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Curriculum Vitæ

Philipp Hennig

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date of birth:	7th of July, 1980	**address:**	Stauffenbergstraße 27, 72074 Tübingen, Germany
place of birth:	Ludwigsburg, Germany	**phone:**	+49 176 2391 9501
nationality:	German		
family status:	married, two children		

Education & Career

Max Planck Institute for Intelligent Systems, Tübingen, Germany

> **09 / 2016 – current:** *Independent Max Planck Group Leader*   German federal W2 (Associate Prof.) salary level

> previous positions, hosted or funded by the Department of Empirical Inference (Bernhard Schölkopf):

>> **04 / 2015 – 08 / 2016:** *Emmy Noether Group Leader*
>> **03 / 2013 – 04 / 2015:** *Senior Research Scientist*
>> **07 / 2011 – 03 / 2013:** *Research Scientist*
>> **03 / 2011 – 06 / 2011:** *Postdoc Scholar*

11 / 2010 – 01 / 2011 Engineering Department, University of Cambridge, UK
Visiting Researcher; Computational and Biological Learning Laboratory

2008 – 2010 Microsoft Research Ltd., Cambridge External Consultant

07 / 2008 – 10 / 2008 Microsoft Research Ltd., Cambridge Research Intern

10 / 2007 – 11 / 2010 Cavendish Laboratory and Robinson College, University of Cambridge, UK
PhD in Physics. Title: *Approximate Inference in Graphical Models*. Advisor: Sir David J C MacKay
viva voce defense on 11 Jan 2011 (not graded, accepted without corrections), graduated 30 April 2011.

05 / 2007 – 07 / 2007 McKinsey & Company, Berlin, Germany Summer Associate

04 / 2006 – 04 / 2007 Max Planck Institute for Medical Research, Heidelberg, Germany
Diplom-thesis [German 5-year degree, roughly equivalent to MSc level]. Advisor: Winfried Denk
Title: *Point-Spread Functions for backscattered imaging in the Scanning Electron Microscope*
graded 1.0 on German university scale from 1.0 (best) to 4.0

10 / 2001 – 03 / 2007 Faculty of Physics, University of Heidelberg, Germany
studies towards the *Diplom* degree in physics. Graduated March 2007
overall grade point average 1.1 on German university scale from 1.0 (best) to 4.0

10 / 2004 – 06 / 2005 Department of Physics, Imperial College, London, UK
Participation in the theoretical physics MSc "Quantum Fields and Fundamental Forces" as an Erasmus exchange
student (passed all necessary examinations for the MSc degree, exchange students generally cannot graduate).

07 / 2000 – Christoph Schrempf Gymnasium, Besigheim, Germany *Abitur* (A-Levels)
Grade point average 1.3 on German school scale from 1.0 (best) to 6.0

Peer-Reviewed Publications (chronological. open-access publications marked with **[OA]**)

In machine learning, conferences have *higher* standing, and are *more* competitive than journals. The two flagship conferences are NIPS and ICML, which each have about 25% acceptance rates. These conferences have a full-fledged review process (at least 3 independent reviews per paper, often more, with optional author feedback and an evaluation discussion among reviewers, and typically three layers of program committee hierarchy). Full orals at NIPS (about 15 each year) are awarded to less than 1% of submitted papers. The most prominent journal is JMLR (27% acceptance rate—counting re-submissions as new submissions, impact factor 3.4, in 2012). It primarily plays an archival role.

──────────── in review ────────────

[OA] Lukas Balles & Philipp Hennig
Follow the Signs for Robust Stochastic Optimization
in review — arXiv 1705.07774

[OA] Paul Rubenstein, Ilya Tolstikhin, Philipp Hennig, Bernhard Schölkopf
Probabilistic Active Learning of Functions in Structural Equation Models
in review — arXiv 1706.10234

[OA] Filip de Roos & Philipp Hennig
Krylov Subspace Recycling for Fast Iterative Least Squares in Machine Learning
in review — arXiv 1706.00241

[OA] Maren Mahsereci, Lukas Balles, Christoph Lassner, and Philipp Hennig
Early Stopping without a Validation Set
in review — arXiv 1703.09580

