Abolfazl Ziaeemehr

I got my PhD in **computational neuroscience** at Institute for Advanced Studies in Basic Science (IASBS) Zanjan, Iran. Currently I am working at Institute for Research in Fundamental Sciences (IPM Tehran) as a researcher.

Research Interest

- Network Neuroscience: Complex network approaches to brain structure and function
- Computational Neuroscience: Dynamic models of brain networks, neural synchrony and binding, information-theoretical measures of functional interactions.
- Data science: Analysis and visualization of data.

PhD Theses

Title **Synchronization dynamics on undirected and directed hierarchical networks**

Supervisors Mina Zarei, Alireza Valizadeh

Description The goal of my research was to develop a theoretical framework and computational tools for studying the collective behavior and synchronization of neuron populations. For example, I investigated the effects of the time delay, number, length, and place of directed loops, the interplay between node dynamics and network structure on the collective behavior of the networks. I also worked on the information proccessing at hierarchical complex networks.

Experience

Research

Present **Dr, Vahabie, School of cognitive science, IPM, Tehran.** I work on modeling Basal Ganglia network for Parkinson disease.

2016-2020 **Prof. Alireza Valizadeh and Prof Mina Zarei's research group**. I studied a wide variety of topics such as optimization of synchronization in coupled oscillators and neuron populations in presence of noise, intrplay between structure and dynamics in connectome networks, information processing measurements, graph analysis approach to study complex networks, and analysing the electrophysiological brain recording data.

2019 **Dr. Abbasian lab,School of congnitive science, IPM, Tehran**. I worked on chimera state project and using phase models to see some chimera like states on the connectome of the human.

2018 **Dr. Joaquin J. Torres lab, university of Granada**. I had a vist for 6 month in the department of electromagnetism and matter physics, Universidad de Granada, Spain. I studied the phase-transition phenomena and analyzing to what extent a weak signal endures in noisy environments. I also studied the noise-induced volatility in a network of interacting LIF neurons. I had useful discussions with Dr. Muñoz.

No. 444, Prof. Yousef Sobouti Blvd. – P.O.Box 45195-1159 Zanjan – Iran
+98 (919) 6074 296 • a.ziaeemehr@iasbs.ac.ir
github.com/Ziaeemehr

Teaching

Jul 2020 **TA** at Neuromatch Academy summer school.

2016-2017 **Workshop Lecturer**, Holding workshops at IASBS on Python scripting for scientific programming several times, and also some other programming sessions on Julia, C++ and neuron simulation packages like Brian and Nest simulator.

2015-2016 Being **TA** several times in PhD period in Classical Electrodynamics (I, II) and Computational Physics.

Some of open source software development and contributions

- **ziaeeNN2020**, This repository contains the source codes for reproducing results and figures of Neural Networks, 2020 paper.
- **SReport2020** This repository contains the source codes for reproducing results and figures of: Scientific Reports, 2020 paper.
- **Frontiers2020**, repository contains the source codes for reproducing results and figures of: Frontiers 2021 paper (under rewiew).
- Developing nest simulator by adding new neuron models, available on PR 543, PR560.
- **ModelingNeuraldynamics**, I wrote the codes for this book: "An Introduction to Modeling Neuronal Dynamics" by Borgers in Python scripts and using Brian.
- **SBI**, *sbi* package by mackelab is a *PyTorch* package for simulation-based inference. Simulation-based inference is the process of finding parameters of a simulator from observations. I provide some examples to integrate *sbi* with the *NEST simulator* and *scipy*.
- **workshop scripting** This repository is created for weekly sessions of Python scripting course at IASBS and including many example and application from simple to complex.
- **workshop julia** The source code and examples for the Julia workshop including benchmarking simple and generalized Kuramoto model.
- **workshop C++** The source code and examples for the C++ workshop.

List of Publications

Jul 2020 Ziaeemehr A, Zarei M, Valizadeh A, Mirasso C. **Frequency-dependent organization of the brain's functional network through delayed-interactions**. J. Neural Networks, 2020 Aug.

Feb 2020 Ziaeemehr A, Zarei M, Sheshbolouki A. **Emergence of global synchronization in directed excitatory networks of type I neurons**. *Scientific Reports. 2020 Feb 24;10(1):1-1.*

Jan 2021 Ziaeemehr, A. and Valizadeh, A., 2020. **Frequency-resolved functional connectivity: Role of delay and the strength of connections**, under review, Frontiers in neural circuits.

Presentations

Oct 2020 Neuromatch Conference 3, "Effects of Anti-Hebbian learning on the synchronization and structure of directed networks with pure and hybrid inhibitory and excitatory couplings".

Sep 2020 Bernstein Conference online, "Frequency-dependent functional connectivity: Role of delay and connections strength".

May 2020 Neuromatch Conference 2, "Emergence of global synchronization in directed excitatory networks of type I neurons".

Programming skills

OS	Linux;
Languages	Python, C++, Julia;
packages	Nest Simulator, Brian, MNE-Python;
GUI	PyQtGraph;

Honors and Awards

Jan 2018	Scholarship by the Ministry of science of Iran to carry out part of ongoing Ph.D research study at the *Department of Electromagnetism and Matter Physics, Universidad de Granada, Spain*;
2014	Rank 26 th among about 5000 people in entrance exames of PhD;

Notable events attended

Jan 2018	Comprehensive Workshop on Analysis and Interpretation of Primate Electrophysiological data, Institute for Research in Fundamental Science(**IPM**), Tehran, Iran;
Mar 2017	5th Workshop on Advanced Techniques for Scientific Programming and Management of Open Source Software Packages, **ICTP**, Sharif University, Tehran, Iran;
Oct 2016	Introductory School on Parallel Programming and Parallel Architecture for High-Performance Computing, **ICTP**, Trieste,Italy;
Nov 2014	High-Performance Computing and Grid computing (HPC8), Institute for Research in Fundamental Science(**IPM**), Tehran, Iran.

Languages

- English:reading,writing,listening — good
- Persian — Native

Advanced Courses Passed

PhD course	Advanced scientific computation;
PhD course	Parallel Computation and optimization;
PhD course	Statistical Physics of Fields;

Reading inside Neuroscience

- Theoritical Neuroscience (Abbott);
- Networks: An Introduction (Newman);
- Modeling neuronal dynamics, (Borgers);
- Neuroscience : Exploring the Brain (Connors) ;
- Dynamical Systems in Neuroscience (Izhikevich);
- An Introduction to Transfer Entropy, (Bossomaier)
- Directed Information Measures in Neuroscience, (Wibral).
- Neuronal Dynamics From Single Neurons to Networks ... (Grestner);

References

Mina Zarei, *Assistant Professor of Physics*, mina.zarei@iasbs.ac.ir.
Tel: +98 24 33152017

Alireza Valizadeh, *Associate Professor of Physics*, valizade@iasbs.ac.ir.
Tel: +98 24 33152120