Bradley **Gram-Hansen**

Projects: https://github.com/bayesianbrad • Email: bradleygramhansen@gmail.com • Publications: Google Scholar

Education

University of Oxford — Ph.D. in Machine Learning, April 2021

- **Thesis**: Extending Probabilistic Programming Systems and Applying them to Real-World Simulators
  - **Supervisors**: Prof Yee Whye Teh, Dr Tom Rainforth, Dr Atılım Günes Baydin, Prof Philip Torr

University of Nottingham — Masters in Mathematics & Physics, July 2015

- **Dissertation:** An Investigation into the Creation of Entanglement Mediated by Interaction.
  - **Supervisor:** Alexander Ossipov
- **Thesis:** Quantum Random Walks
  - **Supervisor:** Mădălin Guţă
- Graduated in top 5%. Equivalent GPA 4.0.

Experience

Intelligent Networks
London, UK
Chief Technology Officer & Co-founder — Sept 2020 – Present

• Entrepreneurial spirit. Co-founded https://intelligentnetworks.ai, built the website with HTML, Bootstrap, CSS, hosted and deployed in the cloud with AWS (Route 53, Amplify) via Github (Git) for CI/CD.
• Built innovative probabilistic machine learning & AI solutions for our enterprise customers using a combination of classification and regression algorithms to forecast and extract anomalous alarms, reducing false alarm incidents by 96 % and generating a significant ROI of 86% for our customers.
• The data processing, visualization & AI framework was deployed on AWS (S3, EC2, Amplify, Sagemaker) with Python (PyTest, Pandas, Pytorch, Seaborn, Matplotlib, Scikit-learn, PyMC3, Pyro & Flask), and Docker. • Raised $110,000 in funding from the Entrepreneur First accelerator, managed finances, payroll, and provided technical supervision to our clients.

University of Oxford
Oxford, UK
Machine Learning Researcher — Sept 2016 – Apr 2021

• Created PyLFPPL, an open source compiler built with Python & Clojure to enable new and existing classes of probabilistic graphical models and Bayesian inference algorithms to be deployed in probabilistic programming systems in an automated way via a standard API. Work published at AISTATS.
• Collaborated with teams at CERN, Intel, Oxford University, UBC, Google, and NYU, where I helped to develop two novel open source deep learning and Bayesian modeling tool-kits, PPX and PyProb, using Python, a small amount of C++ & Google FlatBuffers, to convert real-world simulators into probabilistic programs for deep learning inspired statistical inference algorithms. Work published at NeurIPS (main conference) and ICML (workshop).
• Created new generative modeling strategies for agent-based models that utilized custom deep learning frameworks based on variational auto-encoders and MCMC algorithms built with Pytorch and provided a 50% increase in statistical efficiency over previous methods. Work published at AABI.
• Developed innovative kernel-based algorithms in Python using GPy with Pandas for forecasting and predicting events in financial and non-financial time-series datasets.
• In this role, I got to apply my passions for data and machine learning to solve real-world problems in the financial services, scientific, and health care domains and published several papers at top AI conferences.

Frontier Development Lab
Oxford & Frascati, UK & IT
Machine learning scientist — Jun 2018 – Sept 2018

• Collaborated with Nvidia, NASA, ESA, Google Cloud, and UNICEF and led a team on an ambitious, yet ambiguous, project to detect Informal settlements for UNICEF, using free, low-resolution satellite imagery - it's very blurry! I engineered the prototype and the initial solution that turned spectral signals from satellite images into actionable insights for UNICEF. I used Matlab & Python (GeoPandas).
  • Enabled UNICEF to save $100,000 annually in surveying costs
  • Invited to present the research results to industry leaders at the UN AI for social good conference.

Publications & Pre-prints

Pre-prints

- B. Gram-Hansen, *Extending Probabilistic Programming Systems and Applying Them to Real-World Simulators*, 2021, Doctoral Thesis
- B. Gram-Hansen, Adam Golinski, C. Schroeder de Witt, P.H.S.Torr, Y.W. Teh, A. G. Baydin and T. Rainforth, *Effective Approximate Inference for Nested Simulator*s, 2021
- B. Gram-Hansen and S.J Roberts, *Multi-layer Stacked Gaussian Processes*, 2021