[OA] Philipp Hennig & Roman Garnett
Exact Sampling from Determinantal Point Processes
in review — arXiv 1609.06840

──────────── published or in press ────────────

▶ Niklas Wahl, Philipp Hennig, Hans-Peter Wieser and Mark Bangert
Analytical incorporation of fractionation effects in probabilistic treatment planning for intensity-modulated proton therapy
Medical Physics, 2018. in press

[OA] Michael Schober, Simo Särkkä, Philipp Hennig
A probabilistic model for the numerical solution of initial value problems
Statistics & Computing, 2018. in press

[OA] Maren Mahsereci and Philipp Hennig
Probabilistic Line Searches for Stochastic Optimization
Journal of Machine Learning Research (JMLR), vol. **18** (2017), no. 119, pp. 1–59 (cf. NIPS paper below)

▶ Hans-Peter Wieser, Philipp Hennig, Niklas Wahl, Mark Bangert
Analytical probabilistic modeling of RBE-weighted dose for ion therapy
Physics in Medicine and Biology, vol. **62** (2017), no. 23, pp. 8959–8982

▶ Alonso Marco Valle, Philipp Hennig, Stefan Schaal, and Sebastian Trimpe
On the Design of LQR Kernels for Efficient Controller Learning
in A. Astolfi, ed., *IEEE Conference on Decision and Control (CDC)*, vol. **56** (2017)

[OA] Lukas Balles, Javier Romero, and Philipp Hennig
Coupling Adaptive Batch Sizes with Learning Rates
in G. Elidan & K. Kersting, eds., *Uncertainty in Artificial Intelligence (UAI)*, vol. **33** (2017)

▶ Niklas Wahl, Philipp Hennig, Hans-Peter Wieser, and Mark Bangert
Efficiency of analytical and sampling-based uncertainty propagation in intensity-modulated proton therapy
Physics in Medicine and Biology, vol. **62** (2017), no. 14, pp. 5790–5807

[OA] Aaron Klein, Stefan Falkner, Simon Bartels, Philipp Hennig and Frank Hutter
Fast Bayesian Optimization of Machine Learning Hyperparameters on Large Datasets
in Singh & Zhu, eds; *Artificial Intelligence and Statistics (AISTATS)* vol. **20** (2017)

▶ Alonso Marco, Felix Berkenkamp, Philipp Hennig, Angela P. Schoellig, Andreas Krause, Stefan Schaal, and Sebastian Trimpe
Virtual vs. Real: Trading Off Simulations and Physical Experiments in Reinforcement Learning with Bayesian Optimization; in Nakamura & Okamura, eds.; *International Conference on Robotics and Automation (ICRA)*, 2017

[OA] Arthur Gretton and Philipp Hennig and Carl Edward Rasmussen and Bernhard Schölkopf (editors)
New Directions for Learning with Kernels and Gaussian Processes (Dagstuhl Seminar 16481)
Dagstuhl Reports, vol. **6** (2017) no. 11, pp. 2192–5283

[OA] Edgar Klenske & Philipp Hennig
Dual Control for Approximate Bayesian Reinforcement Learning
Journal of Machine Learning Research (JMLR), vol. **17**, no. 127, pp. 1–30 (2016)

[OA] Hans Kersting & Philipp Hennig
Active Uncertainty Calibration in Bayesian ODE Solvers
in Ihler & Janzing, eds.; *Uncertainty in Artificial Intelligence (UAI)*, vol. **32** (2016), pp. 309–318

[OA] Edgar Klenske, Philipp Hennig, Bernhard Schölkopf, Melanie N. Zeilinger
Approximate Dual Control Maintaining the Value of Information with an Application to Building Control
European Control Conference (ECC) (2016), to appear

▶ Alonso Marco, Philipp Hennig, Jeannette Bohg, Stefan Schaal, Sebastian Trimpe
Automatic LQR Tuning Based on Gaussian Process Global Optimization
in Okamura, ed.; *IEEE International Conference on Robotics and Automation (ICRA)* (2016), pp. 270–277

