David Pfau

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Professional Experience

DeepMind, London, UK

Senior Research Scientist 2019 - present

Research Scientist 2015 - 2019

Qadium (now Expanse), San Francisco, CA

Senior Research Scientist 2014 - 2015

Consulted on Data Microscopes, an open-source library of fast, modular nonparametric Bayesian models.

Education

Columbia University, New York, NY 2008 - 2014

Ph.D., Neurobiology and Behavior. July 2014.

- Advisor: Liam Paninski
- Thesis: *Learning Structure in Time Series for Neuroscience and Beyond*

M.Phil., Neurobiology and Behavior. November 2011.

Stanford University, Stanford, CA 2003 - 2007

B.S., Physics, Minor in Mathematics. GPA: 3.76, 3.88 in major.

Honors and Awards

National Science Foundation Graduate Research Fellowship 2009

Stanford Summer Research Fellowship 2006

National Merit Scholarship 2003

Journal Publications

D. Pfau,* J. S. Spencer,* A. G. de G. Matthews, W. M. C. Foulkes (2020). *Ab initio Solution of the Many-Electron Schrödinger Equation with Deep Neural Networks.* Physical Review Research 2(3), 033429.

E. A. Pnevmatikakis, D. Soudry, Y. Gao, T. A. Machado, J. Merel, **D. Pfau**, T. Reardon, Y. Mu, C. Lacefield, W. Yang, M. Ahrens, R. Bruno, T. M. Jessell, D. S. Peterka, R. Yuste, L. Paninski (2016). *Simultaneous Denoising, Deconvolution, and Demixing of Calcium Imaging Data.* Neuron 89(2), 285-299.

F. Doshi-Velez, **D. Pfau**, F. Wood, N. Roy (2015). *Bayesian Nonparametric Methods for Partially-Observable Reinforcement Learning.* IEEE Transactions on Pattern Analysis and Machine Intelligence 37(2), 394-407.

J. Zylberberg, **D. Pfau**, M. DeWeese (2012). *Dead Leaves and the Dirty Ground: Low-level Image Statistics in Transmissive and Occlusive Imaging Environments.* Physical Review E 86(6), 066112.

Conference Publications

D. Pfau, I. Higgins, A. Botev, S. Racanière (2020). *Disentangling by Subspace Diffusion.* 33rd Advances in Neural Information Processing Systems, Virtual.

D. Pfau, S. Petersen, A. Agarwal, D. G. T. Barrett, K. Stachenfeld (2019). *Spectral Inference Networks: Unifying Deep and Spectral Learning.* 7th International Conference on Learning Representations, New Orleans, LA.

L. Metz, B. Poole, **D. Pfau**, J. Sohl-Dickstein (2017). *Unrolled Generative Adversarial Networks.* 5th International Conference on Learning Representations, Toulon, France.

M. Andrychowicz, M. Denil, S. Gomez, M. W. Hoffman, **D. Pfau**, T. Schaul, N. de Freitas (2016). *Learning to Learn by Gradient Descent by Gradient Descent.* 29th Advances in Neural Information Processing Systems, Barcelona, Spain.

C. Fernando, D. Banarse, M. Reynolds, F. Besse, **D. Pfau**, M. Jaderberg, M. Lanctot, D. Wierstra (2016). *Convolution by Evolution: Differentiable Pattern Producing Networks.* The Genetic and Evolutionary Computing Conference, Denver, CO.

D. Pfau, E. Pnevmatikakis, L. Paninski (2013). *Robust Learning of Low-Dimensional Dynamics from Large Neural Ensembles.* 26th Advances in Neural Information Processing Systems, Lake Tahoe, NV.

Y. Wong, D. Putrino, M. Vigeral, **D. Pfau**, J. Merel, L. Paninski, B. Pesaran (2012). *Decoding Arm and Hand Movements Across Layers of the Macaque Frontal Cortices.* Proceedings of the 34th Conference of the IEEE Engineering in Medicine and Biology Society, San Diego, CA.

D. Pfau, N. Bartlett, F. Wood (2010). *Probabilistic Deterministic Infinite Automata.* 23rd Advances in Neural Information Processing Systems, Vancouver, Canada. **Spotlight Presentation**.

N. Bartlett, **D. Pfau**, F. Wood (2010). *Forgetting Counts: Constant Memory Inference for a Dependent Hierarchical Pitman-Yor Process.* Proceedings of the Twenty-Seventh International Conference on Machine Learning, Haifa, Israel.

Workshop Papers and Preprints

D. Pfau, D. Rezende (2020). *Integrable Nonparametric Flows.* NeurIPS Workshop on Machine Learning and Physical Sciences. `arXiv:2012.02035`.

J. S. Spencer, **D. Pfau**, A. Botev, W. M. C. Foulkes (2020). *Better, Faster Fermionic Neural Networks.* NeurIPS Workshop on Machine Learning and Physical Sciences. `arXiv:2011.07125`.

I. Higgins,* D. Amos,* **D. Pfau**, S. Racanière, L. Matthey, D. Rezende, A. Lerchner (2018). *Towards a Definition of Disentangled Representations.* `arXiv:1812.02230`.

