Real-Time Recognition of Dynamic Hand Postures on a Neuromorphic System

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Abstract : To explore how the brain may recognize objects in its general,accurate and energy-efficient manner, this paper proposes the use of a neuromorphic hardware system formed from a Dynamic Video Sensor~(DVS) silicon retina in concert with the SpiNNaker real-time Spiking Neural Network~(SNN) simulator. As a first step in the exploration on this platform a recognition system for dynamic hand postures is developed, enabling the study of the methods used in the visual pathways of the brain. Inspired by the behaviours of the primary visual cortex, Convolutional Neural Networks (CNNs) are modeled using both linear perceptrons and spiking Leaky Integrate-and-Fire (LIF) neurons. In this study's largest configuration using these approaches, a network of 74,210 neurons and 15,216,512 synapses is created and operated in real-time using 290 SpiNNaker processor cores in parallel and with 93.0% accuracy. A smaller network using only 1/10th of the resources is also created, again operating in real-time, and it is able to recognize the postures with an accuracy of around 86.4% -only 6.6% lower than the much larger system. The recognition rate of the smaller network developed on this neuromorphic system is sufficient for a successful hand posture recognition system, and demonstrates a much-improved cost to performance trade-off in its approach.

Keywords : spiking neural network (SNN), convolutional neural network (CNN), posture recognition, neuromorphic system

Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development

Conference Location : Chicago, United States

Conference Dates : December 12-13, 2020