

## Georgios Is. Detorakis (GID), PhD

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### Contact Information

Machine Learning Engineer  
Independent Researcher  
Irvine, CA, USA

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🌐 <https://github.com/gdetor>  
🏠 <https://gitlab.com/gdetor>  
🏠 <https://gdetor.github.io>

### Research Interests

**Computational Neurosciences and Machine Learning:** Machine learning algorithms with applications on time-series analysis and forecasting. Brain-machine interfaces with applications in neurodegenerative disorders (Parkinson's disease). Self-organization and attention mechanisms. Cortical plasticity, memory and learning. Neuromorphic computing. **Evolutionary Computing:** Genetic algorithms, island models and applications in the context of machine learning and neuroscience.

### Professional Experience

**Independent Contractor**, Irvine (CA), USA

#### Machine Learning Engineer

**December 2020–Now**

- Develop machine learning algorithms with applications on time series analysis and forecasting.
- Deploy time series forecasting machine learning algorithms.

**adNomus Inc.**, Santa Clara, CA, USA

#### Data Science Architect

**August 2019–Now**

- Developed NLP algorithms with applications in context analysis.
- Analyzed behavioral data.
- Used machine and deep Learning algorithms for time-series prediction.

### Academic Appointments

#### Postdoctoral Researcher

**January 2016 – July 2019**

**Neuromorphic Machine Intelligence Lab**, University of California Irvine

- Research in stochastic deep neural networks.
- Developed a neuromorphic framework (<https://github.com/nmi-lab/NSAT>).
- Developed machine learning algorithms for neuromorphic devices.
- Co-developed algorithms for Brain-Machine Interface using machine learning and neuromorphic devices.
- Integrated neuromorphic sensors (DVS camera) with neuromorphic frameworks.

#### Postdoctoral Researcher

**December 2013 – December 2015**

**Laboratoire des signaux et systèmes**, Supélec, University Paris Sud

- 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 Experience

**INRIA - Nancy Grand Est**, Nancy, France  
CORTEX Team

#### Research Assistant in Computational Neuroscience

**October 2010 – October 2013**

- 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.

**FORTH**, Heraklion, Hellas

Computational Vision and Robotics Laboratory

#### Research Intern in Robotics

**May 2008 – October 2008**

- Configuration and calibration of a HOAP3 humanoid robot.
- Applied biped locomotion algorithms on a HOAP3 robotic platform.

**The University of Crete - Faculty of Medicine**, Heraklion, Hellas  
Laboratory of Systems Physiology and Computational Neuroscience

**Research Intern in Systems Neuroscience**

**October 2007 – April 2008**

- 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.

Professional  
Service

**Editorial Service**

- [The ReScience Journal](#)
- [Frontiers in Neuroscience–Neuromorphic Engineering](#)

**Workshop Service**

- Co-organizer (with Prof. Antoine Chaillet) of a workshop on: “Neural Population Dynamics”, Supélec, Gif-sur-Yvette, February 2015.

Education

**The University of Lorraine**, Lorraine, France

**Ph.D., INRIA Nancy Grand-Est, October 2010 – October 2013**

- Thesis Topic: *Cortical plasticity, dynamic neural fields and self-organization*.
- Adviser: [Dr. Nicolas P. Rougier](#)
- Area of Study: Computational Neuroscience.

**The University of Crete**, Heraklion, Hellas

**M.Sc., Faculty of Medicine, January 2007 – January 2009**

- Interdisciplinary two-years graduate program in “Brain & Mind Sciences”.
- Area of Study: Neuroscience.

**B.Sc., Department of Applied Mathematics, September 2002 – September 2006**

- Four years undergraduate program.
- Mathematical methods and software development track.

Travel  
Grants

- Federation of European Neuroscience Societies (FENS), Regional Meeting 2015, Thessaloniki, Greece (€500).
- Organization for Computational Neurosciences, CNS 2013 Annual Meeting, Paris, France (\$ 200).

