



INTERNATIONAL CONFERENCE
ON NEUROMORPHIC, NATURAL
AND PHYSICAL COMPUTING

Program of NNPC 2023

General program

Day 1: 25/10/2023	
Welcome address: VW-Foundation and conference chairs	8:45 - 9:00
Session 1/1: Theory: new concepts and mathematical foundations. Chair: Anna Levina	9:00-10:30
Keynote: Christof Teuscher, Material and physical reservoir computing for beyond-CMOS electronics	9:00-10:00
TH.C1: Johannes Zierenberg , Flexible tuning to task requirements via input statistics, local learning, and homeostatic plasticity	10:00-10:30
Coffee break	10:30-11:00
Session 1/2: Theory: new concepts and mathematical foundations	11:00-12:00
TH.C2: Guillaume Pourcel , Recurrent Neural Networks: from prediction to representation, a dynamical systems perspective	11:00-11:30
TH.C3: Gouhei Tanaka , Diverse-timescale echo state networks for multiscale modeling	11:30-12:00
Lunch break	12:00-13:30
Session 2: Physical Substrates: materials, devices, micro-architectures. Chair: Thomas Van Vaerenbergh	13:30-16:00
Keynote: Julie Grollier, The power of Equilibrium Propagation for training neuromorphic systems	13:30-14:30
PS.C1: Melika Payvand , Dendritic computation through exploiting resistive memories as both delays and weights	14:30-15:00
PS.C2: Anas Skalli , A high performance fully tunable laser-based neural network	15:00-15:30
PS.C3: Hermann Osterhage , Neuromorphic matter bottom-up constructed from individual atoms	15:30-16:00
Coffee discussion plus Plenary I: John Paul Strachan (17:00-18:00)	16:00-18:00
Dinner	18:00-19:30
Evening lecture: Yves Fregnac, From metaphors of the human mind to the myth of digital consciousness	19:30-20:30



Day 2: 26/10/2023	
Session 3/1: Guides from Nature: neuroscience, theoretical biology, complex systems. Chair: Mihai Petrovici	9:00-10:30
Keynote: Walter Senn, A theoretical physics guide to neuroscience and cognition	9:00-10:00
GN.C1: Younes Bouhadjar , Bio-inspired sequence learning mechanisms and their implementation in a memristive neuromorphic hardware	10:00-10:30
Coffee break	10:30-11:00
Session 3/2: Guides from Nature: neuroscience, theoretical biology, complex systems.	11:00-12:00
GN.C2: Kevin Max , Learning efficient backprojections cross cortical hierarchies in real time	11:00-11:30
GN.C3: Tanguy Cazalets , New insights on homeostatic activity-dependent structural plasticity in rate based neural networks	11:30-12:00
Lunch break	12:00-13:30
Session 4: Scaling Up: modular architectures, complex data structures and processes. Chair: Christopher Bennett	13:30-16:00
Keynote: Brad Aimone, The Pursuit of the Brain's Ubiquitous Stochasticity	13:30-14:30
SU.C1: Alpha Renner , Neuromorphic hyperdimensional visual scene factorization	14:30-15:00
SU.C2: Miguel C Soriano , Physical implementation of a deep recurrent neural network folded in time	15:00-15:30
SU.C3: Ria Talukder , Large scalable electro-optical spiking neural network	15:30-16:00
Coffee discussion	16:00-17:00
Poster session I	17:00-19:00
Banquet	19:00-21:00



Day 3: 27/10/2023	
Session 5/1: APplications: demonstrators, use-cases, user interfacing, hybrid solutions. Chair: Xavier Porte	9:00-10:30
Keynote: Chiara Bartolozzi, Neuromorphic engineering to improve robotic perception	9:00-10:00
AP.C1: Fabian Boehm , Teaching Ising machines new tricks: Accelerating Monte-Carlo sampling and machine learning	10:00-10:30
Coffee break	10:30-11:00
Session 5/2: APplications: demonstrators, use-cases, user interfacing, hybrid solutions.	11:00-12:00
AP.C2: Nathan Leroux , Spiking Online Transformer with for Fast Prosthetic Hand Control	11:00-11:30
AP.C3: Mustafa Yildirim , Nonlinear Computing with Lithium Niobate Waveguide	11:30-12:00
Lunch break	12:00-13:30
Plenary II: Harish Bhaskaran, Higher-dimensional processing using a photonic tensor core with continuous-time data	13:30-14:30
Coffee discussion	14:30-15:30
Poster session II	14:30-17:00
Poster prize and closing remarks	17:30-18:00



