Chiao Tung University. His research interests include system-on-chip design methodology, low-power integrated circuits, neural interface circuits, and biomimetic systems. Dr. Chiueh is a member of the Technical Committees on Biomedical and Life Science Circuits and Systems and Nanoelectronics and Gigascale of the IEEE Circuits and Systems

Society. He was a co-recipient of the ISSCC 2013 Distinguished-Technical Paper Award to recognize his research in “closed-loop neural-prosthetic SoC.” He has served as the Demonstrations Chair of the 2012 IEEE Biomedical Circuits and Systems (BioCAS) Conference, the Conference Secretariat of the 2007 IEEE SOC Conference, and the Finance Chair of the 2007 IEEE International Workshop on Memory Technology, Design and Testing. He also serves as the Chief Talents and Information Officer of the Asia Silicon Valley Development Agency (ASVDA Program) under the National Development Council, Taiwan. He has served as the Education Affairs Officer of the IEEE Circuits and Systems Society, Taipei Chapter, in 2011.

15:45 – 17:15

A1L-A: Neuromorphic Systems & Quality of Life Technologies

Chairs: Ibrahim Elfadel, Yongfu Li

Neuromorphic Spike Timing Dependent Plasticity with Adaptive OZ Spiking Neurons

Avi Hazan, Elishai Ezra Tsur
Open University of Israel, Israel

Low-Hardware-Cost SNN Employing FeFET-Based Neurons with Tunable Leaky Effect

Hongyi Liu{2}, Xiangao Qi{2}, Yuqing Lou{2}, Liang Qi{2}, Zuo-Wei Yeh{1}, Kea-Tiong Tang{1}, Jian Zhao{2}
{1}National Tsing Hua University, Taiwan; {2}Shanghai Jiao Tong University, China

A Highly Energy-Efficient Hyperdimensional Computing Processor for Wearable Multi-Modal Classification

Alisha Menon, Daniel Sun, Melvin Aristio, Harrison Liew, Kyoungtae Lee, Jan Rabaey
University of California, Berkeley, United States

A Neuromorphic Processing System for Low-Power Wearable ECG Classification

Haoming Chu, Hao Jia, Yulong Yan, Yi Jin, Liyu Qian, Leijing Gan, Yuxiang Huan, Lirong Zheng, Zhuo Zou
Fudan University, China

Benefits of Stochastic Computing in Hearing Aid Filterbank Design

Timothy Baker, Yiqiu Sun, John Hayes
University of Michigan, United States

Evaluation Method of Subjective Sleep Satisfaction by Measurement of Body Movement

Takeshi Muto{1}, Yu Akitaya{1}, Ayumi Nishimura{1}, Aya Orikasa{1}, Kazuma Kurita{1}, Yuki Miyasaka{1}, Joji Ishiwata{1},
Yumiko Muto{2}
{1}Bunkyo University, Japan; {2}Tamagawa University, Japan

15:45 – 17:15

A1L-B: Energy Harvesting & Closed-Loop Systems

Chairs: Yan Liu, Yaoyao Jiang

A New Multilevel Pulsed Modulation Technique for Low Power High Data Rate Optical Biotelemetry

Guido Di Patrizio Stanchieri{2}, Graziano Battisti{2}, Andrea De Marcellis{2}, Marco Faccio{2}, Elia Palange{2}, Timothy G.
Constandinou{1}
{1}Imperial College London, United Kingdom; {2}University of L'Aquila, Italy

A Load-Insensitive Hybrid Back Telemetry System for Wirelessly-Powered Implantable Devices

Hyun-Su Lee{1}, Minjae Kim{2}, Jisan Ahn{1}, Hyung-Min Lee{1}
{1}Korea University, Korea; {2}Samsung Electronics America, Korea

Wirelessly Powered, Batteryless Closed-Loop Biopotential Recording IC for Implantable Leadless Cardiac Monitoring Applications

Jaeun Jang, Iman Habibagahi, Hamed Rahmani, Aydin Babakhani
University of California, Los Angeles, United States

CMOS Neural Probe with Multi-Turn Micro-Coil Magnetic Stimulation

Edward Szoka{1}, Jesse Werth{1}, Thomas Cleland{1}, Shelley Fried{2}, Alyosha Molnar{1}
{1}Cornell University, United States; {2}Massachusetts General Hospital, United States

Novel Wearable Tactile Feedback System for Post-Stroke Rehabilitation

Yahya Abbass, Lucia Seminara, Moustafa Saleh, Maurizio Valle
University of Genoa, Italy

