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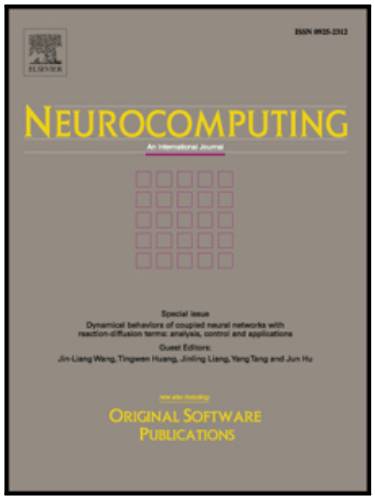

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Deep Neural Networks with Weighted Spikes

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Abstract

Spiking neural networks are being regarded as one of the promising alternative techniques to overcome the high energy costs of artificial neural networks. It is supported by many researches showing that a deep convolutional neural network can be converted into a spiking neural network with near zero accuracy loss. However, the advantage on energy consumption of spiking neural networks comes at a cost of long classification latency due to the use of Poisson-distributed spike trains (rate coding), especially in deep networks. In this paper, we propose to use weighted spikes, which can greatly reduce the latency by assigning a different weight to a spike depending on which time phase it belongs. Experimental results on MNIST, SVHN, CIFAR-10, and CIFAR-100 show that the proposed spiking neural networks with weighted spikes achieve significant reduction in classification latency and number of spikes, which leads to faster and more energy-efficient spiking neural networks than the conventional spiking neural networks with rate coding. We also show that one of the state-of-the-art networks the deep residual network can be converted into spiking neural network without accuracy loss.

Keywords: Spiking neural network, weighted spike, supervised learning

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