

# PROF. DR. RER. NAT. JAKOB H. MACKE

Professorship for Computational Neuroengineering (CNE)  
Department of Electrical and Computer Engineering  
Technical University of Munich  
Office: Karlstraße 45, 80333 München  
Mail: Arcisstraße 21, 80333 München  
macke@tum.de  
www.mackelab.org, www.ei.tum.de/CNE

## Employment

- from 05/18 Tenure-Track Professor, Computational Neuroengineering, Department of Electrical and Computer Engineering, TU München
- 10/17-04/18 Professor, Centre for Cognitive Science, Institute of Psychology, TU Darmstadt
- 05/15-09/18 Research Center caesar, Bonn, an associate of the Max Planck Society  
Max Planck Research Group Leader (W2, as 'Nebentätigkeit' since 10/17)
- 05/12-04/15 Max Planck Institute for Biological Cybernetics, Bernstein Research Group Leader
- 04/10-04/12 Gatsby Computational Neuroscience Unit, University College London, postdoc with Prof. M Sahani
- 10-12/09 McKinsey & Company, Associate Intern
- 08-11/07 Molecular Biology, Princeton University, Visiting Graduate Student with Prof. Berry
- 10/05-03/10 Max Planck Institute for Biological Cybernetics Tübingen, Graduate Student

## Education

- 01/03/2010 Dr. rer. nat. University of Tübingen  
International Max Planck Research School of Neural and Behavioural Sciences  
with Profs. M Bethge and B Schölkopf, Grade *Summa cum laude*,  
awarded *Otto Hahn Medal* by the Max Planck Society
- 10/01-06/05 University of Oxford (Somerville College), Master in Mathematics,  
07/2005 Summer Course *Intelligent Extraction of Information from Graphs and High Dimensional Data*, at Institute for Pure and Applied Mathematics (IPAM), UCLA
- 07-08/2004 Summer Intern at Cold Spring Harbor Laboratory, NY, with Prof. K Svoboda
- 07-08/2003 Summer Intern at IPAM UCLA, with Prof. M Pellegrini
- 09/92-06/01 Finsterwalder Gymnasium Rosenheim, Bayern

## Awards

- 09/2018 Scholar, FENS Kavli Network of Excellence
- 2013-2018 Member of *Young Academy at the Berlin-Brandenburg Academy of Sciences and Humanities and the German National Academy of Sciences Leopoldina*
- 06/2012 Otto Hahn Medal by the Max Planck Society
- 07/2005 Gibbs Prize in Mathematics: Proxime Accessit by Oxford University
- 2003-05 Studienstiftung des Deutschen Volkes
- 10/2002 Somerville College Cobbe Scholarship
- 2001-05 Bayerisches Begabtenstipendium

## Professional activities

- 03/2019 Program Committee, COSYNE 2019
- 10/2018 Director, Masters in Neuroengineering (MSNE), Elite Network Bayern
- 05/2018 Associate Faculty, Graduate School for Systemic Neurosciences, Ludwig Maximilians University Munich

09/2018 Workshop Chair, Bernstein Conference Berlin 2019

09/2018 Program Committee, KogWis Darmstadt 2018

07/2018 Member, Working Group “Verantwortung: Maschinelles Lernen und Künstliche Intelligenz”, Berlin Brandenburgische Akademie der Wissenschaften

09/2018 Member of Study-Commission, Department of Electrical and Computer Engineering, TU Munich

07/2018 Editor, NBDAT (Neural and Behavioural data and theory)

06/2018 Member, Bernstein Center for Computational Neuroscience Munich

06/2018 Organizer, Conference *Bridging scales* at caesar Bonn

17-20 Director, European FENS Cajal Course in Computational Neuroscience, lecturer for ‘Bayesian statistics for neural and behavioral data analysis’

12/2016 Associate Editor, PLoS Computational Biology

12/2016 Area chair at Conference on Neural Information Processing Systems (NeurIPS, formerly NIPS)

2013-16 Organiser of 4 workshops at Conference on Neural Information Processing Systems

09/2013 Organizing- and program committee of the Bernstein Conference 2013, Tübingen

