Arash Golmohammadi

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Summary

Computational scientist and PhD researcher specializing in distributed temporal representation in physical and neuro-inspired systems. Experienced in numerical methods, stochastic modeling, machine learning and simulation pipelines applied to neuroscience, fluid dynamics, and statistical physics. Strong background in applied mathematics and physics, with research experience in academic and industrial environments.

Education

2022 - now **Ph.D. in Computational Neuroscience** (SFB 1286)
Georg-August-Universität Göttingen, Germany
Research focus: *reservoir computing and neuromorphic approaches to neural systems*

2017 - 2020 **M.Sc. in Computational Science and Engineering** (5.0/6.0, very good)
École Polytechnique Fédérale de Lausanne (EPFL), Switzerland
Thesis title: *Extracting Chemical Abundance of Milky Way Stars Using Machine Learning*

2012 - 2017 **B.Sc. in Physics** and **Mechanical Engineering** (double major) (18.05/20, very good)
Sharif University of Technology, Iran
Thesis title: *Simulation of Wind Flow Over Turbine Blades Equipped with Piezoelectric Jets*

Work Experience

Research Assistant – University of Rostock (SFB 1270), Dec 2020 - Jun 2022

- Developed finite-element models of electrode-tissue interaction using FEniCS and NGSolve for deep brain stimulation (DBS), a treatment for Parkinson's disease
- Implemented floating potential boundary conditions to enable realistic simulation of electric field and activation thresholds in DBS settings

Outputs: code repository

Research Intern – EPFL (MCSS lab), Mar 2020 - Aug 2020

- Designed and generated a CFD-based dataset of turbulent flow around 2D airfoil profiles for downstream training of deep-learning-based flight controllers
- Set up and executed parallel RANS simulations from scratch, including geometry definition, meshing with gmsh, and solver configuration in OpenFOAM
- Built automated preprocessing and data-management pipelines to ensure simulation reproducibility

Skills

Scientific Computing	Python, C, C++, MATLAB
Methods	Numerical analysis, stochastic and partial differential equations, signal processing
Machine Learning	Deep learning, Bayesian and variational inference, generalized linear models
Tools	Git, Linux/Unix, SLURM-based HPC systems, LaTeX
Libraries	Brian2, NEST, snnTorch, pyTorch, statmodels

Selected Projects

Parkinson's Disease Biomarkers in the Basal Ganglia-Thalamo-Cortical Network (2021)

- Built a mean-field model of the BGTC network reproducing the characteristic oscillatory biomarkers of Parkinson's disease
- Showed, within the modeling framework, that commonly used oscillatory biomarkers are not unique, motivating the use of complementary markers

Outputs: code repository

High-Order Stochastic Integrators for Stochastic Differential Equations (2019)

- Implemented a numerical integrator for stochastic differential equations with non-commutative noise
- Based on the Milstein-Platen scheme; validated via numerical convergence tests in Python

Outputs: code repository

Variational Inference for Polynomial Chaos Expansion (2019)

- Developed a sparse polynomial chaos expansion for uncertainty quantification in Darcy flow
- Applied hierarchical variational inference for coefficient estimation and validated approximation error against theoretical bounds

Outputs: code repository

EEG-Based Movement Classification (2018)

- Designed and trained neural network models to predict finger movement from EEG signals
- Achieved classification accuracy exceeding 70% on labeled EEG datasets

Outputs: code repository

Languages

English (C1), German (B1), French (A1), Persian (Native)

Awards

Gold medal – International Olympiad on Astronomy and Astrophysics (2012, Brazil)

Teaching Experience

Tutor – University of Göttingen, 2022 - present

- Conducted tutorials and problem-solving sessions for Bachelor- and Master-level courses in Dynamical Systems, Nonlinear Dynamics, Computational Neuroscience, and Neuromorphic Computing

Publications

Golmohammadi, Arash, Luboeinski, J., & Tetzlaff, C. (2025). *Skewed Neuronal Heterogeneity Enhances Efficiency On Various Computing Systems*. arXiv: 2412.05126 [cs]. https://doi.org/10.48550/arXiv.2412.05126

Yilmaz, E., Rahimi, A., Münchhalfen, M., Alevra, M., **Golmohammadi, Arash**, Tetzlaff, C., Opazo, F., & Engels, N. (2025). Immunoglobulin divalence promotes B-cell antigen receptor cluster scale-dependent functions. *Cell Mol Immunol*, *22*(9), 1093–1108. https://doi.org/10.1038/s41423-025-01327-1

Golmohammadi, Arash, Payonk, J. P., van Rienen, U., & Appali, R. (2025). A Computational Study on the Activation of Neural Transmission in Deep Brain Stimulation. *IEEE Trans Biomed Eng*, *72*(3), 1132–1147. https://doi.org/10.1109/TBME.2024.3489799

Bonnin, E. A., **Golmohammadi, Arash**, Rehm, R., Tetzlaff, C., & Rizzoli, S. O. (2023). High-resolution analysis of bound Ca2+ in neurons and synapses. *Life Science Alliance*, *7*(1). https://doi.org/10.26508/lsa.202302030