

# Curriculum Vitae

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## PERSONAL DATA

Name **DIEGO FASOLI**  
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## KEY POINTS

Fields of expertise **Computational Neuroscience** and **Neural Networks** ([link to my website](#)) (collaboration in **7** international projects, see page 3 of the CV, **10** published papers + **2** in preparation, see pages 5-6), **Artificial Intelligence** ([link](#)).

Other interests **GPUs** ([link](#)), **Digital Health** ([link](#)), **Econophysics** ([link](#)).

Ph.D. in Informatics *FINAL MARK: **Très Honorable*** (the highest distinction in the French academic system).  
My Ph.D. was funded by the **Marie Curie [FACETS-ITN](#) fellowship** (FP7-PEOPLE-ITN-2008 under the Grant #237955).

Master's Degree in Physics *FINAL MARK: **magna cum laude*** (110/110 e lode), I was also granted a **special mention** by the board of trustees of UCSC ([link](#)).  
*AVERAGE EXAM GRADE: **30.875 out of 30*** (a 30 "cum laude" is awarded the value of 31).

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## HARD SKILLS

Language Italian (native), English (fluent), French (intermediate).

Mathematical Background **Neural network models**, propagation of chaos, mean-field theory and dimensional reduction, finite-size effects, **probability theory**, extreme value theory, continuous- and discrete-time **dynamical systems**, attractors, bifurcation theory, ordinary and stochastic differential equations, critical slowing down, fractals, **complexity**, **graph theory**, **machine/deep learning theory**, Alzheimer's models (see [this link to my website](#)).

Script Coding I have been writing algorithms in Python since 2010, using libraries such as **Scikit-Learn**, **TensorFlow** (machine learning and artificial intelligence, see also [this link](#)), **OpenCV**, **YOLO**, **DeepFace**, **MediaPipe**, **Teachable Machine**, **PixelLib** (computer vision, in particular object classification and detection, semantic and instance segmentation, human pose estimation, facial image processing, hand tracking), **Bard-API**, **NLTK** (large language models and

natural language processing), **Scipy**, **Numpy** (optimization, statistics, mathematical analysis, etc), **NetworkX** (graphs and complex networks), **Numba** (GPU-accelerated statistics and integration of ODEs, PDEs, PIDEs and SDEs, see also [this link](#)), **Pygame**, **VPython** (development of multimedia applications, games, and 3D animations), and **Matplotlib** (data visualization).

#### Data Analysis

Regression, **dimensional reduction**, **model fitting**, **statistical analysis of fMRI data**, spectral analysis of time series, data filtering, clustering and community detection, **classification**, **graph analysis** and study of fractality of real connectomes.

#### Other

Video editing with **DaVinci Resolve** and website building with **Elementor**.

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### **SOFT SKILLS**

Self-learning capability, ability to work as a team and independently, excellent presentation skills and ability to explain sophisticated scientific concepts in a simple manner to non-specialists.

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### **WORK HISTORY**

#### 01/2022 – Present

Freelance software developer (Italy (01-07/2022) and **Hong Kong (08/2022 - Present)**). In my work I combine artificial intelligence, data science, and hardware acceleration through GPUs, to solve real-world problems in industry, business, and scientific research.

#### 07/2017 – 12/2021

Postdoctoral researcher at the Laboratory of Neural Computation of the Italian Institute of Technology ([IIT](#)) in Rovereto, Italy, led at the time by [Dr. Stefano Panzeri](#). I was responsible for the development of data-constrained realistic models of large-scale cortical regions in mice and humans, for understanding how the dynamics of spontaneous brain activity is shaped by the underlying axonal connectivity, and ultimately for studying how the brain architecture gives rise to complexity of collective behavior in the concerted activity of brain areas.

#### 07/2016 – 07/2017

Visiting postdoctoral researcher at the [Computational and Theoretical Neuroscience Group](#) of the Pompeu Fabra University ([UPF](#)) in Barcelona, Spain, led by [Dr. Gustavo Deco](#). My work focused on the development of efficient algorithms for the numerical study of bifurcations in finite-size networks of binary neurons, and on the analysis of the relationship between the network architecture and the formation of stationary and oscillatory attractors.

