PURDUE INNOVATES | Office of Technology Commercialization

Reconfigurable Spin Switch

Spin switch technology enables low-power, compact hardware neural networks with adjustable weights stored in an underlying CMOS layer for character recognition and potential computer network applications.

Nanomagnets driven by spin currents provide a natural implementation for a neuron and a synapse. Currents allow convenient summation of multiple inputs, while the magnet provides the threshold function. Spin switch is a recently proposed device based on established technology with a transistor-like gain and input-output isolation.

Researchers at Purdue University have developed technology for a hardware neural network implementation using a spin switch (SS) as its basic building block. This allows neural networks to be constructed with purely passive interconnections without intervening clocks or amplifiers. The weights for the neural network are conveniently adjusted through analog voltages that can be stored in a non-volatile manner in an underlying CMOS layer using a floating gate low drop out voltage regulator. The operation of a multilayer SS neural network designed for character recognition is demonstrated using a standard simulation model based on coupled Lanadau-Lifshitz-Gilbert equations, one for each magnet in the network.

Advantages:

-Requires less power than current methods

-Unit size is relatively small

Potential Applications;

-Computer networks

TRL: 3

Intellectual Property:

Provisional-Patent, 2014-01-29, United States | Provisional-Patent, 2014-06-20, United States | Utility Patent, 2015-01-29, United States

Technology ID

2013-DATT-66615

Category

Artificial Intelligence & Machine Learning/Reinforcement & Federated Learning
Semiconductors/Devices & Components
Materials Science & Nanotechnology/Nanomaterials & Nanostructures

Authors

Supriyo Datta

Further information

Parag Vasekar
psvasekar@prf.org

View online

Keywords: Nanomagnets, spin currents, spin switch, hardware neural network, SS neural network, passive interconnections, non-volatile storage, character recognition, Lanadau-Lifshitz-Gilbert equations, low power neural network