2005-now Reviewer for Science, Nature, Nature Neuroscience, Neuron, PNAS, Physical Review Letters, J. Neuroscience, Neuroimage, Frontiers, Neural Computation, Entropy, Mathematical Biosciences, Physical Review E, Network: Computation in Neural Systems, J. Neuroscience Methods, J. of Vision, Vision Research, COSYNE, NeurIPS (formerly NIPS), ICML, ICLR

Research Foundation Flanders (FWO), Research Councils UK (RCUK), Alexander von Humboldt Foundation

## Third-party Funding

- 2018-21 **BMBF-Initiative Maschinelles Lernen:** *ADIMEM: Automatische Daten-getriebene Inferenz in Mechanistischen Modellen*, Lead-PI, with P Hennig, P Berens and M Oberlaender
- 2018-21 **HFSP (Human Frontiers Science Program):** *Remembering the future: Interactions between sensation, memory, and behavior*, with A Saleem (UCL) and G Berman (Emory)
- 2018-21 **DFG SPP Project:** *Predicting Anatomically Realistic Cortical Connectomes using Statistical Inference*, DFG, Priority Program “Computational Connectomics”, with M Oberlaender (caesar Bonn) and HC Hege (Zuse Berlin)
- 2017-20 **DFG SFB Project:** Feature-selectivity of dendritic inputs to CA1 in mouse models of Alzheimer’s disease, in SFB *Synaptic microcircuits in health and disease*, Bonn University, with S Remy (DZNE Bonn)
- 2017-20 **DFG SFB Project:** *Translating the image-processing computations of retinal circuits into retinal prostheses*, in SFB *Robust Vision*, Tübingen University.
- 2017-20 **DFG SFB Project:** *Top-down control of visual inference in sensory representations in early visual cortex*, in SFB *Robust Vision*, Tübingen University, with H Nienborg and F Wichmann (Tübingen)
- 2016 **Amazon AWS Research Education grant:** USD10K in AWS compute-credits to develop machine-learning algorithms for biological data analysis
- 2010-12 **Marie Curie Intra-European Fellowship and Fellowship by Gatsby Charitable Foundation:** Postdoctoral research with Prof. Sahani

## Talks

- 01/19 Bernstein Center for Computational Neuroscience, Berlin
- 10/18 Bonn-Cambridge Meeting on the Future of Artificial Intelligence
- 10/18 General Science talk, *Wie rechnen Nervenzellen?*, Tag der offenen Tür, TUM
- 10/18 Invited speaker, symposium *Neural networks: from brains to machines*, Pasteur Institute, Paris
- 09/18 *CECAM/CSM/IRTG School 2018: Machine Learning in Scientific Computing*, Mainz
- 05/18 Bernstein Lecture, Munich
- 05/18 Bernstein Lecture, Tübingen
- 11/17 Cognitive Science Seminar, SISSA Trieste
- 09/17 Invited Speaker, *Neural Computation, Coding and Dynamics*, Capbreton
- 05/17 Quantitative Neuroscience Seminar, Champalimaud Center for the Unknown
- 05/17 invited to Neurotheory seminar, IDIBAPS Barcelona
- 02/17 Max-Planck/Cambridge Symposium Neuroscience, Berlin
- 01/17 Bernstein Symposium, Tübingen
- 09/16 Workshop Probabilistic Computation in the Brain, CEU Budapest
- 06/16 Department of Biology, University of Bonn
- 05/16 Quantifying structure in large neural datasets, Grossman Center, Columbia University
- 04/16 Hausdorff Forum, Institute for Mathematics, University of Bonn
- 04/16 Workshop Cognitive Computation, TU Darmstadt
- 04/16 113th Boehringer Titisee Conference on Building tools for quantifying brain and behaviour
- 01/16 Bernstein Seminar, Bernstein Center Heidelberg
- 12/15 Workshop *Inference for dynamics on networks*, NIPS, Montreal
- 11/15 Keynote, Bonn International Graduate School Neuroscience Retreat, Castle Diez
- 10/15 Group for Neural Theory, Ecole Normale Supérieure, Paris
- 09/15 Contributed plenary talk, Bernstein Conference Heidelberg
- 09/15 Workshop *Estimating State Variables from Neural Data*, Bernstein Conference Heidelberg
- 04/15 Swiss Computational Neuroscience Series, ETH Zurich
- 03/14 Workshop *Cascaded Computations*, COSYNE, Salt Lake City

