Anish Dhir

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Education

Imperial College London — London
PhD in Machine Learning — *Oct. 2021 - Present*

- Supervised by Dr. Mark van der Wilk
- **Research topics:**
  - Bayesian approaches to causal discovery
  - Causal representation learning and applicability for OOD generalisation
  - Decentralised learning in Neural Networks

University College London — London
Computational Statistics and Machine Learning MSc; Distinction (Dean's List) — *Sep. 2017 – Sep. 2018*

- **Thesis:** Created and tested a novel algorithm for conditionally executed learning in modular networks to ensure the most efficient parameter usage. Method involved learning parameters of a Beta Bernoulli process using the pathwise gradient estimator. Models built in Tensorflow and trained using hpc. Worked under Dr. David Barber and the work was a follow-up of a NeurIPS submission. (82%)
- **Selected Modules:**
  - Probabilistic and Unsupervised Learning[1] (80%)
  - Approximate Inference[2] (83%)
  - Natural Language Processing (83%)
  - Advanced Deep Learning and Reinforcement Learning[3] (89%)
  - Applied Machine Learning (optimization, NNMF, spectral clustering, 91%)
  - Applied Bayesian Methods (Hierarchical Bayesian models)
  - Statistical Modelling (GLMs, GAMs)
  - Supervised Learning (SVM, Learning Theory, Kernels)

Imperial College London — London
Physics MSc; Distinction — *Sep. 2016 – Sep. 2017*

- **Thesis:** Separating modes of B Meson decays to test the validity of using these decays to verify the discrepancy between theory and experiment in lepton universality. Relevant decays were separated from background using machine learning techniques.
- **Essay:** Conducted a 6000-word Self-Study project and a presentation on the principles and benefits of quantum computing (Shors algorithm, Grovers algorithm), as well as experimental procedures for its realisation.
- **Modules:**
  - Advanced Statistical Machine Learning and Pattern Recognition
  - Quantum Information
  - Cryptography Engineering
  - General Relativity
  - Unification (explaining the standard model using group theory)
  - Quantum Field Theory
  - Foundations of Quantum Mechanics

Imperial College London — London
Physics with Theoretical Physics BSc; 2:1 — *Sep. 2013 – July 2016*

- **Project:** Network Centrality 6000-word essay and presentation on properties and unification attempts of centrality indices in networks — statistical methods to determine the most important vertex; included python analysis of networks.

[1] Taught by Gatsby Computational Neuroscience Unit
[2] Taught by Gatsby Computational Neuroscience Unit
[3] Taught by Google DeepMind

Experience

Babylon Health London
Research Scientist *Dec. 2018 - Oct. 2021*

- Research and applications focused on Causal Discovery (finding causal relations in data as opposed to correlations) and Simulation (using causal relations to compute causal effects and counterfactuals)
- Research in causal discovery with multiple datasets lead to publication at AAAI 2020. Multiple studies with overlapping variables are common in medicine. Presented a poster and a gave a talk at AAAI 2020. Work was featured in MIT technology review: Link
- Developed a toolkit containing algorithms required for research. Examples include statistical tests for independence, causal discovery, source separation algorithms, generative models, causal effect computation

Publications

- Anish Dhir and Mark van der Wilk. Causal Discovery using Marginal Likelihood. NeurIPS 2022 Workshop on Causality for Real-world Impact, 2022.
- Alexis Bellot, Anish Dhir, Giulia Prando. Generalization bounds and algorithms for estimating conditional average treatment effect of dosage. 2022. https://arxiv.org/abs/2205.14692.
- Anish Dhir and Ciaran M. Lee. Integrating Overlapping Datasets Using Bivariate Causal Discovery. In AAAI, 2020. https://arxiv.org/abs/1910.11356.

Awards

- Dean's List UCL 2017/18

Mathematical Skills

• Bayesian Statistics • Variational Inference (Expectation Propagation, Variational Bayes, Mean Field Approximations, Recognition Networks) • Gaussian Processes (Variational Sparse GPs) • Latent Variable Models (ICA, PCA, Deep Generative Models) • Sampling Methods • Kernel Methods • Causal Inference • Causal Structure Learning • Graphical Models • Deep Learning • Real Analysis • Linear Algebra • Multivariable Calculus • Group Theory • Complex Analysis • Fourier Analysis • Functional Analysis (pertaining to Hilbert spaces in Quantum Mechanics and Kernel Methods) • Differential Equations • Tensor Calculus

Programming Skills

Languages: fluent in Matlab and Python; limited experience in C++
Frameworks: TensorFlow, PyTorch, Pyro, Numpy, scikit-learn

Other Experience

Teaching Assistant at Imperial College London
TA *Sep. 2021 – Current*

- Conducted seminars and tutorials for groups of students in courses ranging from undergraduate to masters level
- Two courses taught per semester in subjects in the maths and computing departments

Private Tutor London
Tutor *Sep. 2013 – Current*

- Tutored students from secondary school to university level on subjects such as Maths, Physics, Computer Science