

Fernando da Silva Borges, Ph.D.

Postdoctoral Fellow - Downstate Health Sciences University, SUNY The State University of New York: Albany, NY, US.
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PERSONAL PROFILE

Research in computational neuroscience with 27 publications in peer reviewed journals, and PI/co-PI in 7 research grants. Lectured undergraduate courses, and organized Courses on Computational Modeling. Investigates neural network models with research mainly focused on neuronal synchronization, synaptic plasticity, and epilepsy models (*in silico*, *in vivo*, and *in vitro*), also investigates full-scale microcircuits models of hippocampus, somatosensory and motor cortex in rodents through simulations in cloud computing.

EDUCATION

2013-2016 Ph.D. degree in Science/Physics

State University of Ponta Grossa · Paraná, Brazil, with collaborative period at University of Aberdeen, Scotland (2013/2014)

2011-2013 M.Sc. degree in Science/Physics

State University of Ponta Grossa · Paraná, Brazil

2007-2010 B.Sc. degree in Physics

State University of Ponta Grossa · Paraná, Brazil

ACADEMIC APPOINTMENTS

2021-Present Postdoctoral Researcher

Downstate Health Sciences University, SUNY The State University of New York: Albany, NY, US

2018-2021 Postdoctoral Researcher

Center for Mathematics Computation and Cognition, Federal University of ABC. São Paulo, Brazil

2016-2017 Postdoctoral Researcher

Institute of physics, Department of Applied Physics, University of São Paulo. São Paulo, Brazil

2011-2012 Assistant Professor

Department of Mathematics, Federal University of Technology. Paraná, Brazil

GRANTS

2018-2020 **FAPESP**, Analysis of Electrical Synapses Contribution in Neuronal Synchronization, R\$198,024.48

2018-2019 **CAPES-University of Aberdeen**, Synchronous behaviour and synaptic plasticity in neuronal networks, £ 20,400.00

2016-2017 **CNPq**, Synchronisation in Neuronal Networks with Synaptic Plasticity, R\$52,800.00

2013-2014 **CAPES-University of Aberdeen**, Dynamic Range in Neuronal Networks, £ 9,640.00 + US\$ 1,706.00

2019-2021 **CNPq**, Analysis of coupled systems dynamics, R\$10,000.00

2019-2021 **CNPq**, Simulation of Deep Brain Stimulation for the Treatment of Parkinson's Disease, R\$5,000.00

2014-2017 **CNPq**, Dynamic behavior of neural networks, R\$16,000.00

2018-2020 **FAPESP**, An interdisciplinary approach on the role of gap junctions and miRNAs in the development and degeneration of the nervous system, R\$54.197,27 + US\$49.102,19

2018-2020 **FAPESP**, Non Linear Dynamics, R\$607.231,76 + US\$21.649,21

PUBLICATIONS

27. C. A. TRUJILLO, E. S. RICE, N. K. SCHAEFER, I. A. CHAIM, E. C. WHEELER, A. A. MADRIGAL, J. BUCHANAN, S. PREISL, A. WANG, P. D. NEGRAES, R. A. SZETO, R. H. HERAI, A. HUSEYNOV, M. S. A. FERRAZ, **F. S. BORGES**, A. H. KIHARA, A. BYRNE, M. MARIN, C. VOLLMERS, A. N. BROOKS, J. D. LAUTZ, K. SEMENDEFERI, B. SHAPIRO, G. W. YEO, S. E. P. SMITH, R. E. GREEN, A. R. MUOTRI. Reintroduction of the archaic variant of NOVA1 in cortical organoids alters neurodevelopment. *Science*, v. 371, n. 694, 2021.

26. LAMEU, E. L.; **BORGES, F. S.**; IAROSZ, K. C.; PROTACHEVICZ, P. R.; ANTONOPOULOS, C. G.; MACAU, E. E. N.; BATISTA, A. M. Short-term and spike-timing-dependent plasticity facilitate the formation of modular neural networks. *Communications in Nonlinear Science & Numerical Simulation*, v. 96, n. 105689, 2021.