Teaching  
Experience

**Supélec**, Gif-sur-Yvette, France

**Guest Instructor** for a crash course in Python.

**March 2014 – April 2014**

- Introduction to the Python Programming Language, Numpy, Scipy, and Matplotlib packages.

**The University of Crete**, Heraklion, Hellas

**Teaching Assistant**

**Spring Semester 2006**

- TEM 202: Undergraduate Algorithms’ Theory.
- Instructor: Prof. M. Karavelas.
- Course tutoring.

Student  
Advising

- Supervised undergraduate students’ projects in Engineering on oculomotor control, Centrale-Supélec, Gif-sur-Yvette, France.  
Primary adviser: Prof. Antoine Chaillet.
- Supervised a postgraduate (M.Sc.) internship student working on sensorimotor integration at INRIA Nancy Grand-Est, Lorraine, France.  
Primary adviser: Dr. Nicolas P. Rougier.

Other Meeting  
Attendance

**General Participant**

- Workshop on *Neuromorphic Cognition Engineering*, Telluride, Colorado (USA), 2017.
- Summer school on *Neural Dynamics Approach to Cognitive Robotics III - A Hands-on*, Bochum (Germany), 2012.

Software

**Software with applications in Neuromorphic Systems:**

- **NSAT** A C/Python simulator for the Neural and Synaptic Array Transceiver (NSAT) neuromorphic framework (<https://github.com/nmi-lab/NSAT>).
- **NSATcarl** A C++ interface of CARLsim (<http://www.socsci.uci.edu/~jkrichma/CARLsim/>) with a neuromorphic framework (<https://github.com/gdetor/CarlNsat>).

**Software with applications in Neuroscience:**

- **Crebral** A simple C/Python simulator for conductance-based neural networks (<https://github.com/gdetor/Crebral>).
- **SPySort** A Python package for spike sorting (<https://github.com/gdetor/spysort>).
- **SI-RF-Structure** A collection of Python scripts that implement algorithms and experimental protocols for simulating area 3b of primary somatosensory cortex (<https://github.com/gdetor/SI-RF-Structure>).
- **SITopMaps** A Python/C implementation of self-organizing maps with applications on self-organization of area 3b of primary somatosensory cortex (<https://github.com/gdetor/SITopMaps>).

**Software with applications in Optimization:**

- **GAIM** A C++ library for Genetic Algorithms and Island Models ([https://gitlab.com/gdetor/genetic\\_alg](https://gitlab.com/gdetor/genetic_alg)).

Communication  
Skills

**Languages:**

- Greek – native language,
- English – full professional proficiency,
- French – intermediate working proficiency,

Software  
Skills

**Programming:**

- C, C++, Python, Rust, Fortran, Java, Pascal, UNIX shell scripting, GNU make, SQL, Matlab/Octave, Maple, HTML.
- CSS, Bootstrap.
- LAPACK/BLAS, Sundials, OpenMP, OpenCV, Nvidia CUDA, MPI, FEniCS.
- Ray, Scikit-learn, Pandas, Statsmodels, Numba.

**Deep Learning Frameworks:**

- PyTorch, TensorFlow.

**Natural Language Processing Frameworks:**

- spaCy, Hugging Face.

**Simulators:**

- Brian, Neuron (Python).

**Version Control and Software Configuration Management:**

- Git and SVN.

**Devops:**

- Gitlab CI/CD configuration.

**Desktop Editing and Productivity Software:**

- Vim,  $\text{\LaTeX}$  ( $\text{\LaTeX}$ , Bib $\text{\TeX}$ , Tikz), Microsoft Office, Graphviz, GIMP, Inkscape, Scribus.

**Operating Systems:**

- Linux and BSD, Microsoft Windows family, Apple OS X.