A Biologically-Informed Computational Framework for Pathway-Specific Spiking Patterns Generation and Efficacy Evaluation in Retinal Neurostimulators

Tayebeh Yousefi, Hossein Kassiri
York University, Canada

17:15 – 18:45

A2L-A: Biosensor Devices & Interface Circuits

Chairs: Chung-Chih Hung, Ying Wei

An Ultrasound Imaging Front-End System-on-a-Chip with Element-Level Impedance Matching for Acoustic Reflectivity Reduction

Ahmad Rezvanitabar, Sait Kilinc, Coskun Tekes, Evren Arkan, Maysam Ghovanloo, Levent Degertekin
Georgia Institute of Technology, United States

A Switched-Capacitor Closed-Loop Integration Sampling Front-End for Peripheral Nerve Recording

Jialin Liu, David Allstot
Oregon State University, United States

A 0.4 nJ Excitation Energy Bridge-to-Digital Converter for Implantable Pulmonary Artery Pressure Monitoring

Mustafa Besirli^{1}, Kerim Ture^{1}, Diego Barrettino^{1}, Maurice Beghetti^{2}, Marco Mattavelli^{1}, Catherine Dehollain^{1}, Franco Maloberti^{3}
^{1}École Polytechnique Fédérale de Lausanne, Switzerland; ^{2}Geneva University Hospitals, Switzerland; ^{3}University of Pavia, Italy

Super-Resolution Electrochemical Impedance Imaging with a 100 × 100 CMOS Sensor Array

Kangping Hu, Christopher Arcadia, Jacob Rosenstein
Brown University, United States

Wireless Multimodal Neural Interface Device for Neural Control Studies

Linran Zhao^{2}, Yan Gong^{1}, Wen Li^{1}, Yaoyao Jia^{2}
^{1}Michigan State University, United States; ^{2}University of Texas at Austin, United States

Non-Parametric Genomic Fourier Power Spectra Filter Designs

Micah Thornton^{2}, Monnie McGee^{1}
^{1}Southern Methodist University, United States; ^{2}University of Texas Southwestern, United States

17:15 – 18:45

A1L-B: Electronics for Neuroscience

Chairs: Tim Constandinou, Andrea De Marcellis

Low-Power 256-Channel Nanowire Electrode-on-Chip Neural Interface for Intracellular Electrophysiology

Jun Wang^{2}, Ren Liu^{2}, Youngbin Tchoe^{4}, Alessio Paolo Buccino^{1}, Akshay Paul^{4}, Agnieszka D'Antonio-Chronowska^{4}, Kelly Frazer^{4}, Chul Kim^{3}, Shadi Dayeh^{4}, Gert Cauwenberghs^{4}
^{1}ETH Zürich, Switzerland; ^{2}Harvard University, United States; ^{3}KAIST, Korea; ^{4}University of California, San Diego, United States

Fast Calcium Trace Extraction for Large-Field-of-View Miniscope

Zhe Chen, Garrett Blair, Hugh Blair, Jason Cong
University of California, Los Angeles, United States

A 4-Channel NMES IC for Wearable Applications

Yu-Kai Huang, Ana Rusu, Saul Rodriguez
KTH Royal Institute of Technology, Sweden

High-Performance, Conformable, Stencil Fabricated Graphene μ -Ecog Array

Ridwan Fayaz Hossain^{2}, Jia Hu^{2}, Zahra Navabi^{2}, Alana Tillery^{1}, Suhasa Kodandaramaiah^{2}
^{1}University of Maryland, United States; ^{2}University of Minnesota Twin Cities, United States

A Hardware Implementation of a qEEG-Based Discriminant Function for Brain Injury Detection

Fotios Kostarellos, Ciaran MacNamee, Brendan Mullane
University of Limerick, Ireland

Automated Multiplexed Potentiostat System (AMPS) for High-Throughput Characterization of Neural Interfaces

Travis Massey, Jeremy Gleick, Razi-UI Haque
Lawrence Livermore National Laboratory, United States

An EMG-Based, Real-Time Personal Identification Method Using an Gesture-Detection 1D Convolutional Neural Networks

Lijing Lu, Jingna Mao, Wuqi Wang, Zhiwei Zhang
Institute of Automation, Chinese Academy of Sciences, China

Ultra-Low Power and Area-Efficient Hardware Accelerator for Adaptive Neural Signal Compression

Qier Ma, Liyuan Guo, Seyed Mohammad Ali Zeinolabedin, Christian Mayr
Technische Universität Dresden, Germany

