JÜLICH
Forschungszentrum

Shaping change: this is what drives us at Forschungszentrum Jülich. As a member of the Helmholtz Association with some 7,600 employees, we conduct interdisciplinary research into a digitalized society, a climate-friendly energy system, and a sustainable economy. We focus on the natural, life, and engineering sciences in the fields of information, energy, and bioeconomy. We combine this with expertise in high-performance computing and artificial intelligence using unique scientific infrastructures.

Apply your data science skills to real-world challenges! At the Helmholtz School for Data Science in Life, Earth and Energy (HDS-LEE), we train the next generation of data scientists to tackle key global issues in domain sciences such as life, earth or energy. Learn more at https://www.hds-lee.de

The current opening is located at the Institute for Advanced Simulation - Computational and Systems Neuroscience - IAS-6, https://www.csn.fz-juelich.de , which consists of seven working groups that conduct research in the field of computational and systems neuroscience. The Statistical Neuroscience group headed by Prof. Sonja Grün develops computational methods to analyze the joint activity of neuronal networks, and applies these methods to experimental data in the context of international collaborations. The PhD candidate will be co-supervised by Prof. Michael Schaub, RWTH Aachen University.

We are looking to recruit a

PhD position - Bridging classical and AI-based approaches for the analysis of massively parallel neural spike trains within the HDS-LEE graduate school

Your Job:
This PhD project bridges between classical analytical methods and modern AI based techniques to analyse spike train recordings to advance our understanding of neural population coding while maintaining clarity in the interpretation of results. Concurrently, AI-based methods are developed that prioritize interpretability and reduce data dependency by imposing desirable constraints on model behavior.

We will divide our work into three thrusts:

- Thrust A: A first major objective will be to augment classical spike train analysis

The job will be advertised until the position has been successfully filled. You should therefore submit your application as soon as possible. We look forward to receiving your application via our **Online-Recruitment-System!**

Questions about the vacancy?
Get in touch with us by using **our contact form.**
Please note that for technical reasons we cannot accept applications via email.
www.fz-juelich.de

methods particularly those developed by Prof. Grün and others for detecting synchronous spiking activity with AI-based enhancements. After profiling the classical methods for their bottlenecks, these steps will then be replaced or supplemented with ML-based surrogates or approximators, such as random forests or shallow neural networks, trained to mimic the outputs of the original computations at a fraction of the cost. This hybridization aims not only to accelerate performance but also to maintain, if not improve, analytical rigor. The improved modules will be integrated into an updated analytical pipeline and validated against benchmark datasets drawn from prior studies in the field.

- Thrust B: A second central thrust of this project focuses on making contemporary ML-based techniques more interpretable and biologically meaningful in their application to neural population coding. As a starting point, we will build upon recent advances in graph neural networks (GNNs), particularly those described by which offer a promising architecture for modelling population-level neural interactions. Prior work has emphasized rate-based codes due to their relative simplicity; our approach will explicitly extend these models to capture temporal structure within spike trains thereby moving towards analyses that are sensitive not just to firing rates but also precise timing relationships underpinning temporal codes. To ensure that these advanced models do not become opaque “black boxes,” we will integrate post-hoc explainability tools such as SHAP values (SHapley Additive exPlanations)
- Thrust C: The utility of all developed methods will be rigorously evaluated using both synthetic and real-world datasets. Synthetic benchmarks will be generated using established generative models capable of producing ground-truth synchronous patterns under varying conditions to enable systematic validation across relevant scenarios. All software arising from this work including improved analysis pipelines and benchmarking datasets will be released through an open-source library.

Your Profile:

- A Masters degreee with a strong academic background in physics, mathematics, computer science, or a related field
- Proficiency in at least one programming language (Python, C++, …)
- Experience in neuroscience is an advantage
- Good analytical skills with a sound understanding of data evaluation
- Good organisational skills and ability to work systematically, independently and collaboratively
- Effective communication skills and an interest in contributing to a highly international and interdisciplinary team
- Motivation for academic development, supported by bachelor’s and master’s transcripts and two reference letters
- Working proficiency in English for daily communication and professional contexts (TOEFL or equivalent or excemption required)
- Knowledge of German is beneficial

Our Offer:

We work on the very latest issues that impact our society and are offering you the chance to actively help in shaping the change! This HDS-LEE PhD position will be located at Forschungszentrum Jülich and RWTH Aachen University. We offer ideal conditions for you to complete your doctoral degree:

- World class science environment at the interface between neuroscience and digital technologies, enabling scientific progress on the most complex known systems
- Outstanding scientific and technical infrastructure
- A highly motivated group as well as an international and interdisciplinary working environment at one of Europe’s largest research establishments

- Continuous scientific mentoring by your scientific advisors
- Chance of participating in (international) conferences
- Unique HDS-LEE graduate school program (including data science courses, soft skill courses and annual retreats) https://www.hds-lee.de/about/
- 30 days of annual leave (depending on agreed working time arrangements) and provision for days off between public holidays and weekends (e.g. between Christmas and New Year)
- A large research campus with green spaces, offering the best possible means for networking with colleagues and pursuing sports alongside work
- Further development of your personal strengths, e.g. through an extensive range of training courses; a structured program of continuing education and networking opportunities specifically for doctoral researchers via JuDocS, the Jülich Center for Doctoral Researchers and Supervisors: https://www.fz-juelich.de/en/judocs
- Targeted services for international employees, e.g. through our International Advisory Service

The position is for a fixed term of 3+1 years. Pay in line with 75% of pay group 13 of the Collective Agreement for the Public Service (TVöD-Bund) and additionally 60 % of a monthly salary as special payment („Christmas bonus“). Pay higher than the basic pay may be possible. The monthly salaries in euro can be found on the BMI website: https://go.fzj.de/bmi.tvoed.entgelt Further information on doctoral degrees at Forschungszentrum Jülich (including its various branch offices) is available at https://www.fz-juelich.de/en/careers/phd

We welcome applications from people with diverse backgrounds, e.g. in terms of age, gender, disability, sexual orientation / identity, and social, ethnic and religious origin. A diverse and inclusive working environment with equal opportunities in which everyone can realize their potential is important to us.

Further information on diversity and equal opportunities: https://go.fzj.de/equality