## 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.

## Expertise

### Mathematics:

- Linear and Nonlinear Dynamical Systems, Control Theory, Numerical Analysis, Numerical Solutions of PDEs, Linear Algebra, Probabilities 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.

## Talks

- [1] **“Biologically plausible contrastive divergence: Towards an abstract complementary learning system”**  
Hughes Research Laboratory (HRL), 2017.
- [2] **“Closed-loop deep brain stimulation for Parkinson’s disease: A computational study”**  
University of California Irvine, 2016.
- [3] **“Neural Fields 101”**, CentraleSupélec, 2015.
- [4] **“The perception of touch: A computational approach”**  
Aix Marseille University, 2014.
- [5] **“Coherent 6–10 Hz rhythms in muscle activities-Humanoid Robot & Biped Locomotion-EEG & Time Series Analysis”**  
Bernstein Center for Computational Neuroscience, 2008.

## Journal Publications (peer-reviewed)

- [6] 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.
- [7] 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.
- [8] N. P. Rougier and **G. Is. Detorakis**, *Randomized Self-Organizing Map*, *Neural Computation*, 33(8), 2021.
- [9] **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.
- [10] **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.
- [11] 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*, *Frontiers in Neuroscience (Neuromorphic Section)*, 13, 2019.
- [12] **G. Detorakis**, T. Bartley and E. Neftci, *Contrastive Hebbian Learning with Feedback Random Weights*, *Neural Networks*, 114, 2019.

- [13] **G. Detorakis**, S. Sheik, C. Augustine, S. Paul, B.U. Pedroni, N. Dutt, J. Krichmar, G. Cauwenberghs, and E. Neftci, *Neural and Synaptic Array Transceiver: A Brain-Inspired Computing Framework for Embedded Learning*, Frontiers in Neuroscience (Neuromorphic section) 12, 2018.
- [14] N.P. Rougier, K. Hinsén, [et al., including **Georgios Detorakis**], *Sustainable computational science: the ReScience initiative*, PeerJ Computer Science 3, 2017.
- [15] E. Neftci, S. Paul, C. Augustine, **G. Detorakis**, *Event-Driven Random Back-Propagation: Enabling Neuromorphic Deep Learning Machines*, Frontiers in Neuroscience 11, 2017.
- [16] A. Chaillet, **G. Is. Detorakis**, S. Palfi and S. Senova, *Robust stabilization of delayed neural fields with partial measurement and actuation*, Automatica 83, 2017.
- [17] **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.
- [18] **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.
- [19] **G. Is. Detorakis** *Cortical plasticity, dynamic neural fields, and self-organization*, University of Lorraine (Thesis), 2013.
- [20] **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.

Reproducible  
Science  
(peer-reviewed)

- [21] **G. Detorakis**, [Re] *A generalized linear Integrate-and-Fire neural model produces diverse spiking behaviors*, The ReScience Journal, 3:1, 2017.
- [22] **G. Is. Detorakis**, [Re] *Multiple dynamical modes of thalamic relay neurons: rhythmic bursting and intermittent phase-locking*, The ReScience Journal, 2:1, 2016.

Conference  
Publications  
(peer-reviewed)

- [23] **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.
- [24] 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.
- [25] **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.
- [26] 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.
- [27] 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.
- [28] C. Pouzat and **G. Is. Detorakis**, *SPySort: Neural spike sorting with Python*, Proc. of the 7th Eur. Conf. on Python in Science (Euroscipy), 2014.
- [29] N.P. Rougier and **G. Is. Detorakis**, *Self-Organizing Dynamic Neural Fields*, Advances in Cognitive Neurodynamics III, 2012.

Book Chapters

- [30] 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.