Research on Classification of Patient-Ventilator Asynchrony Using Permutation Disalignment Index

Xiaohao Qiao, Huihui Li, Bo Wang, Fuhai Xiong, Yan Yan, Lei Wang
Shenzhen Institute of Advanced Technology, CAS, Wuhan University of Technology, China

Residual Learning Attention CNN for Motion Intention Recognition Based on EEG Data

Ting Wang, Jingna Mao, Ruozhou Xiao, Wuqi Wang, Guangxin Ding, Zhiwei Zhang
Institute of Automation, Chinese Academy of Sciences, China

Hardware-Oriented Pruning and Quantization of Deep Learning Models to Detect Life-Threatening Arrhythmias

Lizeth Gonzalez-Carabarin^{2}, Alexandre Schmid^{1}, Ruud J.G. van Sloun^{2}
^{1}École Polytechnique Fédérale de Lausanne, Switzerland; ^{2}Eindhoven University of Technology, Netherlands

Slope-Based Event-Driven Feature Extraction for Cardiac Arrhythmia Classification

Julien Duforest^{2}, Benoît Larras^{2}, Deepu John^{3}, Olev Märtens^{1}, Antoine Frappé^{2}
^{1}Tallinn University of Technology Institute of electronics, Estonia; ^{2}Université Lille1, CNRS, Centrale Lille, Junia, Université Polytechnique Hauts-de-France, France; ^{3}University College Dublin, Ireland

EMG Signal Classification Using Reflection Coefficients and Extreme Value Machine

Reza Azhiri^{2}, Mohammad Esmaeili^{2}, Mohsen Jafarzadeh^{1}, Mehrdad Nourani^{2}
^{1}University of Colorado Colorado Springs, United States; ^{2}University of Texas at Dallas, United States

Demystifying Drug Repurposing Domain Comprehension with Knowledge Graph Embedding

Edoardo Ramalli^{1}, Alberto Parravicini^{1}, Guido Walter Di Donato^{1}, Mirko Salaris^{1}, Céline Hudelot^{2}, Marco Domenico Santambrogio^{1}
^{1}Politecnico di Milano, Italy; ^{2}Université Paris-Saclay CentraleSupélec, France

Unsupervised Continuous Time Domain Spike Sorting for Large Scale Neural Processing Systems

Changyun Fu, Tongtong Guo, Yongfu Li, Yan Liu
Shanghai Jiao Tong University, China

Towards Long-Term Non-Invasive Monitoring for Epilepsy via Wearable EEG Devices

Thorir Mar Ingolfsson^{1}, Andrea Cossetti^{1}, Xiaying Wang^{1}, Enrico Tabanelli^{3}, Giuseppe Tagliavini^{3}, Philippe Ryvlin^{2}, Luca Benini^{1}, Simone Benatti^{3}
^{1}ETH Zürich, Switzerland; ^{2}Lausanne University Hospital, Switzerland; ^{3}Università di Bologna, Italy

A 10-Bit, 771 nW Time-Mode ADC with a 2-Step TDC for Bio-Signal Acquisition

Emmanouil Kandilakis, Wouter A. Serdijn, Omer Can Akgun
Delft University of Technology, Netherlands

A CNN-Based Cardiac Arrhythmia Classification Algorithm with Wavelet Transform and Training Sample Balancing Rule

Qinxin Zhou^{1}, Yang Zhao^{2}, Yong Lian^{2}
^{1}Universities of Electronic Science and Technology of China, China; ^{2}York University, Canada

Neuromorphic Adaptive Body Leveling in a Bioinspired Hexapod Walking Robot

Michael Ehrlich, Elishai Ezra Tsur
Open University of Israel, Israel

3D Object Tracking with Neuromorphic Event Cameras via Image Reconstruction

Hadar Cohen Duwek, Avinoam Bitton, Elishai Ezra Tsur
Open University of Israel, Israel

Design of Scalable Neurotransmitter-Mediated Biohybrid Synapse

Kevin White, Mingjie Lin, Brian Kim
University of Central Florida, United States

Silicon Neuron with Programmable Ion Channel Kinematics for Bioelectronic Applications

Elisa Donati, Giacomo Indiveri
University of Zürich and ETH Zürich, Switzerland

Attention State Classification with In-Ear EEG

Akshay Paul, Gopabandhu Hota, Behnam Khaleghi, Yuchen Xu, Tajana Rosing, Gert Cauwenberghs
University of California, San Diego, United States

A 405nW/4.8 μ W Event-Driven Multi-Modal (V/I/R/C) Sensor Interface for Physiological and Environmental Co-Monitoring