- 07/14 Population Codes: From Data Analysis to Mechanisms, Bernstein Center Munich
- 06/15 Workshop Modelling variability in neuronal populations, New York University
- 05/14 Computational Neuroscience Seminar, Friedrich Miescher Institute Basel
- 05/14 OCCAM Osnabrück
- 01/14 Seminar, Center for Advanced European Studies and Research, Bonn, 01/2014
- 12/13 Computational Neuroscience Seminar, EPFL Lausanne
- 12/13 Workshop Talk at NIPS, Lake Tahoe
- 10/13 Biotheory Seminar, Max Planck Institute for Brain Research, Frankfurt
- 09/13 Institute of Computational Biology, Helmholtz Zentrum München
- 09/13 Institute for Neuroinformatics, ETH Zürich
- 09/13 Workshop Modelling neural response properties, Bernstein Conference Tübingen
- 09/13 Workshop *Unsolved problems in 2p imaging analysis*, Bernstein Conference
- 03/13 Cambridge University, Department of Information Engineering
- 05/12 Janelia Conference Machine Learning, Statistical Inference and Neuroscience
- 01/13 Max-Planck/CNRS collaboration meeting on neuroscience, Paris
- 06/11 Modelling of Cognitive Processes Group, TU Berlin
- 06/11 Computational Neuroscience Seminar, Department of Biology, LMU Munich
- 11/10 Department for Mathematics and Statistics, Boston University
- 09/12 Conference on information representation at University College London, Dep. of Statistics
- 06/10 Tri-Center Workshop on Computational Neuroscience, Hebrew University
- 05/10 Spike train analysis seminar series, Newcastle University
- 07/09 Workshop *Statistical analysis of multi-electrode recordings*, CNS Berlin
- 06/09 Computational Neuroscience Seminar, EPFL Lausanne
- 05/09 Center for Theoretical Neuroscience, Columbia University
- 05/09 Symposium *Modern approaches to modeling visual data* at the annual meeting of the Vision Sciences Society, Naples, FL
- 12/08 Workshop *Modelling response dependencies in neural populations*, NIPS
- 10/08 Contributed plenary talk, Bernstein Symposium, München
- 01/06 Max Planck Institute of Neurobiology, Martinsried

## PUBLICATIONS

### Preprints

2. JM Lueckmann, G Bassetto, T Karaletsos, **JH Macke**: Emulator networks for likelihood-free inference (Arxiv– accepted at NeurIPS workshop)
1. DGT Barrett, AS Morcos, **JH Macke**: Analyzing artificial and biological neural networks: Challenges with opportunities for synergies? (Arxiv, under review)

### Journal papers

21. P Berens, J Freeman, T Deneux, N Cherkov, T McColgan, A Speiser, **JH Macke**, S Turaga, et al: Community-based benchmarking improves spike inference from two-photon calcium imaging data, PLoS Computational Biology, 05 2018
20. JM Lueckmann, **JH Macke**\*, H Nienborg\*, Can serial dependencies in choices and neural activity explain choice probabilities?, Journal of Neuroscience, 04 2018
19. V Djurdjevic, A Ansuini, D Bertolini, **JH Macke**, D Zoccolan: Accuracy of rats in discriminating visual objects is explained by the complexity of their perceptual strategy, Current Biology, 03 2018
18. M Nonnenmacher, C Behrens, P Berens, M Bethge, **JH Macke**, Signatures of criticality arise from random subsampling in simple population models, PLoS Computational Biology, 10 2017

