Computer Architecture underlying Mesoscopic Neurocomputing

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Abstract

Research on brain-machine interfaces reveals that when large populations of broadly tuned neurons are working together, precise computations can be achieved. This leads us to create a new computing model, a design of an interneural computing machine (ICM) that can resolve network computation from a microscopic level (single neurons) to a mesoscopic level (neuromorphic ensembles). ICM mathematically models a machine that mechanically operates on an evolutionary neural network. Operation of ICM is fully determined by a finite set of learning algorithms that constantly change the coupling strength between neuromorphic nodes. Three algorithms, called the seed growth algorithm, the coupling-isometric cliquishness algorithm, and the regenerative prototype algorithm, are proposed to determine a primordial neuromorphic ensembles from the evolutionary neural network. A population dynamics simulation shows that information is well-represented by those neuromorphic ensembles, which defines the concept of mesoscopic neurobits of interneural computing machines.