Michael Painter

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<small>EDUCATION</small>

University of Oxford, Oxford Robotics Institute, Pembroke College   Oct 2018 – Apr 2024
DPhil Engineering Science (Robotics/Machine Learning)
- Research focuses: *Monte Carlo Tree Search* and (multi-objective) *sequential decision making*
- Teaching: masters project supervision and teaching assistant for robotics/software engineering courses
- Presenting (my own/others) research, and reviewing for conferences such as IJCAI, ICRA and AAAI

Stanford University   Sep 2016 – Jun 2018
MS Computer Science
- Main courses: AI, Machine Learning, Reinforcement Learning, Robotics, Computer Vision, NLP with Deep Learning, Randomised Algorithms, Optimisation and Algorithmic Paradigms, Data Mining
- Course staff (CA) for Probability, Principles of Computer Systems and Reinforcement Learning

University of Cambridge, Churchill College   Oct 2013 – Jun 2016
BA (Hons) Computer Science
- Algorithms, Concurrent/Distributed Systems, Networks, Software Engineering, Databases, Security

<small>EMPLOYMENT</small>

Software Engineer Intern — Google, Display Ads Predictions   Jul 2019 – Oct 2019
- Worked on estimating parameters in *Generalised Linear Mixed Models* with billions of data points
- Used *variational inference* to optimise the model, outperforming the baseline with less training time
- Documented how to distribute the algorithm across multiple machines to exploit model sparsity
- Technologies used: Python, TensorFlow, Borg (including BCL)

Applied Scientist Intern — Microsoft, DNN Frameworks Team   Jul 2018 – Sep 2018
- Used *Generative Adversarial Networks* to produce *3D human pose estimates* given a single RGB image
- Improved robustness to "in the wild" images using *data augmentation* and *semi-supervised* techniques
- Incorporated *depth estimation networks* to produce global 3D pose predictions, for *Kinect for Azure*
- Technologies used: Python, PyTorch, NumPy, SciPy, ONNX

<small>SELECTED PROJECTS</small>

Code for most projects found at: github.com/MWPainter

THTS++   Oct 2022 – Ongoing
- Open source parallelised implementation of *Trial Based Heuristic Tree Search* in C++

MCTS with Boltzmann Exploration (*NeurIPS2023*)   Jan 2022 – May 2023
- Developed two *Monte Carlo Tree Search* (MCTS) algorithms using *Boltzmann search policies*
- Proved *exponential convergence bounds* for the performance of both algorithms using *simple regret*
- Used the *Alias Method* for faster sampling and improving the *asymptotic complexity* of the algorithms
- Technologies used: C++, KataGo

Convex Hull Monte-Carlo Tree Search (*ICAPS2020*)   Apr 2019 – Jan 2020
- Adapted *Monte Carlo Tree Search* for multi-objective planning using *convex hull backups*
- Novel analysis of *sample based multi-objective planning* algorithms using *contextual regret*
- *Improved scalability* over prior works, demonstrated with *Generalised Deep Sea Treasure* environments
- Technologies used: Python, NumPy, SciPy

Sequential Variational Autoencoders — SAIL/Ermon Group   Jan 2018 – Jun 2018
- Work on applying *Variational Autoencoders* (VAEs) sequentially to generate "sharper" images
- Developed novel objective functions and used multiple VAE architectures to improve image quality
- Technologies used: Python, TensorFlow, NumPy

CNNs for Visual Recognition — *Efficient Architecture Search*   Apr 2018– Jun 2018
- Implemented novel *network preserving transformations* for *Convolutional Neural Networks*.
- Demonstrated training speed up on simple classification tasks, by utilising the transformations.
- Used the transformations with *neuroevolution* and parameter sharing in an *efficient architecture search*.
- Technologies used: Python, PyTorch, NumPy.

<small>LANGUAGES</small>   Python, C++, C, Cython, Java, Javascript, Matlab, PHP, MySQL, HTML.

<small>PACKAGES</small>   PyTorch, TensorFlow, NumPy, SciPy, GTest, Git, SKLearn, ONNX, Microsoft Azure, AWS.

<small>ACTIVITIES AND INTERESTS</small>   Trying not to burn my food; Keen hiker; Ex-competitive track and field athlete; Picking up skills, such as juggling, slacklining and cocktail making; Getting lost in a novel; Struggling to find shoes that fit

LIST OF
PUBLICATIONS

2023   Painter, M.; Baioumy, M; Hawes, N; and Lacerda, B. Monte Carlo Tree Search With Boltzmann Exploration. *Advances in Neural Information Processing Systems (NeurIPS)*

2020   Painter, M.; Lacerda, B.; and Hawes, N. 2020. Convex Hull Monte Carlo Tree Search. *Int.Conf on Automated Planning and Scheduling (ICAPS)*

In Progress   Multi-Objective Maximum Entropy Tree Search

Using Tree Search To Integrate Skills From Multiple Agents

Boltzmann Policy Improvement