17. H Schütt, S Harmeling, **JH Macke**, FA Wichmann: Painfree accurate Bayesian estimation of psychometric functions for overdispersed data, *Vision Research* 122, 105-123, 2016
16. R Küffner et al: Crowdsourced analysis of clinical trial data to predict amyotrophic lateral sclerosis progression. *Nature Biotechnology*, 33(1), 51-57, 01 2015
15. I Fründ, FA Wichmann, **JH Macke**: Quantifying the effect of inter-trial dependence on perceptual decisions. *Journal of Vision*, 14 (7), 06 2014
14. M Watanabe, A Bartels, **JH Macke**, Y Murayama, NK Logothetis: Temporal jitter of the BOLD signal reveals improved spatial resolution. *Current Biology* 23 (21), 2146-2150, 08 2013
13. **JH Macke**, I Murray, P Latham: Estimation bias in maximum entropy models. *Entropy* 15:3109-3219, 08 2013
12. R Haefner, S Gerwinn, **JH Macke**, M Bethge: Inferring decoding strategies from choice probabilities in the presence of correlated variability. *Nature Neuroscience* 16(2), 235–242, 01 2013
11. G Schwartz, **JH Macke**, D Amodei, H Tang, MJ Berry: Low error discrimination using a correlated population code. *Journal of Neurophysiology*, 108(4), 1069-1088, 04 2012
10. L Büsing, **JH Macke**, M Sahani: Learning stable, regularised latent models of neural population dynamics. *Network: Computation in Neural Systems*, 23(1-2) 24-47, 03 2012
9. **JH Macke**, M Opper, M Bethge: Common input explains higher-order correlations and entropy in a simple model of neural population activity. *Physical Review Letters* 106, 208102, 05 2011
8. **JH Macke**, S Gerwinn, L White, M Kaschube, M Bethge: Gaussian process methods for estimating cortical maps. *Neuroimage* 56(2), 570-81, 05 2011
7. D Lyamzin, **JH Macke**, NA Lesica: Modeling population spike trains with specified time-varying spike rates, trial-to-trial variability, and pairwise signal and noise correlations. *Frontiers in Computational Neuroscience*, 4:144, 11 2010
6. S Gerwinn, **JH Macke**, M Bethge: Bayesian inference for generalized linear models for spiking neurons. *Frontiers in Computational Neuroscience*, 4:12, 05 2010
5. **JH Macke**, FA Wichmann: Estimating critical stimulus features from psychophysical data: The decision-image technique applied to human faces. *Journal of Vision*, 10(5):22, 1-24, 05 2010
4. S Gerwinn, **JH Macke**, M Bethge: Bayesian population decoding of spiking neurons. *Frontiers in Computational Neuroscience* 3(21), 1-28, 10 2009
3. **JH Macke\***, P Berens\*, AS Ecker, AS Tolias and M Bethge: Generating Spike Trains with Specified Correlation Coefficients. *Neural Computation* 21(2), 397-423, 02 2009
2. SP Ku, A Gretton, **JH Macke** and NK Logothetis: Comparison of Pattern Recognition Methods in Classifying High-resolution BOLD Signals Obtained at High Magnetic Field in Monkeys. *Magnetic Resonance Imaging* 26(7), 1007-1014, 09 2008
1. **JH Macke\***, N Maack\*, B Schölkopf, W Denk, A Borst: Contour-Propagation Algorithms for Semi-Automated Reconstruction of Neural Processes. *Journal of Neuroscience Methods* 167(2), 349-357, 01 2008

### Peer reviewed conference papers

The annual conference ‘Neural Information Processing Systems’ (NeurIPS, formerly NIPS) has an acceptance rate of 20 – 25% for papers, and 1 – 2% for talks. In machine learning and related disciplines, peer-reviewed conference proceedings of high-profile conferences (e.g NeurIPS, ICML) are the primary means for publication.

15. M Nonnenmacher, S Turaga, **JH Macke**: Extracting low-dimensional dynamics from multiple large-scale neural population recordings by learning to predict correlations, *Advances in Neural Information Processing Systems (NIPS)*, 12 2017
14. A Speiser, J Ye, E Archer, S Turaga, **JH Macke**: Fast amortized inference of neural activity from calcium imaging data with variational autoencoders, *Advances in Neural Information Processing Systems (NIPS)*, 12 2017  
(selected as one of 112 spotlights out of 3240 submissions)

