Manu Kalia (he/him)

Born December 24, 1994 in New Delhi, India (Dutch citizen)
Postdoctoral researcher in Mathematics, Freie Universität Berlin
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Languages: English, Hindi, French, Dutch
Programming: (Preferred) Julia, Python; (Comfortable) C++, Matlab, Mathematica
(Environments) Linux, bash, LaTeX, vim

I'm an applied mathematician by training, with research interests in computational and mathematical problems arising in neuroscience, climate and social dynamics, dynamical systems and bifurcation theory, network theory, and the interaction of machine learning with dynamical systems.

Work Experience

Jul 2022 - | Postdoctoral researcher at Freie Universität Berlin, Germany
Mathematical treatment of coherence in climate and social dynamics. Funded by the Einstein Visiting Fellowship for three years. Lead developer and maintainer of `TemporalNetworks.jl` (Julia).

Mar 2020 - Jul 2020 | Visiting researcher (remote) at University of Washington, Seattle, USA
Worked with Profs. Nathan Kutz and Steven Brunton on data-driven model discovery. Funded by the NDNS+ cluster in the Netherlands.

Aug 2017 - Feb 2022 | Researcher at University of Twente, Enschede, The Netherlands
Part of the Applied Analysis group at the Applied Mathematics department. Supersedes the duration of my PhD. Taught applied dynamical systems theory topics and performed research towards my PhD. PhD thesis here.

Jul 2016 - Nov 2016 | Intern at Medisch Spectrum Twente, Enschede, The Netherlands
Modelling extracellular dynamics in a biophysical model for cytotoxic cell swelling. (This work is extended to my PhD project)

May- Aug 2014 | Research Intern at Defense Research and Development Organisation (DRDO), New Delhi, India
PDE models of the displacement of torsional waves caused by earthquakes in viscoelastic isotropic media.

Education

2017 - 22 | PhD in Applied Mathematics at University of Twente, Enschede, The Netherlands
Applying dynamical systems and machine learning methods in mathematical modeling, focusing on models of ischemic stroke. In collaboration with Heinrich Heine University, Düsseldorf, Germany. Funded by: DFG (German Research Foundation) FOR 2795, 'Synapses Under Stress' (link). Promoters: Prof. Christine Rose (HHU Düsseldorf) and Prof. Stephan van Gils (Twente).

2015-17 | M. Sc. in Applied Mathematics, University of Twente, Enschede, The Netherlands
Chair: Applied Analysis, Credits completed: 131/120, Average grade : 8.08/10

2012-15 | B.Sc. (with Honours) in Mathematics, University of Delhi, New Delhi, India
Average grade : 89.7/100

Grants and awards

2022-26 | Two rounds of postdoc funding from the Einstein Foundation Visiting Fellowship Scheme (Gary Froyland).

2020 | NDNS+ travel grant for visit to University of Washington.

2018-2022 | DFG FOR 2795 'Synapses under stress' grant for 3 years of PhD.

2019 | Poster award for 'Ion dynamics at the tripartite synapse', 28th Annual Computational Neuroscience Meeting.

2015-17 | University of Twente Scholarship (UTS) granted by the University of Twente for the full length of the master programme (€25,000 per annum)

2012-15 | Scholarship granted by the Indian Naval Benevolent Association for undergraduate students majoring in the sciences (INR 25,000 per annum)

Peer-reviewed publications

1. Ziebarth, T. *et al.* Atypical plume-like events contribute to glutamate accumulation in metabolic stress conditions. *iScience* **28,** 112256 (Apr. 2025).
2. Engels, M. *et al.* Glial Chloride Homeostasis Under Transient Ischemic Stress. *Frontiers in Cellular Neuroscience* **15,** 365 (2021).
3. Kalia, M., Meijer, H. G. E., van Gils, S. A., van Putten, M. J. A. M. & Rose, C. R. Ion dynamics at the energy-deprived tripartite synapse. *PLOS Computational Biology* **17,** 1–37 (June 2021).
4. Kalia, M., Brunton, S. L., Meijer, H. G., Brune, C. & Kutz, J. N. Deep learning of normal form autoencoders for universal, parameter-dependent dynamics. *NeurIPS workshop on Interpretable Inductive Biases and Physically Structured Learning* (2020).
5. Kalia, M., Kuznetsov, Y. A. & Meijer, H. G. E. Homoclinic saddle to saddle-focus transitions in 4D systems. *Nonlinearity* **32,** 2024–2054 (May 2019).

Preprints

1. Froyland, G., Kalia, M. & Koltai, P. Multi-set spectral clustering of time-evolving networks using the supra-Laplacian. *arXiv:2409.11984 (in review JMLR)* (2024).
2. Kalia, M., Ligtenstein, S. L., Meijer, H. G. & van Putten, M. J. A neural mass model for the EEG in ischemia (Apr. 2023).
3. Kalia, M., Brunton, S. L., Meijer, H. G., Brune, C. & Kutz, J. N. Learning normal form autoencoders for data-driven discovery of universal, parameter-dependent governing equations. *arXiv:2106.05102 (In review Physical Review E)* (2021).
4. Kalia, M. & Ghosh, S. Cross-Correlation in cricket data and RMT. *arXiv:1502.03411* (2015).

Talks and posters

1. *Ion dynamics at the tripartite synapse*
   (a) Bonn Brain 2019, Bonn, Germany (Poster)
   (b) ICMNS 2019, Copenhagen, Denmark (Talk)
   (c) CNS 2019, Barcelona, Spain (Poster, award)
   (d) 14th Göttingen Neuroscience Meeting 2021 (Poster, virtual)
   (e) GLIA 2021 (Poster, virtual)
   (f) SMB 2021 (**Invited talk**, virtual)
2. *Learning normal form autoencoders for data-driven discovery of universal,parameter-dependent governing equations*
   (a) NeurIPS workshop on Interpretable Inductive Biases and Physically Structured Learning 2020 (Talk, virtual)
   (b) SIAM DS20 (Talk, virtual, held in 2021)
3. *Estimating Parameters in ODEs with Neural Networks*
   (a) SIAM DS 19, Snowbird, Utah, USA (Poster)
   (b) Lorentz Center Summer School: Data Science for Dynamical Systems 2019, Leiden, The Netherlands (**Invited talk**)
   (c) SIAM MDS 20 (**Invited talk**, virtual)
4. *Detecting birth and death of communities in networks*
   (a) SIAM DS 23, Portland, Oregon, USA (**Invited talk**)
   (b) NADCOM 23, Dresden, Germany (Poster)
   (c) New Challenges in High Dimensional Complex Dynamical Systems, NORDITA, Stockholm, 2024
   (d) ANZIAM 2025, Coffs Harbour, Australia
   (e) Dynamics Days 2025, Thessaloniki, Greece (**minisymposium organiser**)

Teaching and supervision

1. **Teaching**:
   - (Graduate) Nonlinear Dynamics: tutorials, homework, substitute lectures
   - (Graduate) Dynamical behaviour of neuronal networks: tutorials, homework, lecture
2. **Supervision:**
   - Justus Schlenger (Master thesis, 2020), *Modeling postsynaptic responses at the energy deprived tripartite synapse*
   - Naomi Hulst (Bachelor thesis, 2018), *Modelling the interaction between the presynaptic terminal and the astrocyte at a glutamatergic synapse*