25. PROTACHEVICZ, P. R.; **BORGES, F. S.**; IAROSZ, K. C.; BAPTISTA, M. S.; LAMEU, E. L.; HANSEN, M.; CALDAS, I. L.; SZEZECH, J. D.; BATISTA, A. M.; KURTHS, J. Influence of Delayed Conductance on Neuronal Synchronization. *Frontiers in Physiology*, v. 11, n. 1053, 2020.

24. **BORGES, F. S.**; PROTACHEVICZ, P. R.; PENA, R. F. O.; LAMEU, E. L.; HIGA, G. S. V.; KIHARA, A. H.; MATIAS, F. S.; ANTONOPOULOS, C. G.; DE PASQUALE, R.; ROQUE, A. C.; IAROSZ, K. C.; JI, P.; BATISTA, A. M. Self-sustained activity of low firing rate in balanced networks. *Physica A*, v. 537, n. 122671, 2020.

23. SANTOS, V.; **BORGES, F. S.**; IAROSZ, K. C.; CALDAS, I. L.; SZEZECH, J. D.; VIANA, R. L.; BAPTISTA, M. S. BATISTA, A. M. Basin of attraction for chimera states in a network of Rössler oscillators. *Chaos*, v. 30, n. 083115, 2020.

22. PROTACHEVICZ, P. R.; **BORGES, F. S.**; LAMEU, E. L.; JI, P.; IAROSZ, K. C.; KIHARA, A. H.; CALDAS, I. L.; SZEZECH, J. D.; BAPTISTA, M.S.; MACAU, E. E. N.; ANTONOPOULOS, C. G.; BATISTA, A. M.; KURTHS, J. Bistable Firing Pattern in a Neural Network Model. *Frontiers in Computational Neuroscience*, v. 13, p. 1-8, 2019.

21. SANTOS, M. S.; PROTACHEVICZ, P. R.; IAROSZ, K. C.; CALDAS, I. L.; VIANA, R. L.; **BORGES, F. S.**; REN, H. P.; SZEZECH, J. D.; BATISTA, A. M.; GREBOGI, C. Spike-burst chimera states in an adaptive exponential integrate-and-fire neuronal network. *CHAOS*, v. 29, p. 043106, 2019.

