

# PROF. DR. JAKOB H. MACKE

www.mackelab.org

AG Perception  
Centre for Cognitive Science  
Institute of Psychology  
Alexanderstr. 10  
64289 Darmstadt  
+49/6151/1623961  
jakob@cogsci.tu-darmstadt.de

Max Planck Research Group  
Neural Systems Analysis  
research center caesar  
Ludwig-Erhard-Allee 2  
53175 Bonn  
+49/228/9656170  
jakob@caesar.de

## Employment

- 10/17-now Professor, Centre for Cognitive Science, TU Darmstadt
- 05/15-now research center caesar, Bonn, an associate of the Max Planck Society  
Max Planck Research Group Leader
- 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, Max Planck Institute for Biological Cybernetics, with Profs. M Bethge and B Schölkopf, Grade *Summa cum laude*
- 08/2006 Methods in Computational Neuroscience, Marine Biological Laboratory, Woods Hole
- 08/2005 Neuroinformatics Course, Marine Biological Laboratory, Woods Hole
- 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

- 03/2013 Elected 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

- 09/2018 Workshop Chair, Bernstein Conference Berlin 2018
- 09/2018 Program Committee, KogWis Darmstadt 2018
- 06/2018 Organiser, Conference *Bridging scales* at caesar Bonn
- 12/2016 Associate Editor, PLoS Computational Biology
- 12/2016 Area chair at NIPS (Conference on Neural Information Processing Systems)
- 12/2016 Workshop “Neuroscience meets Machine Learning” at NIPS, Barcelona
- 12/2015 Workshop “Statistical methods for analysing neural systems”, NIPS, Montreal

- 09/2015 Founding member, Working Group 'Big Data' of German Young Academy
- 03/2015 Workshop "Causation from correlation?", Ohlstadt, Germany
- 12/2014 Workshop "Large scale optical physiology: From data-acquisition to models of neural coding", NIPS, Lake Tahoe
- 03/2014 Session organizer, 4th *British-German Frontiers of Science Symposium 2014* Alexander von Humboldt Foundation, the Young Academy and the Royal Society
- 12/2013 Workshop "Acquiring and analyzing the activity of large neural ensembles", NIPS, Vancouver
- 09/2013 Organizing- and program committee of the Bernstein Conference 2013, Tübingen
- 2009-10 Co-editor, special issue in *Frontiers in Computational Neuroscience* "Statistical analysis of multi-electrode recordings: Linking models and experimental data"
- 05/2009 Workshop "Statistical analysis of multi-electrode recordings" at annual meeting of the Computational Neuroscience Society (CNS)
- 2005-now Reviewer for Science, 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, NIPS, ICML, ICLR

### Selected Talks

- 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
- 01/17 Bernstein Symposium, Tübingen
- 09/16 Workshop Probabilistic Computation in the Brain, CEU Budapest
- 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
- 10/15 Group for Neural Theory, Ecole Normale Supérieure, Paris
- 09/15 Contributed plenary talk, Bernstein Conference Heidelberg
- 04/15 Swiss Computational Neuroscience Series, ETH Zurich
- 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
- 12/13 Computational Neuroscience Seminar, EPFL Lausanne
- 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
- 03/13 Cambridge University, Department of Information Engineering
- 05/12 Janelia Conference Machine Learning, Statistical Inference and Neuroscience
- 11/10 Department for Mathematics and Statistics, Boston University
- 09/12 Conference on information representation at University College London, Dep. of Statistics
- 05/10 Spike train analysis seminar series, Newcastle University
- 05/09 Center for Theoretical Neuroscience, Columbia University
- 05/09 Symposium *Modern approaches to modeling visual data*VSS, Naples, FL
- 12/08 Workshop *Modelling response dependencies in neural populations*, NIPS
- 10/08 Contributed plenary talk, Bernstein Symposium, München

## PUBLICATIONS

## Journal papers

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* (accepted), 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

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 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 Ocal, 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 Bohnert, **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 presentation 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