[OA] Simon Bartels & Philipp Hennig
Probabilistic Approximate Least-Squares
in Gretton & Robert, eds.; *Artificial Intelligence and Statistics (AISTATS)* vol. **19** (2016)
Journal of Machine Learning Research W&CP vol. **51**, pp. 676–684

[OA] Javier González, Zhenwen Dai, Philipp Hennig, Neil Lawrence
Batch Bayesian Optimization via Local Penalization
in Gretton & Robert, eds.; *Artificial Intelligence and Statistics (AISTATS)* vol. **19** (2016)
Journal of Machine Learning Research W&CP vol. **51**, pp. 648–657

[OA] Maren Mahsereci, Philipp Hennig
Probabilistic Line Searches for Stochastic Optimization
in Cortes, Lawrence, Lee, Sugiyama & Garnett, eds.; *Advances in Neural Information Processing Systems (NIPS)* vol. **28** (2015), pp. 181–189. *(full oral presentation)*

[OA] Philipp Hennig, Michael A. Osborne, Mark Girolami
Probabilistic Numerics and Uncertainty in Computations
Proceedings of the Royal Society A, vol. **471** nr. 2179 (2015)

[OA] Edgar Klenske, Melanie N. Zeilinger, Bernhard Schölkopf, Philipp Hennig
Gaussian Process based Predictive Control for Periodic Error Correction
IEEE Transactions on Control Systems Technology, vol. **24** no. 1, (Jan 2016 / published May 2015)

[OA] Søren Hauberg, Michael Schober, Matthew Liptrot, Philipp Hennig, Aasa Feragen
A Random Riemannian Metric for Probabilistic Shortest-Path Tractography
in Navab, Hornegger, Wells & Frangi, eds.; *Medical Image Computing and Computer Assisted Intervention (MICCAI)* vol. **18** (2015), Springer LNCS vol. **9349**, pp. 597–604

[OA] Eleni Sgouritsa, Dominik Janzing, Philipp Hennig, Bernhard Schölkopf
Inference of Cause and Effect with Unsupervised Inverse Regression
in Lebanon & Vishwanathan, eds.; *Artificial Intelligence and Statistics* vol. **18** (2015)
Journal of Machine Learning Research W&CP vol. **38**, pp. 847–855

▶ Philipp Hennig
Probabilistic Interpretation of Linear Solvers
SIAM Journal on Optimization (SIOPT) vol. **25** no. 1 (2015), pp. 234–260

[OA] Michael Schober, David Duvenaud, Philipp Hennig
Probabilistic ODE Solvers with Runge-Kutta Means
in Ghahramani, Welling, Cortes, Lawrence & Weinberger, eds.; *Advances in Neural Information Processing Systems (NIPS)* vol. **27** (2014), pp. 739–747 *(full oral presentation)*

[OA] Tom Gunter, Michael A. Osborne, Roman Garnett, Philipp Hennig, Stephen Roberts
Sampling for Inference in Probabilistic Models with Fast Bayesian Quadrature
in Ghahramani, Welling, Cortes, Lawrence & Weinberger, eds.; *Advances in Neural Information Processing Systems (NIPS)* vol. **27** (2014), pp. 2789–2797

[OA] Franziska Meier, Philipp Hennig, Stefan Schaal
Incremental Local Gaussian Regression
in Ghahramani, Welling, Cortes, Lawrence & Weinberger, eds.; *Advances in Neural Information Processing Systems (NIPS)* vol. **27** (2014), pp. 972–980

[OA] Martin Kiefel, Christian H. Schuler, Philipp Hennig
Probabilistic Progress Bars
in Jiang, Hornegger & Koch, eds.; *German Conference on Pattern Recognition (GCPR)* vol. **36** (2014)

[OA] Roman Garnett, Michael A. Osborne, Philipp Hennig
Active Learning of Linear Embeddings for Gaussian Processes
in Zhan & Tiang, eds.; *Uncertainty in Artificial Intelligence (UAI)* vol. **30** (2014), pp. 230–239

[OA] Franziska Meier, Philipp Hennig, Stefan Schaal
Efficient Bayesian Local Model Learning for Control
in Burgard, ed.; *IEEE International Conference on Intelligent Robotics Systems (IROS)* 2014, pp. 2244–2249

