

## Georgios Is. Detorakis (GID), PhD

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### Contact Information

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### Summary of Qualification

- Ten years of **research experience** in scientific laboratories of various disciplines such as **computational neuroscience**, **machine learning**, **neuromorphic computing**, **control theory**, and **robotics**.
- Strong **abilities** in combining and bridging different fields such as **machine learning**, **neuroscience**, **computer science** and **mathematics**.
- **Advanced mathematical skills**, especially in linear algebra, dynamical systems, signal processing and control theory.
- **Long experience in programming** in computational scripting and system languages.

### Professional Experience

**Data Science Architect with adNomus Inc.**  
[adNomus](#) | San Jose (CA), USA

August 2019–Now

- Developing NLP algorithms with applications on context analysis.
- Deep learning for time-series forecasting.

### Research Experience

**Postdoc Researcher in Neuromorphic Computing and Machine Learning**

UCI | Irvine (CA), USA

January 2016–July 2019

[Neuromorphic Machine Intelligence Lab](#)

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

**Postdoc Researcher in Neuroscience and Control Theory**

[CentraleSupélec](#) | Gif-sur-Yvette, France

December 2013–December 2015

[Laboratoire des signaux et systèmes](#)

- Developed a neural model (nonlinear, delayed, neural field) 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 using a Plexon recording device.

**Python Instructor** | [CentraleSupélec](#) | Gif-sur-Yvette, France

March 2014–April 2014

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

**Research Assistant in Computational Neuroscience**

[INRIA-Nancy Grand Est](#) | Nancy, France

October 2010–October 2013

[CORTEX Team](#)

- Developed a computational model for self-organizing maps.
- Developed a mathematical model for the development of the somatosensory cortex.
- Developed an attention mechanism for the self-organizing map.
- 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](#)

- Configured and calibrated a humanoid robot (HOAP3).
- Applied biped locomotion algorithms on the robotic platform HOAP3.
- Developed demo simulations for the aforementioned robotic platform.

## Research Intern in Systems Neuroscience

University of Crete | Heraklion, Greece

October 2007–April 2008

Laboratory of Systems Physiology and Computational Neuroscience

- Conducting EMG and EEG experiments for studying human tremor.
- Developed software on Matlab for EMG signal processing and analysis.
- Analyzing EMG and EEG data.
- Developed simulations of motor units.

## Education

**INRIA Nancy Grand-Est/The University of Lorraine**, Lorraine, 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 (dead).

## Software Skills

### Programming:

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

### Deep Learning Frameworks:

- PyTorch, TensorFlow.

### Natural Language Processing Frameworks:

- spaCy.

### Simulators:

- Brian, Neuron (Python).

### Version Control and Software Configuration Management:

- Git and SVN.

### Devops:

- Gitlab CI/CD configuration.

### Desktop Editing and Productivity Software:

- Vim,  $\text{T}_{\text{E}}\text{X}$  ( $\text{L}_{\text{A}}\text{T}_{\text{E}}\text{X}$ , Bib $\text{T}_{\text{E}}\text{X}$ , Tikz), Microsoft Office, Graphviz, GIMP, Inkscape, Scribus.

### Operating Systems:

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

## Expertise

### Mathematics:

- Linear and Nonlinear Dynamical Systems, Control Theory, Numerical Analysis, Linear Algebra, Probabilities Theory, Theory of Systems and Signals, Information Theory, Optimization, and Empirical Dynamic Modeling.

### Computer Science:

- Deep Learning, Machine Learning, Natural Language Processing, Neural Networks, Neuromorphic Computing, Software Development, Evolutionary Computing, Theory of Algorithms.

## Computational Neuroscience:

- Spiking Neural Networks, Neural Population Models, Mathematical Modeling of Neural Systems.

