Janne Kristian Lappalainen

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Education

since 10/2020 — **Doctoral Candidate**, University of Tübingen and Max Planck Research School for Intelligent Systems, Advisor Prof. Jakob Macke, IMPRS-IS Committee: Prof. Macke, Prof. Martius, Prof. Bethge

10/2017 – 03/2020 — **M.Sc. Neuroengineering**, High Distinction, TU Munich

10/2013 – 07/2017 — **B.Sc. Physics**, Distinction, University of Göttingen and University of La Laguna (via Erasmus)

Research experience

since 10/2020 — **Doctoral Researcher, Machine Learning in Science, University of Tübingen**, Prof. Macke, in collaboration with HHMI Janelia Research Campus, Dr. Turaga

04/2019 – 10/2020 — **Research Intern and Remote Research Collaborator, HHMI Janelia Research Campus**, Dr. Turaga, includes M.Sc. Thesis work *Task-performance optimization of a connectome-based neural network model of the Drosophila visual system*

10/2018 – 02/2019 — **Research Project, TU Munich**, *GANs for predicting distributions of multi-agent pedestrian trajectories*, Group of Prof. Leal-Taixé

09/2018 – 11/2018 — **Research Intern, TU Munich**, *Representational dissimilarity of stimuli in medial temporal lobe and deep neural networks*, Group of Prof. Macke

02/2018 – 12/2018 — **Research Intern, Celonis SE, Munich**, Data Science and Machine Learning

10/2017 – 02/2018 — **Research Project, TU Munich**, *U-nets for nerve segmentation from ultrasound imaging*, Groups of Prof. Nießner and Prof Leal-Taixé

04/2017 – 07/2017 — **Research Project (B.Sc. Thesis), University Göttingen**, *Deriving the firing rate dependencies of a calcium-based and spike-timing-dependent model for synaptic plasticity*, Group of Prof. Dr. Tetzlaff

08/2013 — **Research Intern, Federal Institute for Materials Research and Testing, Berlin**, Prof. Kreutzbrück

Publications and talks

Peer-reviewed journal articles

2024 — **Lappalainen J. K.**, Tschopp F. D., Prakhya S., McGill M., Nern A., Shinomiya K., Takemura S., Gruntman E., Macke J. H., Turaga S. C., Connectome-constrained networks predict neural activity across the fly visual system., ***Nature*** 1–9 (2024). *Link, Code*

2019 — **Lappalainen J. K.**, Herpich J., Tetzlaff C., A theoretical framework to derive simple, firing-rate-dependent mathematical models of synaptic plasticity. Frontiers in Computational Neuroscience, vol. 13, May 2019, p. 26., *Link, Code*

Contributions to peer-reviewed conference articles or preprints

2024 — Alphabetically ordered author list including **Lappalainen J. K.** and twenty others, A practical guide to sample-based statistical distances for evaluating generative models in science. Transactions on Machine Learning Research 2835-8856 (2024). *Contributions include concept, software, writing, visualization.* *Link, Code*

2024 Deistler M., Kadhim K. L., Beck J., Pals M., Huang Z., Gloeckler M., **Lappalainen J. K.**, Schröder C., Berens P., Gonçalves P. J., Macke J. H., Differentiable simulation enables large-scale training of detailed biophysical models of neural dynamics. bioRxiv (2024), *Contributions include software, investigation, reviewing and editing writing.* *Link*, *Code1*, *Code2*

2024 Boelts J., Deistler M., Gloeckler M., Tejero-Cantero Á., Lueckmann J.-M., Moss G., Steinbach P., Moreau T., Muratore F., Linhart J., Durkan C., Vetter J., Miller B. K., Herold M., Ziaeemehr A., Pals M., Gruner T., Bischoff S., Krouglova N., Gao R., **Lappalainen J. K.**, Mucsányi B., Pei F., Schulz A., Stefanidi Z., Rodrigues P., Schröder C., Abu Zaid F., Beck J., Kapoor J., Greenberg D. S., Gonçalves P. J., Macke J. H., sbi reloaded: a toolkit for simulation-based inference workflows. arXiv preprint arXiv:2411.17337 (2024). *Software-contributions during hackathons including a RAG-based sbi-help-bot (unpublished).* ,

Invited workshop talks

2024 Connectome-constrained networks predict neural activity. Computation across scales in brain and beyond, Bernstein Conference Frankfurt 2024.

2024 Connectome and task-optimization predict neural activity. TNC Elevator Pitches 2024.

2021 Connectome and task-constrained neural networks. Machine Learning meets Neuroscience: from Spikes to Stimulation, Bernstein Conference Berlin 2021.

Invited lab meeting talks

2024 Prof. Murthy and Prof. Seung, Princeton Neuroscience Institute, Princeton, USA.

2024 Prof. Gerstner lab, EPFL, Switzerland, Link

2023 Prof. Ramdya lab, EPFL, Switzerland.

2023 Prof. Gjorgjieva lab, Technical University of Munich, Germany.

2022 Reiserlab, HHMI Janelia, Virginia, USA.

Selected talks

2021 Connectome-constrained simulations with task-optimization lead to accurate predictions of tuning properties in the fruit fly visual system. Dialogues on Neural and Machine Intelligence, Champalimaud Research Symposium 2021, Lisbon.

