Spin-Orbit Torque Induced Spike-Timing Dependent Plasticity

This technology uses a heavy metal/ferromagnetic structure to enable more energy-efficient and reliable online learning by separating signal transmission and programming currents.

Large scale cortical brain simulations on present day super computers have proven highly inefficient with respect to the ultra-high density and energy efficient processing capability of the human brain. In order to harness the remarkable efficacy of the human brain in cognition and perception related tasks, the field of neuromorphic computing attempts to develop computing models inspired by the functionality of the basic building blocks of the human brain. However, nanoscale devices attaining the ultra-high density and low energy consumption of the biological have remained impossible to produce.

Researchers at Purdue University have developed a technology that includes a heavy metal/ferromagnetic heterostructure that employs spin-orbit torque to implement spike-timing-dependent plasticity (STDP) in order to create a reliable operation to online learning. The proposed technology offers the advantage of decoupled spike transmission and programming current paths. Subsequently, this technology decreases redundant power consumption and increases energy efficiency.

Advantages:

-Decoupled spike transmission and programming current paths increases reliability of online learning

-Decreases redundant power consumption and increases energy efficiency

Potential Applications:

-Neuromorphic engineering

-Supercomputers

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Category

Artificial Intelligence & Machine Learning/Reinforcement & Federated Learning
Semiconductors/Devices & Components
Materials Science & Nanotechnology/Advanced Functional Materials

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Related Publications:

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