Georgios Is. Detorakis (GID), PhD

Contact Information

Machine Learning Engineer
Independent Researcher
Irvine, CA, USA

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https://gdetor.github.io
https://github.com/gdetor
https://gitlab.com/gdetor

Summary of Qualification

- Five years of experience in **industrial applications of machine and deep learning, time series analysis, and natural language processing**.
- Eleven years of **research experience** in scientific laboratories of various disciplines such as **machine and deep learning**, **neuromorphic computing**, **computational neuroscience**, **control theory**, and **robotics**.
- Strong **abilities** in combining and bridging different fields such as **machine learning**, **neuroscience**, **computer science** and **mathematics**.
- **Long experience in programming** (~ 25 years) in system and scripting languages.

Professional Experience

Machine Learning Engineer
Independent Contractor | Irvine (CA), USA — December 2020 - Today
- Develop machine learning algorithms with applications on time series analysis and forecasting.
- Deploy time series forecasting machine learning algorithms.
- Sentiment analysis for economic news.
- Deep learning computer vision applications on object detection and tracking.

Data Science Architect
adNomus | San Jose (CA), USA — August 2019–December 2020
- Developed NLP algorithms with applications in context analysis.
- Analyzed behavioral data.
- Used machine and deep learning algorithms for time-series prediction.

Python Instructor
CentraleSupélec | Gif-sur-Yvette, France — March 2014–April 2014
- Taught a course on the Python Programming Language.

Research Experience

Postdoc Researcher in Neuromorphic Computing and Machine Learning
UCI | Irvine (CA), USA — January 2016–July 2019
Neuromorphic Machine Intelligence Lab
- Research in stochastic deep neural networks.
- Developed a neuromorphic framework (https://github.com/nmi-lab/NSAT).
- Developed machine learning algorithms for neuromorphic devices.
- Integrated neuromorphic sensors (DVS camera) with neuromorphic frameworks.

Postdoc Researcher in Neuroscience and Control Theory
CentraleSupélec | Gif-sur-Yvette, France — December 2013–December 2015
Laboratoire des signaux et systèmes
- Developed a mathematical model (neural fields with time delays) and a closed-loop simulation for Parkinson's disease treatment.
- Conducted theoretical work on non-linear retarded dynamical systems in a closed-loop setup.
- Co-developed software for spike-sorting (https://github.com/gdetor/SPySort).
- Developed Matlab software for on-line data processing on a Plexon recording device.

Research Assistant in Computational Neuroscience
INRIA-Nancy Grand Est | Nancy, France — October 2010–October 2013
CORTEX Team
- Developed algorithms for self-organizing maps.
- Developed a mathematical model for the development of the somatosensory cortex.
- Studied attention mechanisms in the somatosensory cortex.
- Reproduced an *in vivo* experiment *in silico* to study self-organization in the brain.

Research Intern in Robotics
FORTH | Heraklion, Greece — May 2008–October 2008
Computational Vision and Robotics Laboratory
- Configuration and calibration of a HOAP3 humanoid robot.
- Applied biped locomotion algorithms on a HOAP3 robotic platform.

Research Intern in Systems Neuroscience
University of Crete | Heraklion, Greece — October 2007–April 2008
Laboratory of Systems Physiology and Computational Neuroscience
- Conducted EMG and EEG experiments for studying human tremor.
- EMG and EEG recordings, data processing and analysis.
- Software development for signal processing.
- Computational simulations of motor units.

Education

INRIA Nancy Grand-Est/The University of Lorraine, Nancy, France

Ph.D. in Computer Science, October 2010–October 2013
- Thesis Topic: *Cortical plasticity, dynamic neural fields, and self-organization*.
- Area of Study: Computational Neuroscience.

The University of Crete, Heraklion, Greece

M.Sc. in "Brain & Mind Sciences" January 2007–January 2009

B.Sc. in Applied Mathematics September 2002–September 2006
- Mathematical methods and software development track.

Communication Skills

Languages:
- Greek-native language,
- English-full professional proficiency,
- French-intermediate working proficiency,
- German-elementary proficiency.

Software Skills

Programming	C, Python, C++, Rust, Fortran, Java, GNU Make, Pascal.
ML/DL	Pytorch, TorchScript, TensorFlow, Ray, XGBoost.
PyData	Ray, Scikit-learn, Pandas, Statsmodels, Numba.
Version Control	Git, SVN.
Libs	OpenMP, Nvidia CUDA, MPI, OpenCV, FEniCS, LAPACK/BLAS, Sundials.
Web	HTML, CSS, Bootstrap.
Math	Matlab/Octave, Maple.
Devops	Gitlab CI/CD configuration.
NLP	Hugging Face, spaCy.
Simulators	Brian, Neuron (Python).
Editing	Vim, TEX (LATEX, BibTEX, Tikz), Microsoft Office.
Graphics	Graphviz, GIMP, Inkscape, Scribus.
OS	Linux and BSD, Microsoft Windows family, Apple OS X.