Rishika Agarwala, Peng Wang, Benton Calhoun
University of Virginia, United States

A New Light-to-Frequency Analog Front-End Circuit for Optical Sensing in Biomedical Applications

Guido Di Patrizio Stanchieri^{1}, Andrea De Marcellis^{1}, Marco Faccio^{1}, Elia Palange^{1}, Ulkuhan Guler^{2}
^{1}University of L'Aquila, Italy; ^{2}Worcester Polytechnic Institute, United States

Implantable CMOS Image Sensor with a Neural Amplifier for Simultaneous Recording of Optical and Electrophysiological Signals

Kenji Sugie, Kiyotaka Sasagawa, Yasumi Ohta, Hironari Takehara, Makito Haruta, Hiroyuki Tashiro, Jun Ohta
Nara Institute of Science and Technology, Japan

A Filterless Fluorescence Detector Based on a Time-Gated SiPM

Luca Buonanno, Chiara Putelli, Davide Di Vita, Carlo Fiorini, Marco Carminati
Politecnico di Milano, Italy

Stiffness Characterization of Healthy and Deficient Tracheal Cartilage Segments Using Micromachined Piezoresistive Force Sensor

Alekya B, V S N Sitaramgupta V, Hardik J Pandya
Indian Institute of Science, India

A 6 pArms 50 kHz-40 MHz Impedance Sensor for Source-Differential Flow Cytometry

Boyu Shen, Jacob Dawes, Matthew Johnston
Oregon State University, United States

A 1-V Nanopower Highly Tunable Biquadratic Gm-C Bandpass Filter for Fully Implantable Cochlear Implants

Berkay Özbek, Haluk Kùlah
Middle East Technical University, Turkey

Digital Count of Antibodies Through Differential Impedance for High-Resolution Immunosensing

Paola Piedimonte^{2}, Francesco Zanetto^{2}, Fabio Toso^{2}, Vittorio Grimaldi^{2}, Laura Sola^{1}, Marina Cretich^{1}, Alessandro Gori^{1}, Marcella Chiari^{1}, Giorgio Ferrari^{2}, Marco Sampietro^{2}
^{1}Istituto di Scienze e Tecnologie Chimiche, Italy; ^{2}Politecnico di Milano, Italy

A Fluorescent Thin Film-Based Miniaturized Transcutaneous Carbon Dioxide Monitor

Tuna Tufan, Ulkuhan Guler
Worcester Polytechnic Institute, United States

Coupling SiNAPS High-Density Neural Recording CMOS-Probes with Optogenetic Light Stimulation

Fabio Boi, Andrea Locarno, Joao Filipe Ribeiro, Raffaella Tonini, Gian Nicola Angotzi, Luca Berdondini
Fondazione Istituto Italiano di Tecnologia, Italy

Practical Measurement of Voltage-Controlled Current Source Output Impedance for Applications in Transcranial Electrical Stimulation

Charl Linssen^{1}, Pieter Harpe^{2}

^{1}Donders Institute for Brain, Cognition and Behaviour, Radboud University, Netherlands; ^{2}Eindhoven University of Technology, Netherlands

Impedance Monitoring for Nerve Regeneration Using an Implantable Cuff

Adan Acosta Calvillo, Tak-Ho Chu, Daniel Umansky, Alec Lamb, Rajiv Midha, Colin Dalton, Kartikeya Murari
University of Calgary, Canada

17:30 – 19:00

B2L-A: Sensor Networks & Wearable Health Monitoring

Chairs: Paolo Motto Ros, Massimo Barbaro

Design and Implementation of 0.23 nJ/Bit Reference-Spur-Free FSK/OOK Transmitter at 400 MHz for Wearable Health Monitoring

Abhishek Srivastava^{3}, Devarshi Das^{2}, Maryam Shojaei Baghini^{1}

^{1}Indian Institute of Technology Bombay, India; ^{2}Indian Institute of Technology Ropar, India; ^{3}International Institute of Information Technology, Hyderabad, India

Towards Magnetic Field Gradient-Based Imaging and Control of In-Body Devices

Hongxiang Gao, Yubin Lin, Manuel Monge

University of Southern California, United States

Modeling Energy-Aware Photoplethysmography Hardware for Personalized Health Care Applications Across Skin Phototypes

Katheryn Flynn, Natalie Ownby, Peng Wang, Benton Calhoun

University of Virginia, United States

A 3.75 nW Analog Electrocardiogram Processor Facilitating Stochastic Resonance for Real-Time R-Wave Detection