D. Pfau, C. P. Burgess (2018). *Minimally Redundant Laplacian Eigenmaps.* 6th International Conference on Learning Representations, Workshop Track, Vancouver, Canada.

D. Pfau, O. Vinyals (2016). *Connecting Generative Adversarial Networks and Actor-Critic Methods.* NeurIPS Workshop on Adversarial Traning, Barcelona, Spain. `arXiv:1610.01945` . **Spotlight Presentation**.

Conference Abstracts and Poster Presentations

J. S. Spencer,* **D. Pfau**,* A. G. de G. Matthews, W. M. C. Foulkes (2020). *Ab initio Solution of the Many-Electron Schrödinger Equation with Deep Neural Networks.* American Physical Society March Meeting, Denver, CO.

D. Pfau, J. Freeman, M. Ahrens, L. Paninski (2013). *Scalable Region of Interest Detection for Calcium Imaging.* NeurIPS Workshop: Acquiring and Analyzing the Activity of Large Neural Ensembles.

D. Pfau, E. Pnevmatikakis, L. Paninski (2013). *Robust Learning of Dynamics for Large Neural Ensembles.* Computational and Systems Neuroscience, Salt Lake City, UT.

K. Emmett, J. Rosenstein, **D. Pfau**, A. Bamberger, K. Shepard, C. Wiggins (2013). *Statistical Inference of DNA Translocation using Parallel Expectation Maximization.* American Physical Society March Meeting, Baltimore, MD.

D. Pfau, N. Bartlett, F. Wood (2010). *Bayesian Infinite Automata.* New York Machine Learning Symposium, New York, NY.

D. Pfau, X. Pitkow, L. Paninski (2009). *A Bayesian Method to Predict the Optimal Diffusion Coefficient in Random Fixational Eye Movements.* Computational and Systems Neuroscience, Salt Lake City, UT.

Patents

D. Pfau, J. S. Spencer, A. G. de G. Matthews. *Antisymmetric Neural Networks.* U. S. Patent Application US17/011569, filed 3 September 2020.

D. Pfau, S. Petersen, A. Agarwal, D. G. T. Barrett, K. Stachenfeld. *Training Spectral Inference Neural Networks Using Bilevel Optimization.* WIPO Patent WO2019234156A1, published 12 December 2019.

M. Denil, T. Schaul, M. Andrychowicz, N. de Freitas, S. Gomez, M. W. Hoffman, **D. Pfau**. *Training Machine Learning Models.* U. S. Patent US20190220748A1, published 18 July 2019.

Invited Talks

Academic

University of Tübingen, Tübingen, Germany	March 2021
University of Oxford, Oxford, UK	March 2021
Princeton Plasma Physics Laboratory, Princeton, NJ	February 2021
Baruch College, New York, NY	February 2021
Osaka University, Osaka, Japan	January 2021
MCQMC, Oxford, UK	August 2020
Baylor College of Medicine and Rice University, Houston, TX	July 2020
Physics in Machine Learning Workshop, Berkeley, CA	May 2019
Imperial College London, London, UK	February 2019
Machine Learning Summer School, Buenos Aires, Argentina	June 2018
IML Machine Learning Workshop, CERN, Geneva, Switzerland	April 2018
International Conference on Computer Vision (ICCV), Venice, Italy	October 2017
Data, Learning and Inference (DALI), Tenerife, Spain	April 2017
University of York, York, UK	March 2017
Redwood Center for Theoretical Neuroscience, Berkeley, CA	April 2014
CoSyNe Workshop: Discovering Structure in Neural Data, Snowbird, UT	March 2014

Public Outreach

British Film Institute, London, UK	April 2019
Creative AI Meetup, London, UK	April 2018
Somerset House, London, UK	January 2018
Jugular Dialogue, London, UK	October 2016
Gray Area Foundation for the Arts, San Francisco, CA	February 2016

Teaching Experience

Columbia University, New York, NY

Guest Lecturer, W3995 Neuroscience and the Law — Fall 2013

Teaching Assistant, G8325 Statistical Analysis of Neural Data — Fall 2012

Teaching Assistant, G4360 Theoretical Neuroscience — Spring 2011

Educational Program for Gifted Youth, Stanford, CA

Tutor and Counselor, Physics Program — Summer 2005

Professional Service

PhD Student Supervision

Jointly with W. M. C. Foulkes and James Spencer:

Gino Cassella, Imperial College London — 2021 - present

Halvard Sutterud, Imperial College London — 2021 - present

Thesis Committees

Georgios Arvanitidis, TU Denmark — 2019

Reviewing and Program Committees

International Joint Conference on Artificial Intelligence	2019
International Conference on Machine Learning	2018
Nature	2017
International Conference on Learning Representations	2017-2019, 2021
Computational and Systems Neuroscience	2017
IEEE Transactions on Pattern Analysis and Machine Intelligence	2012
Neural Information Processing Systems	2011, 2013, 2015-2020
Journal of Machine Learning Research	2011
Artificial Intelligence and Statistics	2011

Workshop Organizing

Learning Disentangled Representations: from Perception to Control, NeurIPS — 2017

Other

Volunteer, Neural Information Processing Systems — 2010