- [31] H.J. Kashyap, **G. Detorakis**, N. Dutt, J.L. Krichmar, E. Neftci *A neural network model of predictive smooth pursuit eye movement in primates*, SfN, San Diego (CA, USA), 2018.
- [32] **G. Detorakis**, T. Bartley, E. Neftci, *Random Contrastive Hebbian Learning as a Biologically Plausible Learning Scheme*, OCNS, Seattle (WA, USA), 2018.
- [33] **G. Detorakis**, T. Bartley, R. Parise, S. Sheik, C. Augustine, S. Paul, B. U. Pedroni, N. Dutt, J. Krichmar, G. Cauwenberghs, and E. Neftci, *Three-factor embedded learning on neuromorphic systems*, COSYNE, Denver (CO, USA), 2018.
- [34] **G. Detorakis**, T. Bartley, R. Parise, S. Sheik, C. Augustine, S. Paul, B. Pedroni, N. Dutt, J. Krichmar, G. Cauwenberghs and E. Neftci, *Embedded Learning on Neuromorphic Systems: Towards a Unified Computing Framework*, NICE, Portland (OR, USA), 2018.
- [35] **G. Detorakis**, T. Bartley, R. Parise, C. Augustine, S. Paul, E. Neftci, *Embedded learning on neuromorphic systems: Towards a unified computing framework*, IEED ICCAD HALO Workshop, 2017.
- [36] **G. Detorakis**, D. Barsever, E. Neftci *NeuroLachesis: A Neuromorphic Framework*, Scipy 2017, Austin (TX, USA).
- [37] A. Chaillet, **G. Is. Detorakis**, S. Palfi and S. Senova, *Robust stabilization of delayed neural fields by proportional feedback using input-to-state stability and small gain theorem*, ICMNS 2016, Juan-les-Pins, France.
- [38] **G. Is. Detorakis** and A. Chaillet, *Closed-loop disruption of oscillations in a targeted frequency band for a delayed neural field STN-GPe model*, FENS Regional Meeting 2015, Thessaloniki (Greece).
- [39] **G. Is. Detorakis** and A. Chaillet, *Incremental stability of delayed neural fields: a unifying framework for endogenous and exogenous sources of pathological oscillations*, CNS 2015, Prague (Czech Republic).
- [40] **G. Is. Detorakis** and A. Chaillet, *Closed-loop regulation of the activity of delayed neural fields with only partial measurement and stimulation*, ICMNS 2015, Antibes - Juan les Pins (France).
- [41] **G. Is. Detorakis** and A. Chaillet and I. Haidar, *A global stability analysis for delayed neural fields*, BCCN 2014, Göttingen (Germany).
- [42] **G. Is. Detorakis** and N. P. Rougier, *A computational view of the primary somatosensory cortex*, CNS 2013, Paris (France).
- [43] **G. Is. Detorakis**, N. P. Rougier, *Neural Fields and Cortical Plasticity*, Front. Comput. Neurosci. BCCN 2011: Computational Neuroscience and Neurotechnology Bernstein Conference & Neurex Annual Meeting, 2011.

- [44] **G. Detorakis**, C. Augustine, S. Paul, E. Neftci, *Embedded learning on neuromorphic systems: Towards a unified computing framework*, 24th Joint Symposium on Neural Computation, San Diego (CA, USA), 2017.
- [45] C. Pouzat and **G. Is. Detorakis**, *On the relation between neuronal size and extracellular spike amplitude and its consequence on extracellular recordings interpretation*, MathStat-Neuro Workshop, Nice (France), 2015.
- [46] C. Pouzat and **G. Is. Detorakis**, *SPySort*, GDR Multielectrode systems and signal processing for Neuroscience, Gif-sur-Yvette (France), 2014.
- [47] **G. Is. Detorakis** and N. P. Rougier, *Skin Topographic Maps in SI*, Progress in Neural Field Theory, Reading (UK), 2012.
- [48] **G. Is. Detorakis**, N. P. Rougier, *Skin Topographic Maps in SI*, Workshop on Cognitive and Dynamics in Neural Systems: Mathematical and Computational Modeling (CONAS), Lyon (France), 2012.



- [49] 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.