Memory technologies with multi-scale time constants for neuromorphic architectures

Résultats

Informations projet

MeM-Scales

N° de convention de subvention: 871371

Site Web du projet

DOI
10.3030/871371

Projet clôturé

Date de signature de la CE
5 Decembre 2019

Date de début
1 Janvier 2020

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30 Juin 2023

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CORDIS fournit des liens vers les livrables publics et les publications des projets HORIZON.

Les liens vers les livrables et les publications des projets du 7e PC, ainsi que les liens vers certains types de résultats spécifiques tels que les jeux de données et les logiciels, sont récupérés dynamiquement sur OpenAIRE.

Livrables

Other (1)

Project web-site on line with public and restricted areas and project logo defined

Project website on line with public and restricted areas and project logo defined

Documents, reports (9)

Report on test structures including memory devices with short-to-medium timescales

Report on test structures including memory devices with shorttomedium timescales

Report describing use-cases and benchmarks for non-conventional memory devices

Report describing usecases and benchmarks for nonconventional memory devices

Layout and circuit simulation results of the multi-time scale analog synapse and neuron circuits

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Report on theoretical models benchmarking

Report on CMOS circuit implementation for local synapse array, including how the interfaces to the TFT neuron chip have been properly dealt with

Report on CMOS circuit implementation for local synapse array including how theinterfaces to the TFT neuron chip have been properly dealt with

Report on options for the computational extension of physically obtained timescales

Summary report on lessons learnt about hardware- and application-centered timescale management

Summary report on lessons learnt about hardware and applicationcentered timescale management

Description and simulation results of the asynchronous circuits used for multi-core routing

Description and simulation results of the asynchronous circuits used for multicore routing

Report comprising (i) a critical survey of existing proposed models of unconventional computing, and (ii) a novel proposal for (components of) a model of computing in indeterminate hardware which resolves (some of) the defects found in existing approaches

Report comprising i a critical survey of existing proposed models of unconventionalcomputing and ii a novel proposal for components of a model of computing in indeterminate hardware which resolves some of the defects found in existing approaches

Demonstrators, pilots, prototypes (1)

Chip software interface for controlling biases, sending input spiketrains and receiving output spike trains

Chip software interface for controlling biases sending input spiketrains and receiving output spike trains

Publications

Conference proceedings (7)

Implementation of binary stochastic STDP learning using chalcogenide-based memristive devices
Auteurs: C. Mohan, L. A. Camuñas-Mesa, J. M. de la Rosa, T. Serrano-Gotarredona, B. Linares-Barranco
Publié dans: Proceedings of the 2021 IEEE Int. Symp. on circ. and Syst., Numéro annual, 2021
Éditeur: IEEE

Empirical study on the efficiency of Spiking Neural Networks with axonal delays, and algorithm-hardware benchmarking
Auteurs: Alberto Patiño-Saucedo, Amirreza Yousefzadeh, Guangzhi Tang, Federico Corradi, Bernabé Linares-Barranco, Manolis Sifalakis
Publié dans: Proceedings of the 2023 IEEE Symposium on Circuits and Systems, Numéro annual, 2023
Éditeur: IEEE
DOI: 10.1109/iscas46773.2023.10181778

Dendritic Computation through Exploiting Resistive Memory as both Delays and Weights
Auteurs: Melika Payvand, Simone D'Agostino, Filippo Moro, Yigit Demirag, Giacomo Indiveri, Elisa Vianello
Publié dans: ACM ICONS 2023, 2023, ISBN 978-1-4503-9789-6
Éditeur: ACM

Experimental Body-Input Three-Stage DC Offset Calibration Scheme for Memristive Crossbar

Auteurs: Charanraj Mohan, L. A. Camunas-Mesa, Elisa Vianello, Carlo Reita, Jose M. de la Rosa, Teresa Serrano-Gotarredona, Bernabe Linares-Barranco
Publié dans: 2020 IEEE International Symposium on Circuits and Systems (ISCAS), Numéro annual, 2020, Page(s) 1-5, ISBN 978-1-7281-3320-1
Éditeur: IEEE
DOI: 10.1109/iscas45731.2020.9180811

Synaptic metaplasticity with multi-level memristive devices

Auteurs: Simone D'Agostino, Filippo Moro, Tifenn Hirtzlin, Julien Arcamone, Niccolò Castellani, Damien Querlioz, Melika Payvand, Elisa Vianello
Publié dans: 2023 IEEE 5th International Conference on Artificial Intelligence Circuits and Systems (AICAS), 2023, ISBN 978-1-7281-9201-7
Éditeur: IEEE
DOI: 10.1109/aicas57966.2023.10168563

PCM-Trace: Scalable Synaptic Eligibility Traces with Resistivity Drift of Phase-Change Materials

Auteurs: Yigit Demirag; Filippo Moro; Thomas Dalgaty; Gabriele Navarro; Charlotte Frenkel; Giacomo Indiveri; Elisa Vianello; Melika Payvand
Publié dans: ISCAS, Numéro 2, 2021, ISBN 978-1-7281-9201-7
Éditeur: IEEE
DOI: 10.1109/iscas51556.2021.9401446

Hardware calibrated learning to compensate heterogeneity in analog RRAM-based Spiking Neural Networks

Auteurs: Filippo Moro, E. Esmanhotto, T. Hirtzlin, N. Castellani, A. Trabelsi, T. Dalgaty, G. Molas, F. Andrieu, S. Brivio, S. Spiga, G. Indiveri, M. Payvand, and E. Vianello
Publié dans: Proceedings of the 2022 IEEE Int. Symp. on circ. and Syst., 2022, ISBN 978-1-7281-3320-1
Éditeur: IEEE
DOI: 10.1109/iscas48785.2022.9937820