13. JM Lueckmann, P Goncalves, G Bassetto, K Oecal, M Nonnenmacher, **JH Macke**: Flexible statistical inference for mechanistic models of neural dynamics, *Advances in Neural Information Processing Systems (NIPS)*, 12 2017
12. M Park, G Bohner, **JH Macke**: Unlocking neural population non-stationarities using hierarchical dynamics models *Advances in Neural Information Processing Systems (NIPS)*, Curran Associates Inc., 12 2015
11. E Archer, U Köster, J Pillow, **JH Macke**: Low-dimensional models of neural population activity in sensory cortical circuits. *Advances in Neural Information Processing Systems (NIPS)*, Curran Associates Inc., 12 2014
10. P Putzky, F Franzen, G Bassetto, **JH Macke**: A Bayesian model for identifying hierarchically organised states in neural population activity. *Advances in Neural Information Processing Systems (NIPS)*, Curran Associates Inc., 12 2014  
(selected as one of 62 spotlights out of 1678 submissions)
9. SC Turaga, L Büsing, AM Packer, H Dalglish, N Petit, M Häusser, **JH Macke**: Inferring neural population dynamics from multiple partial recordings of the same neural circuit. *Advances in Neural Information Processing Systems (NIPS)*, Curran Associates Inc., 2013  
(selected as one of 52 spotlights out of 1420 submissions).
8. L Büsing\*, **JH Macke\***, M Sahani: Spectral learning of linear dynamics from generalised-linear observations with application to neural population data. *Advances in Neural Information Processing Systems (NIPS)*, Curran Associates Inc., 2012  
(selected as one of 20 oral presentations out of 1467 submissions)
7. **JH Macke**, I Murray, P Latham: How biased are maximum entropy models? *Advances in Neural Information Processing Systems (NIPS)*, Curran Associates Inc., 2011
6. **JH Macke**, L Büsing, JP Cunningham, BM Yu, KV Shenoy, M Sahani: Empirical models of spiking in neural populations. *Advances in Neural Information Processing Systems (NIPS)*, Curran Associates Inc., 2011  
(selected as one of 20 oral presentation out of 1400 submissions)
5. **JH Macke**, S Gerwinn, L White, M Kaschube, M Bethge: Bayesian estimation of orientation preference maps. *Advances in Neural Information Processing Systems (NIPS)*, MIT Press, Cambridge, MA 2009
4. **JH Macke**, G Zeck, M Bethge: Receptive Fields without Spike-Triggering. *Advances in Neural Processing Systems (NIPS)*, MIT Press, Cambridge, MA 2007
3. S Gerwinn, **JH Macke**, M Seeger, M Bethge: Bayesian Inference for Spiking Neuron Models with a Sparsity Prior. *Advances in Neural Processing Systems (NIPS)*, MIT Press, Cambridge, MA 2007  
(selected as one of 26 oral presentation out of 975 submissions)
2. M Bethge, S Gerwinn and **JH Macke**: Unsupervised learning of a steerable basis for invariant image representations. *Proceedings of SPIE*, 2007
1. J Laub, **JH Macke**, KR Mueller and FA Wichmann: Inducing Metric Violations in Human Similarity Judgements. *Advances in Neural Processing Systems (NIPS)*, MIT Press, Cambridge, MA 2006

## Reviews and book chapters

5. C Kayser, **JH Macke**, J Gross, S Panzeri: Neural population coding: combining insights from microscopic and mass signals, *Trends in Cognitive Sciences*, 19(3), 162-171, 01 2015
4. **JH Macke**, L Büsing, M Sahani: Estimating state and model parameters in state-space models of spike trains. Invited book-chapter in *Advanced State Space Methods for Neural and Clinical Data*, Cambridge University Press, 2015
3. **JH Macke**: Bayesian analysis of neurophysiological data. *Springer Encyclopedia of Computational Neuroscience*, 2014
2. S Gerwinn, **JH Macke**, M Bethge: Reconstructing stimuli from the spike times of leaky integrate and fire neurons. *Focused Review, Frontiers in Neuroscience*, 5:1, 2 2011

1. **JH Macke**, P Berens, M Bethge, Statistical analysis of multi-cell recordings: Linking population coding models to experimental data. Editorial, *Frontiers in Computational Neuroscience* 5(35), 1-2, 07 2011