

Daniel Martí (PhD)

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Profile

I am a machine learning generalist and a data scientist with a strong foundation in mathematical modeling. I use analytical, statistical, and computational tools to gain insight into data.

Skills: Dynamical Systems, Neural Networks, Statistical Mechanics, Stochastic Processes, Random Matrix Theory, Numerical Methods, Machine Learning (supervised learning, non-parametric Bayesian methods), C, C++, python (numpy/scipy/scikit-learn/pandas), spark, functional programming, R, unix, git, gdb, shell scripting.

Education

PhD. in Computational Neuroscience,

Sep 2003 – Sep 2008

Universitat Pompeu Fabra, Barcelona. *Summa Cum Laude*.

- Investigated the neural substrate of decisions from a computational perspective, using neural networks.
- Simulated a neural network model (custom code in C++) and investigated the possible regimes of network activity using analytical tools (Mean-field, Stochastic Differential Equations, Dynamical Systems).
- Graduate courses on Artificial Intelligence, Data Structures, Image Processing.

M. Sc. degree in Theoretical Physics,

Sep 1999 – Sep 2002

Universitat Autònoma de Barcelona. *Summa Cum Laude*

- Studied extensions of the Standard Model of elementary particles based on supersymmetry and extra dimensions, and derived the spectrum of masses of predicted by the model.
- Graduate courses in Particle Physics, Gravitation, Cosmology, and Differential Geometry.

B. Sc. degree in Physics

Sep 1999

Universitat Autònoma de Barcelona. *GPA: 93.5%*

Experience

Blackpills, Paris,

Jul 2016–current

Data Scientist & Machine Learning Engineer

- Design of A/B testing protocols using both frequentist & Bayesian approaches.
- Implementation of on-line ranking systems based on implicit feedback from users.
- Conception of a scrubbing-based multi-speed slider and an on-line estimator for downloading times.

École Normale Supérieure, Paris,

2013–Jun 2016

Postdoctoral Researcher in Theoretical Neuroscience

- Investigated the dynamics of large ($\sim 10^4$) neural networks with random, partially symmetric couplings.
- Used tools from statistical mechanics of disordered systems (Martin-Siggia-Rose formalism, Random Matrix Theory) to characterize the autocorrelation function of neural activities.
- Developed C code to simulate the dynamics of the neural network and to estimate different measures of network activity (average autocorrelation of spike-trains, population firing rates).
- Coded python modules and scripts to organize, analyze, and visualize simulated data.
- Organized external seminars with invited international speakers.

Columbia University, New York

Jan 2012–Dec 2012

Postdoctoral Researcher in Theoretical Neuroscience

- Investigated the scalability of multimodular neural networks, both theoretically and numerically.
- Implemented a neural classifier in a multi-core, neuromorphic TrueNorth IBM chip.
- Compared classification accuracies with standard sparse support vector classifiers.

- Investigated with network models how feature categorization could arise in cortical circuits as a dynamical phenomenon (bifurcation theory, weakly nonlinear analysis)
- Studied several circuit architectures that could underlie the correlations in the reaction times observed during tasks that require coordination between eye and arm movements.
- Analyzed a network of spatially distributed neurons driven by spatiotemporal patterns of stimuli
- Conceived a framework to optimize the goodness of fit of different dynamical models to behavioral data.

Teaching

Mentor at New York University and École Normale Supérieure, 2010, 2015

- Supervised students working on their master project in Applied Mathematics (Courant Institute), Statistical Physics (École Normale Supérieure)
- Teaching at the Research Master in Cognitive Science (Perceptrons, Hopfield Networks, Neural Decoding)

Teaching assistant at Universitat Pompeu Fabra 2003–2008

- Tutored undergraduate students in Computer Science on *Introduction to Neural Networks & Machine Learning*, *Nonlinear Time Series Analysis*, *Introduction to Independent Component Analysis*, and *Physics for Computer Science*.

Teaching assistant at Universitat Autònoma de Barcelona 1999–2003

- Tutored undergraduate students in Physics on *Quantum Physics*, *Theoretical Mechanics*, *Physics for Life Sciences*, *Differential Equations*, and *Experimental Physics* (laboratory sessions).

Peer-reviewed publications

- MARTÍ D, BRUNEL N, OSTOJIC S, Correlations between synapses in pairs of neurons slow down dynamics in randomly connected neural networks, (submitted).
- MARTÍ D, RIGOTTI M, SEOK M, FUSI S, [Energy-Efficient Neuromorphic Classifiers](#) *Neural Computation* 2016, **28**(10):2011–2044.
- MARTÍ D, RINZEL J, [Dynamics of Perceptual Categorization](#), *Neural Computation* **25**(1)1–45.
- DEAN H*, MARTÍ D*, TSUI E, RINZEL J, PESARAN B, [Reaction Time Correlations during Eye-Hand Coordination: Behavior and Modeling](#), *The Journal of Neuroscience* **31**(7):2399–2412, February 2011.
*Equal contribution.
- DECO G, MARTÍ D, LEDBERG A, REIG R, SANCHEZ VIVES MV, [Effective Reduced Diffusion-Models: A Data-Driven Approach to the Analysis of Neuronal Dynamics](#), *PLoS Computational Biology* **5**(12): e1000587, December 2009.
- MARTÍ D, DECO G, MATTIA M, GIGANTE G, DEL GIUDICE P, [A Fluctuation-Driven Mechanism for Slow Decision Processes in Reverberant Networks](#), *PLoS One* **3**(7): e2534, June 2008.
- DECO G, MARTÍ D, [Extended method of moments for deterministic analysis of stochastic multistable neurodynamical systems](#), *Physical Review E*, **75**:031913, March 2007.
- DECO G, MARTÍ D, [Deterministic analysis of stochastic bifurcations in multi-stable neurodynamical systems](#), *Biological Cybernetics*, **96**(5), May 2007.
- MARTÍ D, DECO G, DEL GIUDICE P, MATTIA M, [Reward-biased probabilistic decision making: mean field predictions and spiking simulations](#), *Neurocomputing* **69** 10–12, June 2006.
- MARTÍ D, POMAROL A, [5D Fayet-Iliopoulos terms and its phenomenological implications](#), *Physical Review D*, **66**: 125005, May 2002. [hep-ph/0205034](#).
- MARTÍ D, POMAROL A, [Supersymmetric theories with compact extra dimensions in \$N = 1\$ superfields](#), *Physical Review D*, **64**: 105025, June 2001. [hep-th/010625](#), [topcite](#) **200+**.

Lecture notes, technical reports

- DEL FERRARO G, WANG C, MARTÍ D, MÉZARD M, [Cavity Method: Message Passing from a Physics Perspective](#) Lectures by Marc Mézard at the *Autumn school Statistical Physics, Optimization, Inference, and Message-Passing Algorithms*, Les Houches (France) from September 30th to October 11th 2013.
- [Short tutorial on path integral formalism for stochastic differential equations](#), given at the Workshop in Theoretical Neuroscience in November 2014.