Expertise

Mathematics:
- Linear and Nonlinear Dynamical Systems, Control Theory, Numerical Analysis, Numerical Solutions of PDEs, Linear Algebra, Probability Theory, Theory of Systems and Signals, Information Theory, Optimization, and Empirical Dynamic Modeling (EDM).

Computer Science:
- Deep Learning, Machine Learning, Natural Language Processing, Neural Networks, Neuromorphic Computing, Software Development, Evolutionary Computing, Theory of Algorithms, and Topological Data Analysis (TDA).

Neuroscience:
- Systems Neuroscience, Computational Neuroscience, Cognitive Science, Neuroanatomy, Neurophysiology.

Software

Major contributor in open source projects

- **GAIM** A C++ library for Genetic Algorithms and Island Models.
  Gitlab link: https://gitlab.com/gdetor/genetic_alg.
- **NSAT** A C/Python simulator for the Neural and Synaptic Array Transceiver (NSAT) neuromorphic framework.
  Github link: https://github.com/nmi-lab/NSAT.
- **NSATcarl** A C++ interface of CARLsim (http://www.socsci.uci.edu/~jkrichma/CARLsim/) for the NSAT neuromorphic framework.
  Github link: https://github.com/gdetor/CarlNsat.
- **SPySort** A Python package for spike sorting.
  Github link: https://github.com/gdetor/spysort.
- A full list of all my projects related to machine learning, neuroscience, optimization, and numerical analysis is available here: https://gdetor.github.io/software.

Recording Techniques

Noninvasive:

- Electroencephalography (EEG) – Conducted EEG recordings using an 18-electrodes portable EEG device.

Invasive:

- Extracellular recordings – Set up, calibration and software development on a Plexon Recording Device.
- Electromyography (EMG) – Conducted muscle force and motor units (MUs) activity recordings.

Talks

- **Biologically plausible contrastive divergence: Towards an abstract complementary learning system**
  Hughes Research Laboratory (HRL), 2017.
- **Closed-loop deep brain stimulation for Parkinson's disease: A computational study**
  University of California Irvine, 2016.
- **Neural Fields 101**
  CentraleSupélec, 2015.
- **The perception of touch: A computational approach**
  Aix Marseille University, 2014.

Publications

[1] **G. Is. Detorakis** *Practical Aspects on Solving Differential Equations Using Deep Learning: A Primer* arXiv:2408.11266, 2024.

[2] S. Dutta, **G. Detorakis**, A. Khanna, B. Grisafe, E. Neftci, and S. Datta, *Neural sampling machine with stochastic synapse allows brain-like learning and inference*, Nature Communications 13, 2571, 2022.

[3] R. Parise and **G. Is. Detorakis**, *OpenPelt: Python Framework for Thermoelectric Temperature Control System Development*, The Journal of Open Source Software, 7(73), 4306, 2022.

[4] N. P. Rougier and **G. Is. Detorakis**, *Randomized Self-Organizing Map*, Neural Computation, 33(8), 2021.

[5] **G. Detorakis**, A. Chaillet, and N.P. Rougier, *Stability analysis of a neural field self-organizing map*, The Journal of Mathematical Neuroscience, 10 (20), 2020.

[6] **G. Detorakis**, and A. Burton, *GAIM: A C++ library for Genetic Algorithms and Island Models*, The Journal of Open Source Software, 4(44), 1839, 2019.

[7] **G. Detorakis**, S. Dutta, A. Khanna, B. Grisafe, S. Datta, and E. Neftci, *Inherent Weight Normalization in Stochastic Neural Networks*, Advances in Neural Information Processing Systems (NeurIPS), 32, 2019.

[8] B. U. Pedroni, S. Joshi, S. Deiss, S. Sheik, **G. Detorakis**, S. Paul, C. Augustine, E. Neftci, and G. Cauwenberghs, *Memory-efficient Synaptic Connectivity for Spike-Timing-Dependent Plasticity* accepted for publication in Frontiers in Neuroscience (Neuromorphic Section).

[9] **G. Detorakis**, T. Bartley, E. Neftci, *Contrastive Hebbian Learning with Random Feedback Weights*, Neural Networks, 114, 2019.