#### 10/2013 – 07/2016

Postdoctoral researcher at the Laboratory of Neural Computation in Rovereto (Italy). My role was to develop analytical methods for studying bifurcations and critical slowing down in a finite-size model of cortical column, and therefore to understand how variations in the biophysical parameters of the network cause sudden qualitative changes in the dynamical and statistical behavior of the neural activity.

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## **EDUCATION**

- 01/2010 – 09/2013 Ph.D. in Informatics at the University of Nice-Sophia Antipolis in France (merged in 2019 into the University of Côte d'Azur, [UCA](#)), under the supervision of [Dr. Olivier Faugeras](#). My Ph.D. was funded by the French Institute for Research in Computer Science and Automation ([INRIA](#)), with a **Marie Curie FACETS-ITN fellowship**. My work focused on the development of a mean-field theory of densely connected neural networks, and on the analytical and numerical study of the statistical differences between infinite-size and finite-size networks. I got my Ph.D. on September 25th 2013, with mention "**Très Honorable**" (the highest distinction in the French academic system), discussing a thesis entitled "*Attacking the brain with neuroscience: Mean-field theory, finite size effects and encoding capability of stochastic neural networks*".
- 01/2005 – 01/2007 Master's Degree in Physics at the Catholic University of the Sacred Heart ([UCSC](#)) in Brescia (Italy). I graduated **magna cum laude** discussing a thesis entitled "*Elements of tachyon condensation in background independent string field theory*".
- 09/2001 – 12/2004 Bachelor's Degree in Physics at the Catholic University of the Sacred Heart ([UCSC](#)) in Brescia (Italy). I graduated **magna cum laude** discussing a thesis entitled "*Quantum teleportation*".
- 09/1996 – 06/2001 Diploma in Electronics and Telecommunications at the Technical Institute Luigi Cerebotani in Lonato del Garda (Italy).  
Final mark: **100/100**.

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## **COLLABORATION IN INTERNATIONAL PROJECTS**

- 01/2021 – 12/2021 [NIH Brain Initiative](#) (Grant No. 1U19NS107464-01).
- 01/2018 – 12/2019 [SFARI](#) (Explorer Grant No. 602849).
- 09/2017 – 12/2017 [Slow Dyn](#) (FLAG-ERA/Human Brain Project).
- 07/2016 – 07/2017 [Human Brain Project](#) (FP7-FET Flagship Programme), WP4.3: Large-scale models of human cognitive function.
- 10/2013 – 08/2017 ATTEND (Autonomous Province of Trento, Call "Grandi Progetti 2012").  
[VISUALISE](#) (FET Grant FP7-600954).
- 01/2011 – 09/2013 [BrainScaleS](#) (FP7-FET-Proactive, under the Grant #269921).

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## **SUPERVISED STUDENTS & TEACHING ACTIVITY**

- 05/2023 – Present I have been working on a series of videos to teach Neuroscience and Artificial Intelligence (see [this link to the trailer video](#)).
- 10/2013 – 12/2021 Journal clubs, progress reports, and presentations to colleagues and **Ph.D. students** at [IIT](#) in Rovereto (Italy).
- 10/2018 – 03/2019 M. Ranjan (**master's student at the University of Trento**), research project at [IIT](#) in Rovereto (Italy).
- 05/2014 – 12/2014 D. Corti, *Oscillatory behavior in asymmetric Hopfield networks*, **Politecnico di Milano, Master's Thesis**.
- 06/2008 – 06/2009 Private lessons of mathematics and physics to **high school, bachelor's, and master's students** (at least 3 hours/day).
- 09/2007 – 11/2007 High school teacher of mathematics, physics and informatics at Scuola Bottega Artigiani-c.f.a. in San Polo, Brescia (Italy).