Cihan Berk Güngör^{2}, Patrick Mercier^{2}, Hakan Töreyn^{1}

^{1}San Diego State University, United States; ^{2}University of California, San Diego, United States

An Active Electrode IC with Embedded Analog CMRR Enhancement for Interference- and Gain-Mismatch-Resilient EEG Recording

Alireza Dabbaghian, Hossein Kassiri

York University, Canada

FPGA Acceleration of Pairwise Distance Calculation for Viral Transmission Clustering

Sahand Salamat, Niema Moshiri, Tajana Rosing

University of California, San Diego, United States

17:30 – 19:00

B2L-B: Implantable Medical Electronics

Chairs: Gert Cauwenberghs, Maurizio Valle

An Electronic Osteosynthesis Implant for Continuous Load Monitoring Using a Strain Gauge

Christian Adam{2}, Tobias Barth{1}, Matthias Münch{1}, Klaus Seide{1}, Wolfgang Krautschneider{2}
{1}BG Hospital Hamburg, Germany; {2}Hamburg University of Technology, Germany

Ultrasonic Backscatter Communication for Brain Implants: Mathematical Model, Simulation, and Measurement

Magnus Christensen{1}, Milad Zamani{1}, Amin Rashidi{2}, Farshad Moradi{1}
{1}Aarhus University, Denmark; {2}Delft University of Technology, Netherlands

Design and Evaluation of Electronic-Microsaccade with Balanced Stimulation for Artificial Vision System

Yaogan Liang{2}, Zhengyang Qian{2}, Bang Du{2}, Jinming Ye{2}, Kohei Nakamura{2}, Shengwei Wang{2}, Hisashi Kino{2}, Takafumi Fukushima{2}, Koji Kiyoyama{1}, Tetsu Tanaka{2}
{1}Nagasaki Institute of Applied Science, Japan; {2}Tohoku University, Japan

Evaluation of Stimulation Waveforms for Safe and Efficient Peripheral Nervous System Activation

Louis Regnacq{3}, Roland Giraud{3}, Arianna Ortega Sanabria{1}, Anil Thota{1}, Laure Roversi{3}, Morteza Rouhani{2}, Laura McPherson{5}, James Abbas{2}, Ranu Jung{1}, Olivier Romain{3}, Sylvie Renaud{4}, Yannick Bornat{4}, Florian Kölbl{3}
{1}Adaptive Neural Systems Laboratory, Florida International University, United States; {1}Adaptive Neural Systems Laboratory, Florida International University, France; {2}Arizona State University, United States; {3}ETIS, UMR 8051, CY Cergy Paris Universi

A Temperature-Aware Fully-Wireless mm-Scale Optically-Enhanced Optogenetic Neuro-Stimulator

Tayebeh Yousefi, Ksenia Timonina, Georg Zoidl, Hossein Kassiri
York University, Canada

A Bluetooth Low Energy (BLE)-Enabled Microdevice for Activity-Dependent Stimulation in Nonhuman Primates

Nicholas Vitale{1}, Christopher Delianides{1}, David Guggenmos{2}, Meysam Azin{1}, Heather Hudson{2}, Randolph Nudo{2}, Pedram Mohseni{1}
{1}Case Western Reserve University, United States; {2}University of Kansas Medical Center, United States

13:00 – 14:15

Biomedical Circuits & Systems II Poster Session

Automated Real-Time Tracking System for Socially-Housed Physically Identical Mice

Yanbo Wang^{1}, Alena V. Savonenko^{2}, Ralph Etienne-Cummings^{1}

^{1}Johns Hopkins University, United States; ^{2}Johns Hopkins University School of Medicine, United States

Assessment of Over-Pronated/Over-Supinated Foot Using Foot-Motion Measured by an In-Shoe Motion Sensor

Chenhui Huang, Zhenwei Wang, Kenichiro Fukushi, Fumiyuki Nihey, Hiroshi Kajitani, Kentaro Nakahara

NEC Corporation, Japan

Minimization of Routing Area in MEDA Biochips

Chiharu Shiro, Hiroki Nishikawa, Xiangbo Kong, Hiroyuki Tomiyama, Shigeru Yamashita

Ritsumeikan University, Japan

Energy-Efficient Modular RF Interface for Fully Implantable Electrical Devices in Small Rodents

Franz Plocksties^{1}, Obaid Ullah Shah^{1}, Felix Uster^{1}, Munawar Ali^{1}, Maximilian Koschay^{1}, Maria Kober^{2}, Alexander Storch^{2}, Dirk Timmermann^{1}

