Abstract

Neuromorphic hardware is based on neuroscience. It provides great possibilities to mimic higher-level human brain functions. In contemporary neuromorphic hardware, artificial spiking neurons that mimic nerve impulse (spike) generation, the construction of their complex networks,and analogue or digital neuromorphic integrated circuits are of vital importance ~\cite{9620507020140601}. In this thesis, an algorithm implementation of Spiking Neural Network (SNN) and a design of configurable digital neuron is covered. A configurable algorithm of SNN based on Spike Timing Dependent Plasticity (STDP) model is implemented and experiments of different number of digits classification are carried out to help evaluate the result of using the algorithm to recognize hand-written digits from MNIST dataset. A flexible and programmable C code modeling for verification analysis of hardware is implemented. A review and comparison of architectures of present existing neuron models is presented. The classification is set to three main kinds: Leaky Integrate-and-Fire (LIF) neuron models, biologically inspired neuron models and other neuron models. After analyzing, the reviewing results is shown in the form of tables. The design of a flexible digital neuron based on Linear Leak Integrate-and-Fire neuron model is introduced. By combining a state machine and register-transfer level, this hardware-friendly neuron is able to provide two kinds of leakage mode to users. Users can manually set several parameters according to different needs and conditions.

Publication

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