Peer reviewed articles (10)

Toward a formal theory for computing machines made out of whatever physics offers

Auteurs: Jaeger, H., Noheda, B. & van der Wiel, W.G.
Publié dans: Nature Communications, Numéro 14, 2023, Page(s) 4911, ISSN 2041-1723
Éditeur: Nature Publishing Group
DOI: 10.1038/s41467-023-40533-1

Toward a generalized theory comprising digital, neuromorphic, and unconventional computing

Auteurs: Herbert Jaeger
Publié dans: Neuromorphic computing and engineering, 1:012002. IOP PUBLISHING LTD, Numéro 1, 2021, ISSN 2634-4386
Éditeur: IOP PUBLISHING LTD
DOI: 10.1088/2634-4386/abf151

2022 roadmap on neuromorphic computing and engineering

Auteurs: Dennis V Christensen; Regina Dittmann; Bernabe Linares-Barranco; Abu Sebastian; Manuel Le Gallo; Andrea Redaelli; Stefan Slesazeck; Thomas Mikolajick; Sabina Spiga; Stephan Menzel; Ilia Valov; Gianluca Milano; Carlo Ricciardi; Shi-Jun Liang; Feng Miao; Mario Lanza; Tyler J Quill; Scott T Keene; Alberto Salleo; Julie Grollier; Danijela Marković; Alice Mizrahi; Peng Yao; J Joshua Yang; Giacomo Indi
Publié dans: Furber , S & et , A 2022 , ' 2022 roadmap on neuromorphic computing and engineering ' , Neuromorphic Computing and Engineering , vol. 2 , no. 2 . https://doi.org/10.1088/2634-4386/ac4a83, Numéro 16, 2022, ISSN 1742-6588
Éditeur: Institute of Physics
DOI: 10.17863/cam.85857

Ultra-Low-Power FDSOI Neural Circuits for Extreme-Edge Neuromorphic Intelligence

Auteurs: Arianna Rubino; Can Livanelioglu; Ning Qiao; Melika Payvand; Giacomo Indiveri
Publié dans: IEEE Transactions on Circuits and Systems I: Regular Papers, 68 (1), Numéro 5, 2020, ISSN 1549-8328
Éditeur: Institute of Electrical and Electronics Engineers
DOI: 10.1109/tcsi.2020.3035575

a roadmap

Auteurs: Abad, B; Alberi, K; Ayers, KE; Badhulika, S; Ban, C; Béa, H; Béron, F; Cairney, J; Chang, JP; Charles, C; Creatore, M; Dong, H; Du, J; Egan, R; Everschor-Sitte, K; Foley, C; Fontcuberta I Morral, A; Jung, MH; Kim, H; Kurtz, S; Lee, J; Leitao, DC; Lemmer, K; Marschilok, AC; Mitu, B; Newman, BK; Owens, R; Pappa, AM; Park, Y; Peckham, M; Rossi, LM; Shim, SH; Siddiqui, SA; Son, JW; Spiga, S; Tsikata
Publié dans: VOLUME=56;ISSUE=7;ISSN=0022-3727;TITLE=Journal of Physics D: Applied Physics, Numéro 15, 2023, ISSN 1742-6588
Éditeur: Institute of Physics
DOI: 10.1088/1361-6463/ac82f9

Self-organization of an inhomogeneous memristive hardware for sequence learning

Auteurs: Melika Payvand, Filippo Moro, Kumiko Nomura, Thomas Dalgaty, Elisa Vianello, Yoshifumi Nishi & Giacomo Indiveri

Publié dans: Nature Communications, 2022, ISSN 2041-1723
Éditeur: Nature Publishing Group
DOI: 10.1038/s41467-022-33476-6

In situ learning using intrinsic memristor variability via Markov chain Monte Carlo sampling
Auteurs: Thomas Dalgaty, Niccolo Castellani, Clément Turck, Kamel-Eddine Harabi, Damien Querlioz, Elisa Vianello
Publié dans: Nature Electronics, Numéro 4/2, 2021, Page(s) 151-161, ISSN 2520-1131
Éditeur: Nature
DOI: 10.1038/s41928-020-00523-3

Neuromorphic object localization using resistive memories and ultrasonic transducers
Auteurs: Filippo Moro, Emmanuel Hardy, Bruno Fain, Thomas Dalgaty, Paul Clémençon, Alessio De Prà, Eduardo Esmanhotto, Niccolò Castellani, François Blard, François Gardien, Thomas Mesquida, François Rummens, David Esseni, Jérôme Casas, Giacomo Indiveri, Melika Payvand & Elisa Vianello
Publié dans: Nat Commun, 2022, ISSN 2041-1723
Éditeur: Nature Publishing Group
DOI: 10.1038/s41467-022-31157-y

Neuromorphic Low-power Inference on Memristive Crossbars with On-chip Offset Calibration
Auteurs: Charanraj Mohan, L.A. Camunas-Mesa, Jose M. De La Rosa, Elisa Vianello, Teresa Serrano-Gotarredona, Bernabe Linares-Barranco
Publié dans: IEEE Access, Numéro monthly, 2020, Page(s) 1-1, ISSN 2169-3536
Éditeur: Institute of Electrical and Electronics Engineers Inc.
DOI: 10.1109/access.2021.3063437

Non-linear Memristive Synaptic Dynamics for Efficient Unsupervised Learning in Spiking Neural Networks
Auteurs: Stefano Brivio, Denys R. B. Ly, Elisa Vianello, Sabina Spiga
Publié dans: Frontiers in Neuroscience, Numéro 15, 2021, Page(s) Article 580909, ISSN 1662-453X
Éditeur: Frontiers
DOI: 10.3389/fnins.2021.580909

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