# Literature Review on Neuromorphic Computation

As more problems arise with our classical approach of cramming more transistors onto silicon chips, a new strategy to increase computational power is required. There are not many ways to address this problem. One is quantum computing, which has even more issues than the classical approach and is far from being commercially viable. The other is neuromorphic computing which represents a paradigm shift in computing architecture inspired by the human brain's neural networks. It emerged from the desire to harness the brain's ability to process immense amounts of information rapidly and at a negligible energy cost. It consists of artificial neurons and synapses that simulate how our brains process signals. Unlike modern deep learning methodologies, this is not abstract as it is based entirely on hardware. This approach offers several desirable features, including remarkably low energy consumption, immense parallelism, event-driven processing, and exceptional performance for AI tasks.

          Even if the current generation of neuromorphic processors isn't superior to today's supercomputers, they are viable for commercial projects at this early stage of development. For example, Innotera Spiking Neural Processor T1 excels in real-time, low-power processing, making it ideal for applications in edge computing, robotics, and healthcare devices. Akida from Brainchipis designed to accelerate neural networks including convolutional neural networks (CNNs), deep neural networks (DNNs), recurrent neural networks (RNNs), and Vision Transformers (ViTs) directly in hardware, and SynSense company has a whole collection of different chips, one of them is Speck - an ultra-low power neuromorphic processor combined with an event-driven vision sensor on a single chip which excels for some computer vision tasks, that required low latency and energy consumption.

          This results in diverse commercial applications, ranging from bionic prostheses equipped with onboard electronics for signal processing and intuitive response to smart devices featuring speech and gesture recognition. Even drones can benefit from enhanced autopilot capabilities and advanced object recognition.

          However, the current generation of neuromorphic chips encounters several challenges, including the absence of standard benchmarks for performance assessment, limited availability of hardware and software, difficulties in learning and application, and reduced accuracy compared to similar neural networks.

References

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