Poster presentations

AP.P1	Romain Lance	Study of the C-band dynamical response of an injection locked LA-EEL for fully integrated telecommunication data processing
AP.P10	Andre Walter	Spiking Sensors for Neuromorphic Systems
AP.P11	Mohammad Hizzani	Mapping NP-Complete Problems to Physics-Based QUBO Solvers: Quantitative Comparison and Understanding
AP.P2	Oliver Neill	Gradient-Free Optimisation of Photonic Neural Networks
AP.P3	Zolfagharinejad	Brain-Inspired Computing Systems
AP.P4	Mingwei Yang	Optical Convolutional Neural Network with Atomic Nonlinearity
AP.P5	Julian Goeltz	Gradient-based methods for spiking physical systems
AP.P6	Melika Payvand	GMap : An Open-source Efficient Compiler for Mapping any Network onto any Neuromorphic Chip
AP.P7	Iker Oguz	Programming High-Dimensional Optical Nonlinearities with Online Modelling
AP.P8	Enrico Picco	High Speed Neuromorphic Computing for Real-Time Applications
AP.P9	Dana Hariga	Classification of sEMG signals for hand prostheses without preprocessing
GN.P1	Viktoria Zemliak	Spike synchrony as a measure of Gestalt structure
GN.P10	Dongshu Liu	Unsupervised Equilibrium Propagation
GN.P11	Atilla Schreiber	Biologically-plausible hierarchical chunk learning on mixed-signal neuromorphic hardware
GN.P2	Tim Bax	Dendritic Computing
GN.P3	Stefanteodor Iacob	Distance-Based Delay Networks
GN.P4	Aditya Kar	The Terabrain Project: Simulating billions of spiking neurons on standard computer hardware
GN.P5	Satoshi Sunada	Neural time-delay dynamics trained without backpropagation
GN.P6	Pascal Nieters	From dendritic computation to symbolic operation
GN.P7	Alex Dimitrov	Sensitivity Analysis of Point Neuron Model Simulations Implemented on Neuromorphic Hardware
GN.P8	Hazem Toutounji	What Are Autapses Good for?
GN.P9	Fatemeh Hadaeghi	Unlocking Reservoir Computing's Potential: Non-Random Connectivity Patterns and Memory Capacity
PS.P1	Albert S Y Wong	Brain-inspired Computable Chemical Reaction Networks
PS.P10	Martin Salinga	Phase Change Materials for Physical Computing
PS.P11	Melika Payvand	Few-shot learning on brain-inspired small-world graphical hardware
PS.P12	Mohab Abdalla	Exploring the bandwidth-limited readout in coherent photonic reservoir computing
PS.P13	Niclas Goetting	Exploring quantum mechanical advantage for reservoir computing
PS.P14	Peter Bienstman	Optical Computing in Silicon Photonics: Self-Adapting Ring Networks and Quantum Recurrent Neural Networks
PS.P15	Ryosho Nakana	Reservoir Computing with Spin Waves Propagating via a Continuous Magnetic Film on a Chip
PS.P16	Simon Brown	Networks of Nanoparticles and Nanowires for Brain-like Computation
PS.P17	Toon Sevenants	Influence of annealing schemes on the success rate of Ising machines
PS.P2	Alessandro Lupo	Deep neuromorphic computing with optical frequency combs
PS.P3	Andreas Grenmyr	Synapses with homo/hetero-synaptic plasticity enabled by ferroelectric polarization modulated Schottky diodes
PS.P4	Corentin Delacour	A Physical Computing Approach based on Coupled Oscillators for Nondeterministic Polynomial-time Hard Problems



PS.P5	Frederik Lohof	Information dynamics and effects of disorder in quantum reservoir computing
PS.P6	Giulia Marcucci	Broadband Frequency-Division Multiplexing in Visually Evoked Potentials Enables Image Transmission and Physical Computing
PS.P7	Jeremei Laydevant	Training an Ising Machine with Equilibrium Propagation
PS.P8	Josh Mallinson	Reservoir Computing using Percolating Networks of Nanoparticles
PS.P9	Leo Jih Liang	Programming Spatial-Spectral Optimization for Multimode Fiber- Based Optical Learning Machines
SU.P1	Jari Kunkel	Routing brain traffic through the von Neumann bottleneck: Optimization strategies for efficient spike delivery in large-scale network simulations on conventional hardware
SU.P10	Miguel C Soriano	Physical implementation of a deep recurrent neural network folded in time
SU.P11	Diego Arguello Ron	On the Noise Robustness of Analog Complex-Valued Neural Networks
SU.P12	Steven Abreu	Developing a Framework for Programming Physical Computing Systems
SU.P2	Raphael Cardoso	Mathematical-Write: a counterpoint of analog computing crossbars exemplified by photonics
SU.P3	Johanna Senk	Performance Benchmarks for Neuromorphic Systems at Scale
SU.P4	Jan Finkbeiner	Exploiting Sparsity for Accelerated SNN Training on Graphcore IPUs
SU.P5	Andrew Walter	Artificial Neural Microcircuits as Building Blocks for Neuromorphic Systems
SU.P6	Adria Grabulosa	Next generation of 3D printed photonic circuits for scalability and high-performance hybrid integration
SU.P7	Lingduo Li	Additional Parallelism for WDM-based Photonic Integrated Convolutional Neural Network
SU.P8	Elizabeth Robertson	A 3-layer injection-locked multimode semiconductor laser neural network
SU.P9	Simon Tricard	Self-assembly of nanoobjects as a bottom-up strategy for the elaboration of neuromorphic materials
TH.P1	Radu Cimpan	Exploring and updating the mathematical model behind the olfactory sense
TH.P10	Egor Manuylovich	Artificial neural networks using stochastic resonances
TH.P2	Piper Powell	Neuromorphic Computing: History, Current Status, and Future
TH.P3	Lina Jaurique	Explicit memory tuning for reservoir computing optimization
TH.P4	Fernandes da Cunha	Chemical Reaction Hypergraphs: Toward Efficient Computing
TH.P5	Jamie Lohhoff	Optimizing Gradient Accumulation in Spiking Neural Networks with AlphaGrad
TH.P6	Claudio Galliccio	Recurrent Neural Networks with intrinsically critical dynamics
TH.P7	Nosrat Nezami	Time scale-plasticity learning rule for dendritic neuron model to achieve online time-invariant sequence processing
TH.P8	Jacobus Lamers	Using continuation methods to analyse the difficulty of problems solved by Ising machines
TH.P9	Anne-Men Huijzer	Networks of memristors and the effective memristor