20. **BORGES, F. S.**; LAMEU, E. L.; IAROSZ, K. C.; PROTACHEVICZ, P. R.; CALDAS, I. L.; VIANA, R. L.; MACAU, E. E. N.; BATISTA, A. M.; BAPTISTA, M. S. Inference of topology and the nature of synapses, and the flow of information in neuronal networks. *Physical Review E*, v. 97, p. 1-7, 2018.
19. PROTACHEVICZ, P. R.; BORGES, R. R.; REIS, A. S.; **BORGES, F. S.**; IAROSZ, K.C.; CALDAS, I. L.; LAMEU, E. L.; MACAU, E. E. N.; VIANA, R. L.; SOKOLOV, I. M.; FERRARI, F. A. S.; KURTHS, J.; BATISTA, A. M. Synchronous behaviour in network model based on human cortico-cortical connections. *Physiological Measurement*, v. 39, p. 074006, 2018.
18. LAMEU, E. L.; YANCHUK, S.; MACAU, E. E. N.; **BORGES, F. S.**; IAROSZ, K. C.; CALDAS, I. L.; PROTACHEVICZ, P. R.; BORGES, R.R.; VIANA, R.L.; SZEZECH JUNIOR, J. D.; BATISTA, A. M.; KURTHS, J. Recurrence quantification analysis for the identification of burst phase synchronisation. *Chaos*, v. 28, p. 085701, 2018.
17. LAMEU, E. L.; MACAU, E. E. N.; **BORGES, F. S.**; IAROSZ, K. C.; CALDAS, I. L.; BORGES, R.R.; PROTACHEVICZ, P. R.; VIANA, R.L.; BATISTA, A. M. Alterations in brain connectivity due to plasticity and synaptic delay. *European Physical Journal-Special Topics*, v. 227, p. 673-682, 2018.
16. MUGNAINE, M.; REIS, A. S.; **BORGES, F.S.**; BORGES, R.R.; FERRARI, F.; IAROSZ, K. C.; CALDAS, I. L.; LAMEU, E.L.; VIANA, R.L.; SZEZECH, J. D.; KURTHS, J.; BATISTA, A. M. Delayed feedback control of phase synchronisation in a neuronal network model. *European Physical Journal Special Topics*, v. 227, p. 1151-1160, 2018.
15. PROTACHEVICZ, P. R.; **BORGES, F. S.**; IAROSZ, K.C.; CALDAS, I.L.; BAPTISTA, M.S.; VIANA, R.L.; LAMEU, E.L.; MACAU, E.E.N.; BATISTA, A.M. How synapses can enhance sensibility of a neural network. *Physica A*, v. 492, p. 1045-1052, 2018.
14. **BORGES, F.S.**; PROTACHEVICZ, P. R.; LAMEU, E. L.; BONETTI, R. C.; IAROSZ, K.C.; CALDAS, I.L.; BAPTISTA, M.S.; BATISTA, A.M. Synchronised firing patterns in a random network of adaptive exponential integrate-and-fire neuron model. *Neural Networks*, v. 90, p. 1-7, 2017.
13. BORGES, R. R.; **BORGES, F. S.**; LAMEU, E. L.; PROTACHEVICZ, P.R.; IAROSZ, K.C.; CALDAS, I. L.; VIANA, R. L.; MACAU, E. E. N.; BAPTISTA, M. S.; GREBOGI, C.; BATISTA, A. M. Synaptic Plasticity and Spike Synchronisation in Neuronal Networks. *Brazilian Journal of Physics*, v. 47, p. 678-688, 2017.
12. BORGES, R.R.; **BORGES, F.S.**; LAMEU, E.L.; BATISTA, A.M.; IAROSZ, K.C.; CALDAS, I.L.; ANTONOPOULOS, C.G.; BAPTISTA, M.S. Spike timing- dependent plasticity induces non-trivial topology in the brain. *Neural Networks*, v. 88, p. 58-64, 2017.
11. SANTOS, M. S.; SZEZECH, J. D.; **BORGES, F. S.**; IAROSZ, K. C.; CALDAS, I. L.; BATISTA, A. M.; VIANA, R. L.; KURTHS, J. Chimera-like states in a neuronal network model of the cat brain. *CHAOS SOLITONS & FRACTALS*, v. 101, p. 86-91, 2017.
10. LAMEU, E. L.; **BORGES, F. S.**; BORGES, R. R.; BATISTA, A. M.; BAPTISTA, M. S.; VIANA, R. L. Network and external perturbation induce burst synchronisation in cat cerebral cortex. *Communications in Nonlinear Science & Numerical Simulation*, v. 34, p. 45-54, 2016.
9. BORGES, R. R.; **BORGES, F. S.**; LAMEU, E. L.; BATISTA, A. M.; IAROSZ, K. C.; CALDAS, I.L.; VIANA, R.L.; SANJUÁN, M.A.F. Effects of the spike timing-dependent plasticity on the synchronisation in a random Hodgkin-Huxley neuronal network. *Communications in Nonlinear Science and Numerical Simulation*, v. 34, p. 12-22, 2016.
8. LAMEU, E. L.; **BORGES, F.S.**; BORGES, R.R.; IAROSZ, K.C.; CALDAS, I.L.; Batista A. M.; VIANA, R.L.; KURTHS, J. Suppression of phase synchronisation in network based on cat's brain. *Chaos*, v. 26, p. 043107, 2016.
7. **BORGES, F. S.**; LAMEU, E. L.; BATISTA, A. M.; IAROSZ, K. C.; BAPTISTA, M. S.; VIANA, R. L. Complementary action of chemical and electrical synapses to perception. *Physica A*, v. 430, p. 236-241, 2015.
6. BORGES, R. R.; IAROSZ, K. C.; BATISTA, A. M.; CALDAS, I. L.; **BORGES, F. S.**; LAMEU, E. L. Sincronização de disparos em redes neuronais com plasticidade sináptica. *Revista Brasileira de Ensino de Física (Online)*, v. 37, p. 2310-1-2310-9, 2015.