^{1}Institute of Applied Microelectronics and Computer Engineering, University of Rostock, Germany; ^{2}University of Rostock, Germany

Registration and Fusion of Visible Light and IRT Images in Neurosurgery

Yahya Moshaei-Nezhad, Juliane Müller, Martin Oelschlägel, Matthias Kirsch, Ronald Tetzlaff

Technische Universität Dresden, Germany

The Impact of the AFE BPF in Ultrasound Harmonic Imaging: An In-Vitro Phantom Study

Meiyi Zhou^{1}, Peiran Chen^{1}, Andreas M.A.O. Pollet^{1}, Sotir Ouzounov^{2}, Simona Turco^{1}, Jaap M.J. Den Toonder^{1}, Massimo Mischi^{1}, Eugenio Cantatore^{1}, Pieter Harpe^{1}

^{1}Eindhoven University of Technology, Netherlands; ^{2}Philips Research, Netherlands

Superpixel-Based Segmentation and Classification of Gastrointestinal Landmarks and Diseases

Hika Dalju, Muhammad Rushdi, Ahmed Morsy

Cairo University, Egypt

Improvements to a Biomechanical Model of the Cardiovascular and Respiratory System

Andreas Kitzig^{2}, Edwin Naroska^{2}, Gudrun Stockmanns^{2}, Reinhard Viga^{3}, Anton Grabmaier^{1}

^{1}Fraunhofer IMS and University of Duisburg-Essen, Germany; ^{2}Hochschule Niederrhein University of Applied Science, Germany; ^{3}University of Duisburg-Essen, Germany

Orientation-Insensitive Multi-Antenna Reader for Wireless Biomedical Applications

Nilan Udayanga, Yubin Lin, Manuel Monge

University of Southern California, United States

Estimation of Positions and Orientations of Activated Muscle Fibers with Electrode Array

Mian Wang, Shihan Ma, Zihang Geng, Chen Chen, Xinjun Sheng, Xiangyang Zhu

Shanghai Jiao Tong University, China

Active Capacitive ECG System with All-Digital “Driven Right Leg” Common Mode Suppression

Tom Torfs, Aakash Patel, Ivan Castro

imec, Belgium

Corona Virus Disease 2019 Respiratory Cycle Detection Based on Convolutional Neural Network

Jing Wang^{3}, Ping Chen^{1}, Cheng Zhang^{2}, Yi Kang^{3}

^{1}Beijing Yiemed Medical Technology Co., Ltd, China; ^{2}Jiangsu Province Hospital of Chinese Medicine, China;

^{3}University of Science and Technology of China, China

Securing Biochemical Samples Using Molecular Barcoding on Digital Microfluidic Biochips

Tung-Che Liang{1}, Tatjana Abaffy{1}, Hiroaki Matsunami{1}, Krishnendu Chakrabarty{1}, Ramesh Karri{2}
{1}Duke University, United States; {2}New York University, United States

Low Latency Protocols Investigation for Event-Driven Wireless Body Area Networks

Andrea Mongardi, Fabio Rossi, Elia Pellegrino, Paolo Motto Ros, Massimo Ruo Roch, Maurizio Martina
Politecnico di Torino, Italy

A Low-Cost Ambu-Bag Based Ventilator for Covid-19 Pandemic

Mohit Kumar{2}, Ravinder Kumar{2}, Vishal Kumar{2}, Amanpreet Chander{2}, Vivek Gupta{1}, Ashish Kumar Sahani{2}
{1}Dayanand Medical College & Hospital, India; {2}Indian Institute of Technology Ropar, India

A Wireless Implantable Potentiostat for Programmable Electrochemical Drug Delivery

Max Wang, Pyungwoo Yeon, Christian Chamberlayne, Mohammad Mofidfar, Haixia Xu, Justin Annes, Richard Zare, Amin Arbabian
Stanford University, United States

Finite Element Simulation of a Microdroplet Generation System for an Implantable Liquid Sampling Probe

Dominic Gauvreau, Gabriel Lachance, Hamza Landari, Élodie Boisselier, Mounir Boukadoum, Younès Messaddeq, Amine Miled
Université Laval, Canada

A System to Facilitate Early and Progressive Ambulation Using Fiducial Markers

Alec Steele{2}, Mehrdad Nourani{2}, Melinda Bopp{1}, Dennis Sullivan{1}
{1}Central Arkansas Veterans Healthcare System, United States; {2}University of Texas at Dallas, United States

Single-Battery Cooperative Sensors for Multi-Lead Long Term Ambulatory ECG Measurement

