Physical Neuronal Heterogeneity & Few-Shot Learning in Neuromorphic Systems

J. C. Gartside[1*]

[1] Imperial College London
*j.carter-gartside13@imperial.ac.uk

Physical neuromorphic systems are often investigated for reasons of energy efficiency relative to CMOS-based software AI approaches. This is a high challenge to achieve due to the long-term industrial optimisation of CMOS technologies. While excellent and increasingly accelerating progress has been made towards this front, the AI performance (e.g. task accuracy) of physics-based neuromorphic systems often just matches or slightly underperforms vs. software AI neural networks on benchmark tasks. Often, the software networks considered are of relatively modest scale and complexity compared to large, modern neural networks.

In this talk, we will examine an area of AI tasks where software typically struggles - few-shot learning, or learning when training data is highly restricted. We will consider a variety of physical neuromorphic systems and examine experimental evidence that specific bio-inspired neuromorphic approaches can outperform even large modern software neural networks in the highly-technologically relevant few-shot regime, of specific interest to edge-AI use cases where the efficiency of physics-based learning approaches is especially attractive[1,2].

References

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