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## **CO-ORGANIZATION OF SCIENTIFIC MEETINGS**

- 09/27/2012 [Second FACETS-ITN student conference](#), Pompeu Fabra University, Barcelona, Spain.
- 09/12/2011 [First FACETS-ITN student conference](#), Kirchhoff Institute for Physics, Heidelberg, Germany.

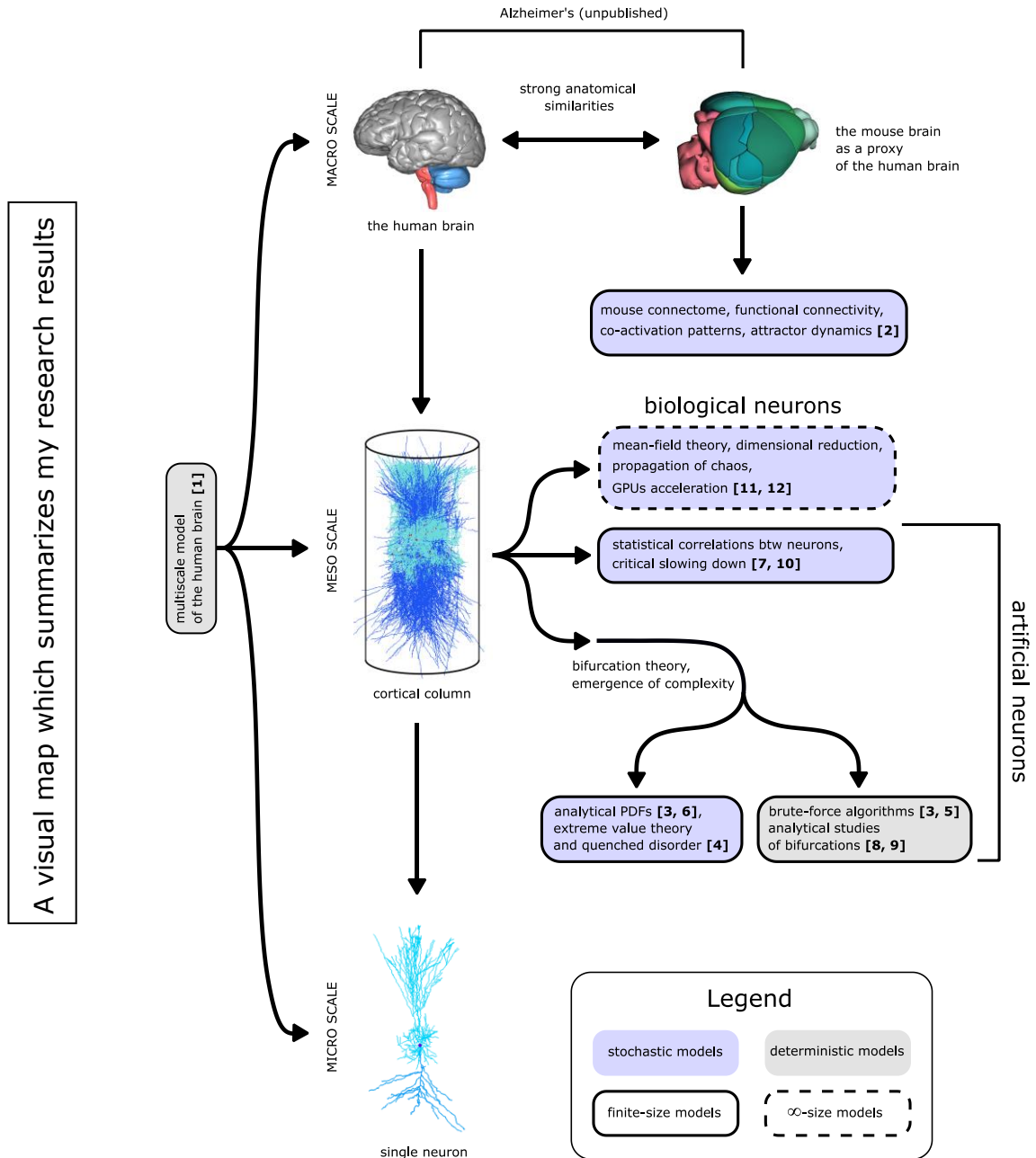
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## **SPEAKER IN INTERNATIONAL EVENTS**