Komail Badami, Marc Pons-Sole, Erfan Azarkhish, Andre Fivaz, Michaël Rapin, Olivier Chételat, Stéphane Emery
CSEM, Switzerland

Injectable Temperature Sensors Based on Passive Rectification of Volume-Conducted Currents

Laura Becerra-Fajardo, Aracelys García-Moreno, Nerea Alvarez de Eulate Llano, Antoni Ivorra
Universitat Pompeu Fabra, Spain

Improving Full-FORCE with Dynamical Data Coupling and Multilayer Architecture

Yue Yin, Emre Neftci
University of California, Irvine, United States

Modeling and Analysis of the Electrolyte Voltage Drop in Dielectrophoresis Actuators

Alexander Frey{1}, Niklas Boldt{4}, Arohi Barai{3}, Mario Birkholz{3}, Ingo Kuehne{2}, Roland Thewes{4}
{1}Augsburg University of Applied Sciences, Germany; {2}Heilbronn University, Germany; {3}IHP - Leibniz-Institut für innovative Mikroelektronik, Germany; {4}Technische Universität Berlin, Germany

Exploiting Heterogeneous Architectures for Rigid Image Registration

Eleonora D'Arnese, Emanuele Del Sozzo, Davide Conficconi, Marco Domenico Santambrogio
Politecnico di Milano, Italy

Multiple Ion-Channel ISFET Neuron for Lab-on-Chip Applications

Prateek Tripathi, Nicolas Moser, Pantelis Georgiou
Imperial College London, United Kingdom

Impedance Matching in Dielectrophoresis Experiments

Niklas Boldt{2}, Danai Malti{2}, Sebastian Damm{2}, Arohi Barai{1}, Mario Birkholz{1}, Roland Thewes{2}
{1}IHP - Leibniz-Institut für innovative Mikroelektronik, Germany; {2}Technische Universität Berlin, Germany

An IoT-Enabled Automated Tight-Glycemic-Control System for Intensive Care

Muhammad Rizwan Khan{2}, Farasat Munir{2}, Cheng Huang{1}
{1}Iowa State University, United States; {2}Lahore University of Management Sciences, Pakistan

Motion Robust Remote Photoplethysmography via Frequency Domain Motion Artifact Reduction

Suraj Hebbbar, Takashi Sato
Kyoto University, Japan

Video Based Heart Rate Extraction Using Skin ROI Segmentation and Attention CNN

Hongbo Guo^{1}, Yang Zhao^{2}, Yong Lian^{2}
^{1}Lanzhou University, China; ^{2}York University, Canada

17:30 – 19:00

C2L-A: Point-of-Care Technologies & Biomedical Image Processing

Chairs: Pantelis Georgiou, Makito Haruta

Filterless TRF Reader with CMOS Sensor ASIC for Lateral Flow Immunoassays

Alexander Hofmann^{1}, Peggy Reich^{1}, Martin Grabmann^{1}, Georg Gläser^{1}, Max Trübenbach^{2}, Alexander Rolapp^{1}, Marco Reinhard^{1}, Friedrich Scholz^{2}, Eric Schäfer^{1}
^{1}IMMS Institut für Mikroelektronik- und Mechatronik-Systeme gemeinnützige GmbH, Germany; ^{2}Senova Gesellschaft für Biowissenschaft und Technik mbH, Germany

Adaptive Few-Shot Learning PoC Ultrasound COVID-19 Diagnostic System

Michael Karnes^{1}, Shehan Perera^{1}, Srikar Adhikari^{2}, Alper Yilmaz^{1}
^{1}Ohio State University, United States; ^{2}University of Arizona Medical Center, United States

Continuous Wave Dental Doppler Ultrasound System for Measuring Pulp Blood Flow

Jaebum Park^{3}, Yeongdae Kim^{1}, Jungyeon Kim^{2}, Tai-Kyong Song^{3}
^{1}Samsung Electronics Device Solutions, Korea; ^{2}Samsung Medison Co., Ltd., Korea; ^{3}Sogang University, Korea

Compressed Sensing Inspired Neural Decoder for Undersampled MRI with Self-Assessment

Filippo Martinini^{2}, Mauro Mangia^{2}, Fabio Pareschi^{1}, Riccardo Rovatti^{2}, Gianluca Setti^{1}
^{1}Politecnico di Torino, Italy; ^{2}Università di Bologna, Italy

