Readings in Neuroinformatics

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Abstract

It is common knowledge that biological systems perform information processing on very different principles than those normally applied in artificial systems. The brain has evolved to process and evaluate information very quickly in a highly parallel fashion and at the same time, it minimizes the energy consumption to only a few Watts. In comparison, computation in an artificial system costs several orders of magnitude more. A lot of energy is wasted in charging up the wire and not the node itself. On the other hand, around 10'000 transistors are used for one single operation adding further to energy loss. Taking the nervous system as our guide, we developed a so-called neuromorphic system capable of simulating the workings of the nervous system based on its inherent physical laws. We exemplify its strength in retinal computation and adaption and learning. The algorithms are located more locally and distributed over different levels in the system. If there is a change in information in a lower level it will be transferred to a higher level for processing. Thus, a neuromorphic system is capable in self-organizing itself to environmental changes. Such a design is superior to a digital system with regard to efficiency, component degradation and failre. Although these systems still cannot compete with the brain it is nonetheless four orders of magnitudes more efficient than a digital system.

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