5. IAROSZ, K. C.; **BORGES, F. S.**; BATISTA, A. M.; BAPTISTA, M. S.; SIQUEIRA, R. A. N.; VIANA, R. L.; LOPES, S. R. Mathematical model of brain tumour with glia-neuron interactions and chemotherapy treatment. *JOURNAL OF THEORETICAL BIOLOGY*, v. 368, p. 113-121, 2015.
4. PASSONI, S.; **BORGES, F. S.**; PIRES, L. F.; SAAB, S. C.; COOPER, M. Software Image J to study soil pore distribution. *Ciência e Agrotecnologia (UFPA)*, v. 38, p. 122-128, 2014.
3. VIANA, R.L.; **BORGES, F. S.**; IAROSZ, K.C.; BATISTA, A.M.; LOPES, S.R.; CALDAS, I.L. Dynamic range in a neuron network with electrical and chemical synapses. *Communications in Nonlinear Science & Numerical Simulation*, v. 19, p. 164-172, 2014.
2. PIRES, L.F.; **BORGES, F.S.**; PASSONI, S.; PEREIRA, A.B. Soil Pore Characterization Using Free Software and a Portable Optical Microscope. *Pedosphere*, v. 23, p. 503-510, 2013.
1. **BORGES, F. S.**; IAROSZ, K. C. ; REN, H. P. ; BATISTA, A. M. ; BAPTISTA, M. S. ; VIANA, R. L. ; LOPES, S.R. ; GREBOGI, C. Model for tumour growth with treatment by continuous and pulsed chemotherapy. *Biosystems (Amsterdam. Print)*, v. 116, p. 43-48, 2013.

ACCEPT FOR PUBLICATION

3. Noise induces continuous and noncontinuous transitions in neuronal interspike intervals range. *Pramana-Journal of Physics*.
2. Effects of drug resistance in the tumour-immune system with chemotherapy treatment. *Pramana-Journal of Physics*.
1. Influence of inhibitory synapses on the criticality of excitable neuronal networks. *Pramana-Journal of Physics*.

PUBLICATIONS SUBMITTED OR/AND IN REVIEW PROCESS

1. Mathematical model of brain tumour growth with drug resistance. *Physica A* (2020).
2. Modeling and characterizing stochastic neurons based on in vitro voltage-dependent spike probability functions. *European Journal of Physics* (2021).

Complementary Education

2019 Machine Learning: Optimization and the Perception, Multi-Layer Networks and the Backpropagation Algorithm, and Architectures and Applications. (Credit Hours: 9h). IRTG Workshop/School, Humboldt-Universität zu Berlin, Germany.

2019 Building biophysically detailed neuronal models: from molecules to networks (NEURON and NetPyNE). (Credit Hours: 6h). CNS Tutorial, Universitat de Barcelona, Spain.

2017 SimNeuroX Simulation Neuroscience. (Credit Hours: 48h). Ecole Polytechnique Fédérale de Lausanne, EPFL, Switzerland.

2016 Sixth Latin American School on Computational Neuroscience. (Credit Hours: 206h). University of São Paulo, USP, Brazil.

2015 School on Complex Networks and Applications to Neuroscience. (Credit Hours: 80h), UNESP, Brazil.

2013 School on Biological Complex Networks: From the Cell to the Brain and beyond. (Credit Hours: 120h). Federal University of Rio Grande do Norte, UFRN, Brazil.