[10] **G. Detorakis**, S. Sheik, C. Augustine, S. Paul, B.U. Pedroni, N. Dutt, J. Krichmar, G. Cauwenberghs, E. Neftci, *Neural and Synaptic Array Transceiver: A Brain-Inspired Computing Framework for Embedded Learning*, Frontiers in Neuroscience (Neuromorphic section) 12, 2018.

[11] H. Kashyap, **G. Detorakis**, N. Dutt, J. Krichmar,and E. Neftci, *A Recurrent Neural Network Based Model of Predictive Smooth Pursuit Eye Movement in Primates*, 2018 International Joint Conference on Neural Networks (IJCNN), 2018.

[12] N.P. Rougier, K. Hinsen, [et al., including **Georgios Detorakis**] *Sustainable computational science: the ReScience initiative*, PeerJ Computer Science 3, 2017.

[13] E. Neftci, S. Paul, C. Augustine, **G. Detorakis** *Event-Driven Random Back-Propagation: Enabling Neuromorphic Deep Learning Machines*, Frontiers in Neuroscience 11, 2017.

[14] **G. Detorakis** and A. Chaillet, *Incremental stability of spatiotemporal delayed dynamics and application to neural fields*, 2017 IEEE 56th Annual Conference on Decision and Control (CDC), 2017.

[15] E. Neftci, C. Augustine, S. Paul, **G. Detorakis**, *Event-Driven Random Backpropagation: Enabling Neuromorphic Deep Learning Machines*, 2017 IEEE International Symposium on Circuits and Systems (ISCAS), 2017.

[16] **G. Detorakis**, *[Re] A generalized linear Integrate-and-Fire neural model produces diverse spiking behaviors*, The ReScience Journal, 3:1, 2017.

[17] A. Chaillet, **G. Is. Detorakis**, S. Palfi and S. Senova *Robust stabilization of delayed neural fields with partial measurement and actuation*, Automatica 83, 2017.

[18] **G. Is. Detorakis**, *[Re] Multiple dynamical modes of thalamic relay neurons: rhythmic bursting and intermittent phase-locking*, The ReScience Journal, 2:1, 2016.

[19] B. U. Pedroni, S. Sheik, S. Joshi, **G. Detorakis**, S. Paul, C. Augustine, E. Neftci, G. Cauwenberghs, *Forward Table-Based Presynaptic Event-Triggered Spike-Timing-Dependent Plasticity*, 2016 IEEE Biomedical Circuits and Systems Conference (BioCAS), 2016.

[20] **G. Is. Detorakis**, A. Chaillet, S. Palfi, and S. Senova, *Closed-loop stimulation of a delayed neural fields model of parkinsonian STN-GPe network: a theoretical and computational study*, Frontiers in Neuroscience, 9:237, 2015.

[21] C. Pouzat and **G. Is. Detorakis**, *SPySort: Neural spike sorting with Python*, Proc. of the 7th Eur. Conf. on Python in Science (Euroscipy), 2014.

[22] **G. Is. Detorakis** and N.P. Rougier, *Structure of Receptive Fields in a Computational Model of Area 3b of Primary Sensory Cortex*, Frontiers in Computational Neuroscience, 8(76), 2014.

[23] **G. Is. Detorakis** *Cortical plasticity, dynamic neural fields, and self-organization*, University of Lorraine, 2013.

[24] **G. Is. Detorakis** and N.P. Rougier, *A Neural Field Model of the Somatosensory Cortex: Formation, Maintenance and Reorganization of Ordered Topographic Maps*, PLoS ONE 7(7): e40257, 2012.

[25] N.P. Rougier and **G. Is. Detorakis**, *Self-Organizing Dynamic Neural Fields*, Advances in Cognitive Neurodynamics III, 2012.

Book Chapters

[26] A. Chaillet, **G. Is. Detorakis**, S. Palfi, and S. Senova, *ISS-stabilization of delayed neural fields by small-gain arguments*, In: Valmorbida G., Seuret A., Boussaada I., Sipahi R. (eds) Delays and Interconnections: Methodology, Algorithms and Applications. Advances in Delays and Dynamics, 10, Springer, 2019.

Popular Science

[27] A. Chaillet, D. Da Silva, **G. Detorakis**, C. Pouzat, S. Senova., “Optogenetics to unravel the mechanisms of Parkinsonian symptoms and to optimize deep brain stimulation”, *ERCIM News, Special issue on cyber-physical systems*, Number 97, April 2014.