

Case ID:M15-157P

Published: 2/3/2016

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Method and apparatus to enhance read accuracy in resistive crosspoint array

Traditional Boolean computing methods are reaching their physical limits. Neuromorphic computing—a system engineered to mimic neuro-biological architectures present in the nervous system—has gained great attention as an alternative. Large scale neural networks consist of a massive number of synapses that connect between groups of neurons. This requires a large volume of memory devices, resulting in a tremendous hardware cost. Therefore, it is beneficial to develop more compact synaptic devices using emerging non-volatile memory devices such as resistive cross-point arrays. Unfortunately, the realistic properties of synaptic devices currently available, such as the limited ON/OFF range of resistive devices, could hamper the read accuracy, and thus the computation results.

Researchers at Arizona State University have invented a method to overcome the limited ON/OFF range of resistive devices. Resistive cross-point array architecture is implemented with a dummy column to correct for non-ideal ON/OFF ranges. Ideally, when a synapse is off, the off-state current should be zero. Unfortunately, this only occurs when the ratio between the maximum and minimum conductance (ON/OFF ratio) approaches infinity, which is not feasible in current resistive devices. This technology analyzes current from a dummy column together with the current from a particular synapse to eliminate the effect of the off-state current and artificially bring it to zero.

Potential Applications

- Computing
- Neuromorphic computing
- Non-volatile memory devices

Benefits and Advantages

- Performance –
 - Design of a dummy column which is used for all other columns in order to eliminate the effect of OFF-state conductance on read operation.
 - Use of a dummy column with minimum conductance simultaneously to all other columns for parallel read operation.
 - Improving the array-level computation performance despite the device-level limitations for resistive devices and arrays.
- Low Cost – Able to store large amounts of memory at a lower hardware cost.
- Accuracy – Differentially adding/subtracting the dummy column current to the column of interest for better read accuracy and margin.
- Better security – Provides increased internet security for non-malicious users on social media sites.

- Low cost – Easily incorporated into current website maintenance, with low overhead cost to users.

For more information about the inventor(s) and their research, please see

[Dr. Shimeng Yu's directory webpage](#)

[Dr. Yu Cao's directory webpage](#)

[Dr. Sarma Vrudhula's directory webpage](#)