Ilan Price

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Education

PhD in Mathematics of Deep Learning | University of Oxford | *Start: Oct 2018, Expected grad: Sep 2022*

- **Research:** low-dimensional and sparse neural networks, mathematical theory for deep learning: expressivity, subspace-training, loss landscapes. Supervisor: Professor Jared Tanner
- **Teaching:**
  - Teaching Assistant and/or Tutor for Oxford Maths 4th year and MSc courses: "Theories of Deep Learning" (2019, 2020); "Continuous Optimisation" (2020); "Random Matrix Theory" (2021).
  - Tutor for two courses at the Gene Golub Summer School 2021: "Perspectives on the theoretical understanding of deep networks", and "Large-scale Optimization for Deep Learning"
- **Winter/Summer Schools:**
  - Low-Rank Models (2020)
  - Reinforcement Learning Summer School at the Alan Turing Institute (2021)
  - Oxford Machine Learning Summer School (2021)

MSc in Mathematical Modelling and Scientific Computing | University of Oxford | *2016 - 2017*

- Awarded with Distinction, 4th top in cohort overall
- Dissertation (Grade: 82%): Gaussian Processes for Flight Ticket Demand Unconstraining.
- Selected Course Content: Continuous Optimisation | Numerical Linear Algebra | Scientific Computing in MATLAB, Python and C++ | ODEs and PDEs | Mathematical Modelling

Bachelor of Science | **Applied Mathematics & Philosophy** | University of Cape Town | *2011 - 2013*

- Distinction (first-class pass) in all courses | 4 Course Medals (top in course)

Publications

- Price, I, Tanner J (2021). Dense for the Price of Sparse: Improved Performance of Sparsely Initialized Networks via a Subspace Offset. *Accepted to the 38th International Conference on Machine Learning, (ICML 2021)* Paper here. Code here.
- Price, I, Gifford-Moore, J, Fleming, J, Roichman, M, Thain, N, Dixon, L, Sorensen, J (2020). Six Attributes of Unhealthy Conversation. Proceedings of the Fourth Workshop on Online Abuse and Harms (pp. 114-124).
- Price, I, Tanner, J, (2020). Trajectory growth lower bounds for random sparse deep ReLU networks. Preprint available at arxiv.org/abs/1911.10651
- Price, I, Jaroslav F, and Daniel H. (2019). Gaussian processes for unconstraining demand. European Journal of Operational Research 275.2: 621-634.
- Hodes, R., Price, I., Bungane, N., Toska, E., & Cluver, L. (2017). How front-line healthcare workers respond to stock-outs of essential medicines in the Eastern Cape Province of South Africa. South African Medical Journal, 107(9), 738-740.

Selected Scholarships and Awards

- Alan Turing Institute PhD studentship (2018) | A studentship awarded by the Alan Turing Institute in London for PhD study in partnership with the institute | *Details here*
- Emirates Studentship (2018) | Funding award by the Mathematical Institute, University of Oxford
- Oxford-Weidenfeld and Hoffman Leadership Scholarship (2016) | A scholarship for future leaders from across the world to study at Oxford in parallel with a year-long leadership programme | *Details here*
- Skye Foundation Scholarship (2016) | Selected from a nationwide pool of candidates nominated by faculty deans from across South Africa, awarded based on academic merit | *Details here*
- Scholarships from University of Cape Town: Science Faculty Scholarship (2013); Twamley December Scholarship (2012); Humanities Entrance Scholarship, Twamley Undergraduate Scholarship (2011).

Selected Technical Experience

Machine Learning Research Intern | ClimateAI | *June-Aug 2021*

- Applying GANs to improve downscaling of precipitation forecasts

Alan Turing Institute Data Study Group | *April 2021*

- Two-week hackathon-style event. Challenge: build a podcast recommendation system for a podcast app.
- Applied text- and data-preprocessing, LDA topic models, and pretrained BERT models to obtain podcast and user embeddings for clustering and nearest-neighbour recommendations.
- Implemented and evaluated Neural Collaborative Filtering on historical user-listen data.

Independent Projects | *2020*

- Conceptualised and coded (in Julia) an agent based Covid-19 simulation model, with a focus on novel modelling of contact tracing, quarantine, and isolation.
- Built a virtual version of 'Hanabi', a multiplayer cooperative online game. Code in Python.

Machine Learning Engineer | Rhodes Artificial Intelligence Lab (RAIL) | *Feb-Aug 2017, Oct 2017 - Oct 2019*

- Applying machine learning for social good (pro-bono work, part-time).
  - Project 1) Uncovered archetypal user behaviour for an online learning platform by applying clustering and topic modeling techniques to data from 3100 students.
  - Project 2) (Project leader) Crowdsourced a new dataset of 44K comments annotated for subtly toxic attributes, and established baseline classification results with BERT. A collaboration with Alphabet's Jigsaw.

Research Assistant | Oxford-Emirates Data Science Lab, University of Oxford | *Sep 2017 - Jul 2018*

- Full-time position. Mathematical modelling and data analytics for revenue management and service personalisation.
- Developed an algorithm for online multiple hypothesis testing with live data.

Programming languages/packages:

- Python (2017 - 2021), Tensorflow (2018 - 2020), Pytorch (2020 - 2021), Matlab (2012 - 2013, 2016 - 2017), Julia (2020)

Talks and Academic Presentations

- "Dense for the Price of Sparse: Initialising deep nets with efficient sparse affine transforms", Feb 2021, Numerical Analysis Group Internal Seminar, University of Oxford.
- "The Unhealthy Comments Corpus: Six attributes of unhealthy conversation", Nov 2020, paper presentation at the Fourth Workshop on Online Abuse and Harms.
- "Trajectory growth lower bounds for random sparse deep ReLU networks", Aug 2020, poster presentation at the LMS-Bath symposium on the Mathematics of Machine Learning. Video.
- "Neural network expressivity and adversarial vulnerability", Apr 2019, at the African Institute for Mathematical Sciences.
- "A non-technical introduction to machine learning", Oct 2018, at Rhodes House, Oxford. Presentation.

Selected Leadership Experience

Co-Director | Rhodes Artificial Intelligence Lab (RAIL) | *July 2018 - Sep 2019*

- Co-led a society of Oxford graduate students which undertakes (pro-bono) projects and public events focused on machine learning for social good (see rhodeslab.com).
- Sourced, scoped, and managed 4 projects with different partners; organised technical and 'literacy' training in machine learning for a combined 60+ people.

COO (*2015*), **National Head** (elected) (*2014*) | Habonim Dror SA (HDSA) Foundation, HDSA

- I was elected to lead HDSA, a countrywide, educational youth movement for South African Jewish youth with an annual turnover of approx. R10 million.
- I took the initiative to establish an endowment fund, and raised more than R2.5 million.
- I managed Habonim's 44 hectare campsite as a business to supplement the revenue of the NPO.
- I managed large scale projects including a summer camp involving 800-1000 people, lasting one month. Other responsibilities included strategic positioning and crisis management.