Andrew M. **Webb**

Machine Learning Research Scientist/Engineer

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Produced 23/04/2019—up to date CV at www.awebb.info/cv

Experience

Postdoctoral Research Associate, LAMBDA/PAMELA Projects *2017–Present*

School of Computer Science, University of Manchester

On the PAMELA project, I am integrating object detection into state-of-the-art SLAM (simultaneous localisation and mapping). On the LAMBDA project, I am studying explicit diversification methods for ensemble methods in deep learning. (See arxiv.org/abs/1902.04422 and github.com/grey-area/modular-loss-experiments). Also presented work at the Arm Research Summit 2018.

Participant, One Week Data Study Group *2018*

Alan Turing Institute, London

Worked with NATS—the UK's main air navigation service provider—and a team of participants to predict aircraft trajectories. Developed a nearest neighbour-based approach. Used a spatial tree to reduce time taken to join flight and weather data (an operation done regularly at NATS) from hours to minutes.

Research Software Engineer, SpiNNaker Project *2016*

School of Computer Science, University of Manchester

Wrote code for generating neural data structures for SpiNNaker—a many-core neuromorphic (spiking neural network) computing platform—in parallel on the machine itself, decreasing load times by an order of magnitude. (See github.com/project-rig/pynn_spinnaker).

Research Software Engineer, SpiNNaker Project *2012*

School of Computer Science, University of Manchester

Developed graphics rendering software for the SpiNNaker many-core neuromorphic computing platform, which did not support floating point arithmetic. Software was demonstrated to visitors from Samsung, and is still in use for demonstrations. (See github.com/SpiNNakerManchester/spinnaker_tools/tree/master/apps/pt_demo).

Publications

- C. Shand, R. Allmendinger et al.: *Evolving Controllably Difficult Datasets for Clustering*, GECCO 2019
- A. M. Webb, G. Brown, and M. Luján: *ORB-SLAM-CNN: Lessons in Adding Semantic Map Construction …* TAROS 2019
- A. M. Webb, C. Reynolds et al.: *Joint Training of Neural Network Ensembles*, preprint arXiv:1902.04422 2019
- S. Saeedi, B. Bodin et al.: *Navigating the Landscape for Real-Time Localization and Mapping…*, Proc. IEEE Vol. 2018
- A. M. Webb: *On Selection for Evolvability*, PhD thesis 2016
- A. M. Webb, J. Handl, and J. Knowles: *How Much Should You Select for Evolvability?*, ECAL 2015
- A. M. Webb and J. Knowles: *Studying the Evolvability of Self-Encoding Genotype-Phenotype Maps*, ALIFE 2014
- A. M. Webb, S. Davies, D. Lester: *Spiking Neural PID Controllers*, ICONIP 2011

Education

PhD in Computer Science, Machine Learning and Optimization Group *2012–2016*

School of Computer Science, University of Manchester

Synopsis of research: Evolutionary algorithms are a family of heuristic algorithms for solving optimization problems, inspired by evolutionary processes. Solutions can differ in their 'evolvability'—their propensity to give rise to good descendant solutions. In my research I model the evolvability of each solution as a hidden variable about which we can learn something by making noisy observations. I use sequential Bayesian filtering algorithms to estimate the evolvability of each solution in the population, in order to select evolvable solutions. Theoretical results obtained by analysing a probabilistic model of my algorithm, and experimental work, showed that periodically selecting solutions based on evolvability estimates can lead to increased expected performance on some optimization problems. (Thesis available at awebb.info/misc/thesis.pdf) During the PhD I attended master's degree level course units on machine learning and data dimensionality reduction, and also undergraduate course units in the mathematics department.

BSc in Artificial Intelligence, First Class Honours *2006–2010*

University of Manchester

Skills

Programming (see github.com/grey-area)

- PyTorch
- Python (with NumPy, SciPy, scikit-learn, pandas, and compiled Python with Cython)
- TensorFlow
- C++
- C

Machine Learning/Inference/Probability

- Implementing deep neural networks from scratch (for learning purposes) and in PyTorch and TensorFlow
- Bayesian statistics, including alternatives to null hypothesis significance testing
- Metaheuristic optimization algorithms such as evolutionary algorithms
- Scikit-learn machine learning library
- MCMC sampling with Stan and PyMC software
- Spiking neural networks and neuromorphic hardware

Other Computing Skills

- Experience writing software for unusual, distributed architectures
- Mathematica
- Git version control
- Graphics with OpenGL

Communication/Other Skills

- Presented peer-reviewed work at international conferences
- Co-chaired a regular research seminar
- One-to-one teaching and marking on a *Mathematical Techniques for CS* course unit

Interests

Hobbies and interests include guitar, fishkeeping (tropical fish and invertebrates), science fiction, board games, and fitness, and I'm a keen fan/follower of the space industry. I maintain a blog at awebb.info/blog that I use to write about topics as I learn or to explore problems that are too small to lead to publication.