Portable Imaging System for Real-Time Cavitation Monitoring

Yujin Kim, Euisuk Chung, Minsung Cho, Tai-Kyong Song
Sogang University, Korea

17:30 – 19:00

C2L-B: Biosignal Recording, Processing, & Machine Learning

Chairs: Shuenn-Yuh Lee, Kiyotaka Sasagawa

A Modulated Template-Matching Approach to Improve Spike Sorting of Bursting Neurons

Payam Sadeghi Shabestari^{1}, Alessio Paolo Buccino^{1}, Sreedhar Saseendran Kumar^{1}, Alessandra Pedrocchi^{2}, Andreas Hierlemann^{1}
^{1}ETH Zürich, Switzerland; ^{2}Politecnico di Milano, Italy

An Automatic Delineator for Arterial Blood Pressure Waveforms Using U-Net Architecture

Jianzhong Chen, Yi Sun, Ke Sun, Xinxin Li
Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, China

Multi-Task Learning Mixed-Signal Classifier for In-Situ Detection of Atrial Fibrillation and Sepsis

Sudarsan Sadasivuni^{2}, Sumukh Prashant Bhanushali^{2}, Sai Srinivasa Singamsetti^{2}, Imon Banerjee^{1}, Arindam Sanyal^{2}
^{1}Emory University, United States; ^{2}State University of New York at Buffalo, United States

An MCU Implementation of PCA/PSA Streaming Algorithms for EEG Features Extraction

Luciano Prono^{1}, Alex Marchioni^{2}, Mauro Mangia^{2}, Fabio Pareschi^{1}, Riccardo Rovatti^{2}, Gianluca Setti^{1}
^{1}Politecnico di Torino, Italy; ^{2}Università di Bologna, Italy

Subject-Independent Freezing of Gait (FoG) Prediction in Parkinson's Disease Patients

Toygun Basaklar, Yigit Tuncel, Umit Ogras
University of Wisconsin - Madison, United States

Denoising for Enhancing Signal-to-Noise Ratio in Proton Sound Detectors

Elia Arturo Vallicelli^{1}, Matteo Corona^{2}, Marco Dell'Acqua^{2}, Andrea Baschirotto^{2}, Marcello De Matteis^{2}
^{1}Università degli Studi Milano-Bicocca and National Institute for Nuclear Physics, Italy; ^{2}University of Milano-Bicocca, Italy

BIOCAS 2021 - SATURDAY, OCTOBER 9TH

15:00 – 17:00

D1L-A: Live Demo Session

Chairs: Sara Ghoreishizadeh, Kerim Ture

Live Demonstration: An IoT Wearable Device for Real-Time Blood Glucose Prediction with Edge AI

Lei Kuang^{1}, Taiyu Zhu^{1}, Kezhi Li^{2}, John Daniels^{1}, Pau Herrero^{1}, Pantelis Georgiou^{1}
^{1}Imperial College London, United Kingdom; ^{2}University College London, United Kingdom

Live Demonstration: Real-Time and High-Speed Ion Imaging Using CMOS ISFET Arrays

Lei Kuang, Junming Zeng, Pantelis Georgiou
Imperial College London, United Kingdom

Live Demonstration: Event-Driven Hand Gesture Recognition for Wearable Human-Machine Interface

Martina Becchio, Niccolò Voster, Andrea Prestia, Andrea Mongardi, Fabio Rossi, Paolo Motto Ros, Massimo Ruo Roch, Maurizio Martina, Danilo Demarchi
Politecnico di Torino, Italy

Live Demonstration: Real-Time EEG-Based Affective Computing Using On-Chip Learning Long-Term Recurrent Convolutional Network

Cheng-Jie Yang, Wei-Chih Li, Meng-Teen Wan, Wai-Chi Fang
National Yang Ming Chiao Tung University, Taiwan

Live Demonstration: Real-Time Calcium Trace Extraction from Large-Field-of-View Miniscope

Zhe Chen, Garrett Blair, Changliang Guo, Daniel Aharoni, Hugh Blair, Jason Cong
University of California, Los Angeles, United States

Live Demonstration: DoMoMEA- a Neuromotor Telerehabilitation System for Post-Stroke Patients

Elisa Gusai^{2}, Andrea Zedda^{2}, Salvatore Spanu^{2}, Giulia Baldazzi^{2}, Marco Caruso^{1}, Stefano Bertuletti^{3}, Andrea Pibiri^{2}, Marco Monticone^{2}, Andrea Cereatti^{1}, Danilo Pani^{2}
^{1}Politecnico di Torino, Italy; ^{2}University of Cagliari, Italy; ^{3}University of Sassari, Italy