[OA] Michael Schober, Niklas Kasenburg, Aasa Feragen, Philipp Hennig & Søren Hauberg
Probabilistic Shortest Path Tractography in DTI using Gaussian Process ODE solvers
in Golland, Hata, Barillot, Hornegger, Howe, eds.; *Medical Image Computing and Computer Assisted Intervention (MICCAI)* vol. **17** (2014), Springer LNCS vol. **8675**, pp. 265–272

[OA] Philipp Hennig, Søren Hauberg
Probabilistic Solutions to Differential Equations and their Application to Riemannian Statistics
in Kaski & Corander, eds.; *Artificial Intelligence and Statistics (AISTATS)* vol. **17** (2014)
Journal of Machine Learning Research W&CP vol. **33**, pp. 347–355

[OA] David Lopez-Paz, Philipp Hennig, Bernhard Schölkopf
The Randomized Dependence Coefficient
in Burges, Bottou, Welling, Ghahramani & Weinberger, eds.; *Advances in Neural Information Processing Systems (NIPS)* vol. **26** (2013), pp. 1–9

[OA] Edgar Klenske, Melanie N. Zeilinger, Bernhard Schölkopf, Philipp Hennig
Nonparametric dynamics estimation for time periodic systems
Annual Allerton Conference on Communication, Control, and Computing vol. **51** (2013)

[OA] Mark Bangert, Philipp Hennig, Uwe Oelfke
Analytical probabilistic modeling for radiation therapy planning
Physics in Biology and Medicine vol. **58** no. 16 (Aug 2013), pp. 5401–5419

▶ Mark Bangert, Philipp Hennig, Uwe Oelfke
Analytical probabilistic proton dose calculation and range uncertainties
in Haworth & Kron, eds.; *International Conference on the Use of Computers in Radiation Therapy (ICCR)* vol. **17** (2013), Journal of Physics Conf. Series vol. **489** (2014), pp. 012002

[OA] Philipp Hennig & Martin Kiefel
Quasi-Newton Methods — A New Direction (extended version of ICML paper below)
Journal of Machine Learning Research (JMLR), vol. **14** (Mar 2013), pp. 807–829

[OA] Philipp Hennig
Fast Probabilistic Optimization from Noisy Gradients
in Dasgupta & McAllester, eds.; *International Conference on Machine Learning (ICML)* vol. **30** (2013)
Journal of Machine Learning Research W&CP vol. **28** no. 1 (2013), pp. 62–70

[OA] Philipp Hennig & Martin Kiefel
Quasi-Newton Methods — A New Direction
in Langford & Pineau, eds.; *International Conference on Machine Learning (ICML)* vol. **29** (2012), pp. 25–32

[OA] Philipp Hennig & Christian H. Schuler
Entropy Search for Information Efficient Global Optimization
Journal of Machine Learning Research (JMLR), vol. **13** (Jun 2012), pp. 1809–1837

[OA] Botond A. Bócsi, Philipp Hennig, Lehel Csató, J. Peters
Learning Tracking Control with Forward Models
in Papanikolopoulos & Oh, eds.; *IEEE International Conference on Robotics and Automation (ICRA)* 2012

[OA] Philipp Hennig, David Stern, Ralf Herbrich, Thore Graepel
Kernel Topic Models
in Lawrence & Girolami, eds.; *Artificial Intelligence and Statistics (AISTATS)* vol. **15** (2012)
Journal of Machine Learning Research W&CP vol. **22** (2012), pp. 511–519

[OA] Philipp Hennig
Optimal Reinforcement Learning for Gaussian Systems
in Shawe-Taylor, Zemel, Bartlett, Pereira & Weinberger, eds.; *Advances in Neural Information Processing Systems (NIPS)* vol. **24** (2011), pp. 325–333

[OA] Philipp Hennig
Approximate Inference in Graphical Models
PhD thesis, University of Cambridge, 14 Nov 2010 (examination) / 30 April 2011 (graduation)

