



New Approaches for Continual Learning through Meta Learning and Sparsity

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ABSTRACT

As machine learning systems are being applied throughout the sciences and technologies impacting our lives in diverse ways, the need for techniques to accumulate skills, update knowledge and rapidly adapt to novel scenarios is becoming more evident. This ability to learn from a long sequence of experience rather than fixed data sets, termed Continual Learning, is critical to the next generation of Machine Learning Systems. In this talk, I will first provide a definition of the Continual Learning problem and its fundamental desiderata along with a review of the principal solution approaches emerging from the literature in recent years. I will then argue that while great progress has been made, too often have existing approaches over-optimised a single objective to the detriment of others. To overcome this problem, I will highlight how Sparsity and Meta-Learning in their various forms have recently surfaced as powerful algorithmic principles allowing the joint optimisation of those desiderata. I will support this view by discussing existing approaches and opportunities for future work in the intersection of those ideas. Firstly, the proposal of a simple weight reparameterisation scheme for Neural networks, leading to inherently sparse solutions, allowing us to build Continual Learning systems immune to forgetting. Secondly, a probabilistic approach allowing for the direct optimisation of objectives involving both weight and gradient sparsity in Meta-Learning. Finally, a flexible system optimised for forward transfer in Continual Learning built from those components. I will conclude by pointing to various opportunities for future work.

BIOGRAPHY

Jonathan Richard Schwarz is a Senior Research Scientist in Machine Learning at DeepMind and a PhD Candidate at University College London advised by Yee Whye Teh and Peter Latham. As part of his primary goal of Efficient Machine Learning he has made research contributions spanning from Continual & Meta-Learning to Transfer in Reinforcement Learning, Sparsity and recent work on neural data compression. Previously, he spent two years at the Gatsby Computational Neuroscience Unit at UCL, graduated top of his class from the University of Edinburgh and made contributions to climate change and robotics research in Japan and Germany. Finally, Jonathan is passionate about science outreach and education, is the founder and director of Eudaimonious, a charity focused on STEM Education and participates in the Royal Institution's scientific outreach programme.

All are welcome!



In case of questions, please contact Dr Ying WEI at yingwei@cityu.edu.hk, or visit the CS Departmental Seminar Web at <https://www.cs.cityu.edu.hk/news/seminars/>.