Published

- B. Gram-Hansen*, C. Schroeder de Witt, P.H.S.Torr, Y.W. Teh, A. G. Baydin and T. Rainforth, *Efficient Bayesian Inference for Nested Simulators*, The 2nd Symposium on Advances in Approximate Bayesian Inference (**AABI**), 2019
- AG. Baydin, L. Heinrich, W. Bhimji, B. Gram-Hansen, G. Louppe, L. Shao, K, Cranmer and F.Wood, *Efficient Probabilistic Inference in the Quest for Physics Beyond the Standard Model,* The International Conference on Neural Information Processing Systems (**NeurIPS**), 2019
- AG. Baydin, L. Heinrich, W. Bhimji, B. Gram-Hansen, G. Louppe, L. Shao, K, Cranmer and F.Wood, *Etalumis: Bringing Probabilistic Programming to Scientific Simulators at Scale*, The International Conference for High-Performance Computing, Networking, Storage, and Analysis (**SC**), 2019, Nominated for Best Paper.
- B. Gram-Hansen*, Y, Zhou*, T. Kohn, T. Rainforth, H. Yang and F. Wood, *A Low-Level Probabilistic Programming Language for Non-Differentiable Models*, The 22nd International Conference on Artificial Intelligence and Statistics (**AISTATS**), 2019
- B. Gram-Hansen*, P. Helber*, I. Varatharajan, F. Azam, A. Coca-Castro, V. Kopackova and P. Bilinski, *Mapping Informal Settlements in Developing Countries using Machine Learning and Low Resolution Multi-spectral Data*, The Thirty-Third AAAI Conference on Artificial Intelligence (**AAAI**), 2018
- B. Gram-Hansen*, Y, Zhou*, T. Kohn, T. Rainforth, H. Yang and F. Wood, *Hamiltonian Monte Carlo for Probabilistic Programs with Discontinuities*, The International Conference on Probabilistic Programming, 2018

Workshop papers

- B. Gram-Hansen*, C. Schroeder de Witt*, N.Nardelli, A. Gambardella,R. Zinkov, P. Dokania, Siddharth N. A. B. Espinosa-Gonzalez, Lord A. Darzi, P.H.S. Torr and A. G. Baydin, *Simulation-Based Inference for Global Health Decisions,* 2020, ML for Health Workshop at the International Conference on Machine Learning (**ICML**), 2020
- B. Gram-Hansen*, C. Schroeder de Witt*, P.H.S.Torr, Y.W. Teh, T. Rainforth and AG. Baydin, *Hijacking Malaria Simulators with Probabilistic Programming*, AI for Social Good Workshop at the International Conference on Machine Learning (**ICML**), 2019

Invited Talks

Talks

- *Applying probabilistic programming to construct knowledge graphs*, Dataminr, New York (virtual), US, 2021
- *AI for space*, United Nations: AI for good global summit, Geneva, CH, 2019
- *Probabilistic Programming,* Oxford center for Human Brain Activity, Oxford, UK, 2018.
- *Using machine learning to detect informal settlements*. European Space Agency, IT, 2018.

Awards

Academic

- 2020 EY (Ernst & Young) Best Technology Business Award, out of 50 teams
- 2019 Runner-up in the Vice-Chancellor's Social Impact Award, out of 300 people
- 2019 NeulPS Travel Award
- 2018 FDL Award for Unexpected Discovery, out of 30 people
- 2016-2020 EPSRC Fully-Funded 4-Year PhD Studentship, 1 of 10 out of 240 people
- 2014 EPSRC Summer Research Award
- 2014 BP Ambition Award, 1 of 20 out of 600 people
- 2012 Eliahou Dangoor Scholarship, 1 of 5 out of 1000 people
- 2012 PWC High Flyers Award
- 2011 Sir Peter Mansfield High Achiever Scholarship
- 2011-2015 St Ann's Experian Scholarship
- 2011-2015 First in the Family Scholarship
- 2010 Excellent Dedication and Contribution A-level Physics
- 2010 Interest and Enthusiasm A-level Mathematics

Sporting

- 2016 IronMan Copenhagen, 11th in age group, out of 400 people
- 2016 Silver Medal, Fell Running championships, competing against 150 people
- 2005-2007 National Mini-field Youth Hockey champion U13 and U15 out of 25 teams

Reviewing Duties

- Neurlps 2021 main conference
- Neurlps 2020 workshop on Deep Learning for the Physical Sciences
- Neurlps 2020 main conference
- AISTATS 2020 main conference
- Neurlps 2019 workshop on Deep Learning for the Physical Sciences
- Neurlps 2019 main conference
- Neurlps 2018 workshop on Deep Learning for the Physical Sciences
- Neurlps 2018 workshop on Critiquing and Correcting Trends in Machine Learning