▶ Mark Bangert, Philipp Hennig, Uwe Oelfke
Using an infinite von Mises-Fisher Mixture Model to Cluster Treatment Beam Directions in External Radiation Therapy
in Khoshgoftaar & Zhu, eds.; *International Conference on Machine Learning and Applications (ICMLA)* vol. **9** (2010), pp. 746–751

[OA] Philipp Hennig, David Stern, Thore Graepel
Coherent Inference on Optimal Play in Game Trees.
in Teh & Titterington, eds.; *Artificial Intelligence and Statistics (AISTATS)* vol. **13** (2010)
Journal of Machine Learning Research W&CP vol. **9**, pp. 326–333

▶ Philipp Hennig & Winfried Denk
Point-spread functions for backscattered imaging in the scanning electron microscope
Journal of Applied Physics vol. **102** (2007), pp. 123101

Patents

▶ P. Hennig, D. Stern, T. Graepel, R. Herbrich
Topic Models (Application)
patent application filed by Microsoft Research Ltd. on 10/26/2010, serial number 12/912428
US patent number 8,645,298 granted February 4, 2014.

Teaching

Thesis Supervision

Master / Diplom

▶ Maolin Gao, MPI IS Tübingen / TU Munich, 2015
▶ Edgar Klenske, MPI IS Tübingen / Stuttgart University, 2012

PhD

▶ Matthias Werner, MPI IS Tübingen / ETAS GmbH, 11/2017 –
▶ Frank Schneider, MPI IS Tübingen, 06/2017 –
▶ Filip de Roos, MPI IS Tübingen, 03/2017 –
▶ Alexandra Gessner, MPI IS Tübingen, 10/2016 –
▶ Lukas Balles, MPI IS Tübingen, 05/2016 –
▶ Hans Kersting, MPI IS Tübingen, 06/2015 –
▶ Simon Bartels, MPI IS Tübingen, 04/2015 –
▶ Michael Schober, MPI IS Tübingen, 12/2013 –
▶ Maren Mahsereci, MPI IS Tübingen, 08/2013 –
▶ Edgar Klenske, MPI IS Tübingen & ETH Zürich, 10/2012 – 01/2017

Lecture Courses

Winter 2013/14 *Intelligent Systems I* (2+2 SWS), Eberhard-Karl University Tübingen, with Stefan Harmeling

Winter 2012/13 *Intelligent Systems I* (2+2 SWS), as above

Seminars

Summer 2012 *Learning Robots* (block seminar), TU Darmstadt, with Jan Peters

Winter 2011/12 *Autonomous Learning Systems* (block seminar), TU Darmstadt, with Jan Peters

Tutorials & Block Courses

July 2017 *Probabilistic Numerics*
the *Dobbiacco Summer School*, Bolzano, Italy. with Chris Oates (12×90min course)

9/10/2015 *Introduction to Gaussian Processes*
at *Medical Image Computing and Computer Assisted Intervention (MICCAI)* 2015, Munich

19-20/7/2015 tutorial on *Probabilistic Numerical Methods*
at the *Machine Learning Summer School 2015*, MPI for Intelligent Systems, Tübingen

19/6/2014 *Introduction to Gaussian Processes*
at the Research Network on Learning Systems Summer School, ETH Zürich

13/1/2014 *Introduction to Gaussian Processes* and
15/1/2014 *Probabilistic Numerical Methods*
both at the *Gaussian Process Winter School*, University of Sheffield, UK

2-3/9/2013 tutorial on *Gaussian Processes*
at the *Machine Learning Summer School 2013*, MPI for Intelligent Systems, Tübingen

10/6/2012 tutorial on *Gaussian Regression Models*
at the *Real-World Inference* workshop, Max Planck Institute of Neurobiology, Munich

29/3/2012 full-day course on *Machine Learning*
at the *Spring School on Human Modelling*, Ludwig-Maximilian University Munich

Community

Conferences, Workshops & Summer Schools

► *ICERM seminar on Probabilistic Scientific Computing*, Providence, RI, USA, June 2017
co-organizer (with G.E. Karniadakis, M.A. Osborne, H. Owhadi, P. Perdikaris)

► *NIPS workshop on Optimizing the Optimizers*, Barcelona, Spain, December 2016
co-organizer (with M. Mahsereci, A. Davies)