Most recent posters

2024 **Lappalainen J. K.**, Tschopp F. D., Prakhya S., McGill M., Nern A., Shinomiya K., Takemura S., Gruntman E., Macke J. H., Turaga S. C., Connectome and task predict neural activity across the fly visual system, Bernstein Conference Frankfurt 2024

2024 Ulmer L., **Lappalainen J. K.**, Turaga S. C., Macke J. H., Integrating activity measurements into connectome-constrained and task-optimized models, Bernstein Conference Frankfurt 2024

2024 Pei F., **Lappalainen J. K.**, Turaga S. C., Macke J. H., Task choice influences single-neuron tuning predictions in connectome-constrained modeling, Bernstein Conference Frankfurt 2024

2024 Stefanidi Z., **Lappalainen J. K.**, Turaga S. C., Macke J. H., Investigating the role of recurrent connectivity in connectome-constrained and task-optimized models of the fruit fly's motion pathway, Bernstein Conference Frankfurt 2024

2024 Deistler M., Kadhim K. L., Beck J., Pals M., **Lappalainen J. K.**, Gloeckler M., Huang Z., Schroeder C., Berens P., Gonçalves P. J. , Macke J. H., Bridging biophysics and computation with differentiable simulation, Bernstein Conference Frankfurt 2024

2024 **Lappalainen J. K.**, Tschopp F. D., Prakhya S., McGill M., Nern A., Shinomiya K., Takemura S., Gruntman E., Macke J. H., Connectome-constrained deep mechanistic networks enable hypothesis generation and refinement., Cosyne Abstracts 2024

Other poster presentations over the years

2020-2024 Connectomics Meeting Berlin 2024, Bernstein Conference Berlin 2022, SFN San Diego 2022, Connectomics Meeting Berlin 2022, Cosyne Abstracts 2020

Teaching assistance and tutoring

since 2020 Probabilistic machine learning; **Computational connectomics seminar (lead lecturer)**; Data literacy; Machine learning seminar; Prof. Macke, University of Tübingen

2019 Statistics and probability theory, Large-scale modeling and large-scale data analysis; Prof. Macke, TU Munich

2016 – 2017 Classical mechanics, Prof. Volkert; Classical electrodynamics, Prof. Salditt; University of Göttingen

Community service & outreach

since 2023 **Healthy Minds**, Mental health in academia workshop and talk-series, Initiator and organizer with N. Effenberger, financially supported by the Excellence Cluster Machine Learning and the Tübingen AI Center, *Link*, *Material*

since 2022 KI Macht Schule, volunteer, Link

Professional development activities

2024 Leadership Training, Leadership Talent Academy, University of Tübingen, Link

2024 Mental Health First Aid Training, University of Tübingen, MHFA Ersthelfer Link

2023 Best Practices for Academic Teaching, Dr. Maria Wirzberger, IMPRS-IS

2021 Conflict Management for Scientists Training, Dr. Imke Lode, IMPRS-IS

2021 Stress Management Training, Suzanne Jones, IMPRS-IS

2021 Responsible Conduct in Research Training, Dr. Leila Masri, IMPRS-IS

Supervision

2024 M.Sc. Artificial Intelligence for Science, Thesis and Research Internship: *Contrastive Learning for Deep Mechanistic Networks*, I. Omolayo, AIMS South Africa and University Tübingen

2023-2024 M.Sc. Machine Learning, Thesis: *Integrating knowledge of neural tuning into connectome-constrained and task-optimized models*, Linda Ulmer, University Tübingen.

2023 M.Sc. Machine Learning, Research Internship: *Correlation and dimensionality analysis of a connectome-constrained network of the fruit fly visual system*, Linda Ulmer, University Tübingen

2023-2024 Lab rotation: *Task choice influences single-neuron tuning predictions in connectome-constrained modeling*, Felix Pei, University Tübingen

2023 M.Sc. Machine Learning, Thesis: *Uncertainty estimation in connectome-constrained neural networks using Deep Ensembles*, P. von Bachmann, University Tübingen

2022 B.Sc. Medical Informatics Thesis: *Decoding object movement from a neural circuit simulation of the Drosophila visual system*, Tharanika Thevururasa, University Tübingen

2021 M.Sc. Machine Learning, Essay rotation: *Actors and controversies around brain-computer interface development*, D. Schultheiß, University Tübingen

2021 *Mackelab meets datajoint: Data- and ML-experiment management* with M. Pals and T. Thevururasa, University Tübingen

Contributions to research grants

2024 Contributor (Discussions, Review, Editing & Poster) CRC1233: ROBUST VISION - Inference Principles and Neural Mechanisms, Prof. Bethge, Prof. Macke, Prof. Franke, accepted.

2022	**Lead contributor**. DeepCoMechTome: Using deep learning to understand computations in neural circuits with Connectome-constrained Mechanistic Models. ERC Grant, Prof. Macke, accepted.
2021	**Lead author**. Optical flow calculations with biologically realistic neural networks. Vector Stiftung Mint Innovationen, J. Lappalainen, Prof. Macke, shortlisted.
2020	Research and writing contributor. Dissociating neuronal representations along the ventral visual processing stream in the human temporal lobe. In DFG SFB "Synaptic microcircuits in health and disease", Prof. Macke (Co-PI), accepted.

Scholarships and awards

2024	Leadership Talent Academy scholarship, supported by the Karl Schlecht Stiftung (KSG)
2019	J-1 short-term scholarship, HHMI Janelia Research Campus
2017	Elite-Network of Bavaria Membership
2016	Erasmus+ EU Grant
2012	DPG Membership for an outstanding Abitur (university admission qualification)

Programming skills

- Programming languages: Python (proficient), MATLAB, C++, SQL (intermediate)
- Examples: *flyvis*, *datamate*, *cbsp*, *dnnvsbrain*

Languages

German: native, English: C2 (TOEFL iBT 118/120), Spanish: B1, French: A1