- 09/12/2016 Transitions between asynchronous and synchronous states: A theory of correlations in small neural circuits, *NeuroMath, Mathematical and Computational Neuroscience: Cell, Network and Data Analysis*, Cortona, Italy.
- 10/25/2012 Finite size effects in a network of rate neurons, *3rd Workshop of the GDR 2904 'Multi-electrode systems and signal processing to study neuronal networks'*, Marseille, France.
- 03/22/2012 Mean-field analysis of populations of realistic spiking neurons, *2nd BrainScaleS Plenary Meeting*, Jülich, Germany.

## SUMMARY OF MY RESULTS

See the link [www.neuroinformatics.it/neuroscience](http://www.neuroinformatics.it/neuroscience) for a more intuitive explanation of my research results.



**[1] D. Fasoli, S. Panzeri, The emergence of complexity in multiscale hierarchical networks: How biophysics, structure and size shape the dynamic repertoire of the brain, *in preparation*.**

**[2] D. Fasoli, L. Coletta, D. Gutierrez-Barragan, A. Gozzi, S. Panzeri, A model of the mouse cortex with attractor dynamics explains the structure and emergence of rsfMRI co-activation patterns, *Submitted, 2022* (URL). See [this link](#) for a more intuitive explanation of the paper.**

**[3] D. Fasoli** and S. Panzeri, Mathematical studies of the dynamics of finite-size binary neural networks: A review of recent progress, *Mathematical Biosciences and Engineering*, **16**(6):8025-8059, 2019 ([URL](#)).

**[4] D. Fasoli** and S. Panzeri, Stationary-state statistics of a binary neural network model with quenched disorder, *Entropy*, **21**(7):630, 2019 ([URL](#)).

**[5] D. Fasoli** and S. Panzeri, Optimized brute-force algorithms for the bifurcation analysis of a binary neural network model, *Physical Review E*, **99**(1): 012316, 2019 ([URL](#)).

**[6] D. Fasoli**, A. Cattani and S. Panzeri, Pattern storage, bifurcations, and groupwise correlation structure of an exactly solvable asymmetric neural network model, *Neural Computation*, **30**(5):1258-1295, 2018 ([URL](#)).

**[7] D. Fasoli**, A. Cattani and S. Panzeri, Transitions between asynchronous and synchronous states: A theory of correlations in small neural circuits, *The Journal of Computational Neuroscience*, **44**(1):25-43, 2018 ([URL](#)).

**[8] D. Fasoli**, A. Cattani and S. Panzeri, Bifurcation analysis of a sparse neural network with cubic topology, *Springer INdAM Series*, **24**:87-98, 2017 ([URL](#)).

**[9] D. Fasoli**, A. Cattani and S. Panzeri, The complexity of dynamics in small neural circuits, *PLoS Computational Biology*, **12**(8):e1004992, 2016 ([URL](#)).

**[10] D. Fasoli**, O. Faugeras and S. Panzeri, A formalism for evaluating analytically the cross-correlation structure of a firing-rate network model, *The Journal of Mathematical Neuroscience*, **5**(1):1-53, 2015 ([URL](#)).

**[11] J. Baladron**, **D. Fasoli** and O. Faugeras, Three applications of GPU computing in neuroscience, *Computing in Science and Engineering*, **14**(3):40-47, 2012 ([URL](#)).

**[12] J. Baladron**, **D. Fasoli**, O. Faugeras and J. Touboul\*, Mean-field description and propagation of chaos in networks of Hodgkin-Huxley and FitzHugh-Nagumo neurons, *The Journal of Mathematical Neuroscience*, **2**(1):10, 2012 ([URL](#)).

**\* Authors in alphabetical order**