

Advancing the Arizona State University Knowledge Enterprise

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Inventors

Jae-Sun Seo Shimeng Yu Yu Cao Sarma Vrudhula

Contact

Shen Yan shen.yan@skysonginnovations. com

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 devicelevel 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