## Software

### Major contributor in open source projects in Neuroscience/Machine Learning

- **GAIM** A C++ library for Genetic Algorithms and Island Models.  
Gitlab link: [https://gitlab.com/gdetor/genetic\\_alg](https://gitlab.com/gdetor/genetic_alg).
- **NSAT** Is a simulator written in C/Python for the Neural and Synaptic Array Transceiver (NSAT) neuromorphic framework.  
Github link: <https://github.com/nmi-lab/NSAT>
- **NSATcarl** Is 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** Is a Python package for spike sorting.  
Github link: <https://github.com/gdetor/spysort>.

## Recording Techniques

### Noninvasive:

- Electroencephalography (EEG) – Operation of portable EEG device consisting in 18 electrodes.

### Invasive:

- Extracellular recordings – Set up, calibration and development of software for extracellular recordings using a Plexon Recording Device.
- Electromyography (EMG) – Conducting muscle force and motor units (MUs) activity recordings.

## Talks

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

## Publications

- [1] **G. Detorakis**, and Andrew Burton, *GAIM: A C++ library for Genetic Algorithms and Island Models*, The Journal of Open Source Software, 4(44), 1839, 2019.
- [2] **G. Detorakis**, S. Dutta, A. Khanna, B. Grisafe, S. Datta, and E. Neftci, *Inherent Weight Normalization in Stochastic Neural Networks*, accepted for Poster Presentation in NeurIPS (NIPS) Conference, Vancouver, (Canada), 2019.
- [3] 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).
- [4] **G. Detorakis**, T. Bartley, E. Neftci, *Contrastive Hebbian Learning with Random Feedback Weights*, Neural Networks, 114, 2019.
- [5] **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.
- [6] 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*, IJCNN, Rio de Janeiro (Brazil), 2018.
- [7] N.P. Rougier, K. Hinsén, [et al., including **Georgios Detorakis**] *Sustainable computational science: the ReScience initiative*, PeerJ Computer Science 3, 2017.
- [8] E. Neftci, S. Paul, C. Augustine, **G. Detorakis** *Event-Driven Random Back-Propagation: Enabling Neuromorphic Deep Learning Machines*, Frontiers in Neuroscience 11, 2017.

- [9] **G. Detorakis** and A. Chaillet, *Incremental stability of spatiotemporal delayed dynamics and application to neural fields*, CDC, Melbourne (Australia), 2017.
- [10] E. Neftci, C. Augustine, S. Paul, **G. Detorakis**, *Event-Driven Random Backpropagation: Enabling Neuromorphic Deep Learning Machines*, IEEE ISCAS, Baltimore (MD, USA), 2017.
- [11] **G. Detorakis**, [Re] *A generalized linear Integrate-and-Fire neural model produces diverse spiking behaviors*, The ReScience Journal, 3:1, 2017.
- [12] A. Chaillet, **G. Is. Detorakis**, S. Palfi and S. Senova *Robust stabilization of delayed neural fields with partial measurement and actuation*, Automatica 83, 2017.
- [13] **G.Is. Detorakis**, [Re] *Multiple dynamical modes of thalamic relay neurons: rhythmic bursting and intermittent phase-locking*, The ReScience Journal, 2:1, 2016.
- [14] 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*, IEEE BioCAS 2016, Shanghai (China), 2016.
- [15] **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.
- [16] C. Pouzat and **G.Is. Detorakis**, *SPySort: Neural spike sorting with Python*, Proc. of the 7th Eur. Conf. on Python in Science (Euroscipy 2014), Cambridge (UK), 2014.
- [17] **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.
- [18] **G. Is. Detorakis** *Cortical plasticity, dynamic neural fields, and self-organization*, University of Lorraine, 2013.
- [19] **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.
- [20] N.P. Rougier and **G.Is. Detorakis**, *Self-Organizing Dynamic Neural Fields*, Advances in Cognitive Neurodynamics III, Hokaido (Japan), 2012.
- [21] A. Chaillet, **G. Is. Detorakis**, S. Palfi, and S. Senova, *ISS-stabilization of delayed neural fields by small-gain arguments*, to be published in Advances on Delays and Dynamics at Springer.