► *Dagstuhl seminar on the Future of Learning with Kernels and Gaussian Processes*, Dagstuhl Castle, November 2016, main organizer (with C. Rasmussen, A. Gretton, B. Schölkopf)

► *Workshop on Analytic Probabilistic Treatment Planning*, Tübingen, April 2016, organizer

► *NIPS workshop on Probabilistic Integration*, Montréal, Canada, 11. Dezember 2015
co-organizer (with. M. Osborne)

► *Machine Learning Summer School (MLSS)*, Tübingen, 2015: co-organizer (with M. Hirsch, B. Schölkopf)

► workshop on *Probabilistic Numerics for Differential Equations*, University of Warwick, April 2015: co-organizer (with C. Oates, M. Osborne, M. Girolami)

► workshop on *Probabilistic Numerics* at *Data, Inference and Learning Systems (DALI)*, April 2015: co-organizer (with M. Osborne, M. Girolami)

► *Machine Learning Summer School (MLSS)*, Tübingen, 2013: main organizer (with S. Harmeling, B. Schölkopf)

► *NIPS workshop on Probabilistic Numerics*, Lake Tahoe, US, 8 December 2012: co-organizer (with M. Osborne, J.P. Cunningham)

► *Machine Learning Summer School*, La Palma, Spain, 2012: local arrangements chair

Reviews and Program Committees

since 2011 Journal of Machine Learning Research (JMLR) – member of the editorial board since 2013

since 2011 Neural Information Processing Systems (NIPS) – area chair in 2014, 2016, 2017

since 2010 International Conference for Machine Learning (ICML) – *ICML reviewer award* in 2015, area chair in 2017

since 2012 Artificial Intelligence and Statistics (AISTATS) – member of senior program committee in 2015, 2016, 2017

since 2012 Uncertainty in Artificial Intelligence (UAI)

and occasional reviews for:
- ▶ Statistics and Computing (Springer Journal)
- ▶ SIAM Journal on Optimization
- ▶ European Conference on Computer Vision (ECCV)
- ▶ Conference on Learning Theory (COLT)
- ▶ Mathematical Programming A
- ▶ Robotics: Science and Systems (R:SS)
- ▶ Scandinavian Journal of Statistics
- ▶ IEEE Transaction on Robotics
- ▶ Data Mining and Knowledge Discovery (Springer Journal)

Outreach
- ▶ principal organizer for a weekend seminar on *probability and uncertainty* for gifted high-school students, in collaboration with the Heidelberg Life Science Lab. March 2013
- ▶ co-founded the *Cambridge University Statistics Clinic* at the Centre for Mathematical Sciences, in Michaelmas 2009, which aims to help non-statisticians from all academic fields make more of their data.
  `http://www.statslab.cam.ac.uk/clinic/`

Student Representation
- ▶ student delegate to the Faculty Council and the Board of Graduate Studies at Heidelberg (2 terms), 2003/04/05
- ▶ President of Robinson College Graduate Student Association (MCR) in 2009/10

Third-Party Funding (excluding scholarships & awards)

- ▶ **Independent Max Planck Research Group** — Max Planck Society for the Advancement of Science.
  Total grant volume confidential. Sufficient for a medium-sized research group, for 5 years.

- ▶ **Emmy Noether Grant of the German Research Union (DFG)**.
  Probabilistic Numerics
  Total grant volume: $\sim$ 840,000 € over 5 years, returned after 2 years, replaced with MPG grant above.

- ▶ **DFG project support grant ("Sachbeihilfe")**
  Analytical Probabilistic Radiation Therapy Treatment Planning
  with Mark Bangert (German Cancer Research Centre, Heidelberg). Total grant volume $\sim$ 300,000 €.

- ▶ **Sub-Project within the DFG focus program ("Schwerpunktprogramm")** *Autonomous Learning*
  Auto-Tune: Automatic Structure Optimization for large-scale learning
  with Frank Hutter, Thomas Brox (University of Freiburg). Total grant volume $\sim$ 500,000 €

- ▶ various smaller project grants, each below 100 000 €, from several sources