

STRUCTICITY: Multi-level STRUCTure and plastICITY in large-scale spiking neural networks for event-based sensing

Initiative: NEXT

Ausschreibung: Neuromorphic Computing

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STRUCTICITY: Multi-level STRUCTure and plastICITY in large-scale spiking neural networks for event-based sensing Understanding the brain's exceptional ability to process dynamic, uncertain environments in real-time is a fundamental pursuit of science. On top, it also offers the tantalising but unrealised opportunity to build neuromorphic computers and intelligent machines. However, presently, we only know how to optimise artificial abstractions of brain networks, deep neural networks, and solve narrow tasks such as recognizing objects in an image. Instead we argue for a change in perspective away from goal-oriented engineering towards agnostically solving a broad selection of tasks on the same data. Our main idea is that the synthesis of specific hierarchical structures in large-scale networks and local structures in complex neural dendrites is key to enabling massively parallel processing in brains. We hypothesise that highly local neural plasticity mechanisms within structurally rich networks facilitate learning of multiple tasks. This is because networks primarily adapt to input, delay task-specialisation and form sub-network structures for different tasks. To test our hypothesis, the proposed project aims to implement necessary cross-boundary expertise in neuromorphic engineering, machine learning, and neuroscience with deep competence in efficient, large-scale simulations. Thus, this project takes important steps towards understanding how to build neuromorphic, intelligent computers that adapt to their environment instead of adapting the environment so the computer understands.

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