2012 Recent developments in the dynamics of complex systems. (Credit Hours: 15h). Federal University of Paraná, UFPR, Brazil.

Conferences (last 3 years)

- 2020 CNS, Speaker - *Inference of topology and the nature of synapses in neuronal networks*. Organization for Computational Neuroscience, 29th Annual Computational Neuroscience Meeting. July 2020 (online).
- 2020 VIII Latin American School on Computational Neuroscience, Invited Lecture - *Firing Patterns and Epileptic Seizures*. University of São Paulo, USP, Brazil.
- 2019 IWCSN 2019, Speaker - *Bistable firing patterns: one way to understand how epileptic seizures are triggered*, Humboldt-Universität zu Berlin, Germany.
- 2019 Bernstein Conference, Poster - *Bistable firing patterns and epileptic seizures*, Technische Universität Berlin, Germany.
- 2019 CNS, Panelist - Student and Postdoc *Career Development Workshop*, Universitat de Barcelona, Spain.
- 2019 CNS, Poster - *Bistable firing patterns: one way to understand how epileptic seizures are triggered*, Universitat de Barcelona, Spain.
- 2019 Conference on Perspectives in Nonlinear Dynamics, Speaker - *Firing patterns in networks of adaptive exponential integrate-and-fire neuron model*, ICTP South American Institute for Fundamental Research, UNESP, São Paulo, Brazil.
- 2018 Organizer - II Practical Course on Computational Modeling (PratiCoNeuro-2018), University of São Paulo, Ribeirão Preto, Brazil.
- 2018 Lecture - II Practical Course on Computational Modeling (PratiCoNeuro-2018), *Synchronisation in Neuronal Networks with Synaptic Plasticity*, University of São Paulo, Ribeirão Preto, Brazil.
- 2007 - 2017 - Online CV: <http://lattes.cnpq.br/6429331046927864>

Interviews and Comments on the media

12. New York Times: <https://www.nytimes.com/2021/02/11/science/neanderthal-brain-organoids.html>
11. Folha de São Paulo: <https://www1.folha.uol.com.br/ciencia/2021/02/cientistas-criam-minicerebros-com-dna-neandertal-e-veem-diferencas-no-surgimento-de-neuronios.shtml>
10. Agência Fapesp: <https://revistapesquisa.fapesp.br/cerebro-neandertal-em-laboratorio/>
9. NEWSWISE: <https://newswise.com/articles/toward-quieting-the-brain-cluster-analysis-of-cat-neural-networks-reveals-promising-anti-seizure-strategies/sc-dwhp>
8. AANS Neurosurgeon: <https://aansneurosurgeon.org/toward-quieting-the-brain-cluster-analysis-of-cat-neural-network-models-reveals-promising-anti-seizure-strategies/>
7. Neuroscience News: <https://neurosciencenews.com/neural-networks-seizure-neuroscience-4082/>
6. Technology Networks: <https://www.technologynetworks.com/neuroscience/news/quieting-brain-cluster-analysis-cat-neural-network-models-reveals-promising-anti-284192>
5. Sociedade Brasileira de Física (Brazilian Society of Physics): <http://www.sbfisica.org.br/v1/home/index.php/pt/destaque-em-fisica/353-bjp-plasticidade-cerebral-estudada-em-redes-neuronais>
4. Exame - ciência: <https://exame.abril.com.br/ciencia/estudo-mostra-como-a-plasticidade-induz-configuracoes-no-cerebro/>
3. Agência Fapesp: <http://agencia.fapesp.br/estudo-mostra-como-a-plasticidade-induz-configuracoes-nao-triviais-no-cerebro/25299/>
2. Jornal da USP: <http://jornal.usp.br/ciencias/ciencias-exatas-e-da-terra/fisica-ajuda-a-entender-como-redes-de-neuronios-se-organizam/>
1. TV Brasil: <http://tvbrasil.ebc.com.br/reportersaopaulo/episodio/pesquisadores-do-instituto-de-fisica-da-usp-estao-usando-a-matematica-para>