

## Georgios Is. Detorakis (GID), PhD

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### 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>

### Professional Summary

Almost six years of professional experience applying machine and deep learning algorithms on time series analysis and forecasting | Natural language processing with applications on recommendation systems and financial data | Deep learning applications for differential equations | Deep learning applications for image processing and object detection & tracking. Eleven years of interdisciplinary research in optimization, neuromorphic computing, neuroscience, control theory, and robotics | Integrating machine learning, neuroscience, computer science, and mathematics to solve complex problems such as brain modeling | Over 27 years of programming expertise in system-level and scripting languages, including, among others, developing real-time simulators and evolutionary computing libraries.

### 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 & tracking, and image processing (super-resolution, denoising).
- Reinforcement learning for controlling TEC devices.

#### Data Science Architect

adNomus | San Jose (CA), USA

August 2019–December 2020

- Developed NLP algorithms with applications in context analysis.
- Analyzed behavioral data.
- Developed 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

### Ph.D. in Computer Science

Inria/University of Lorraine, Nancy, France

October 2010–October 2013

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

### M.Sc. in Brain & Mind Sciences

University of Crete | Heraklion, Greece

January 2007–January 2009

### B.Sc. in Applied Mathematics

University of Crete | Heraklion, Greece

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,  $\text{\LaTeX}$  ( $\text{\LaTeX}$ , Bib $\text{\LaTeX}$ , 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](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. Hinsén, [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.
- [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.
- [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.

Book  
Chapters

Popular  
Science