

# Neural Network Enhancement for Robustness of RRAM-based Design

RRAM-based crossbars shown in Figure 1 are a promising hardware platform to accelerate computations in neural networks. Before such a crossbar can be used as an accelerator for neural networks, RRAM cells should be programmed to target resistances to represent weights in neural networks. However, this process degrades the valid range of the resistances of RRAM cells from the fresh state, called aging effect. Therefore, after a certain number of programming iterations, the RRAM cells cannot be programmed reliably anymore, affecting the classification accuracy of neural networks negatively.

In neural networks, the weights may have different distributions to achieve the same accuracy. This inherent computation redundancy can be used to reduce the stress on specific and/or overall devices. Figure 2(a) shows the weight distribution after traditional software training. However, weights in the training can actually be adjusted to avoid those values that cause large currents and thus aging effects. Consequently, the weight distribution after modified training can have a different shape as shown in Figure 2(b).

In this master thesis, an algorithm will be developed to examine the shapes of weight distribution in neural networks and the mapping of weights with respect to aging models. Defects of devices after manufacturing will also be investigated and countered by training and weight mapping.

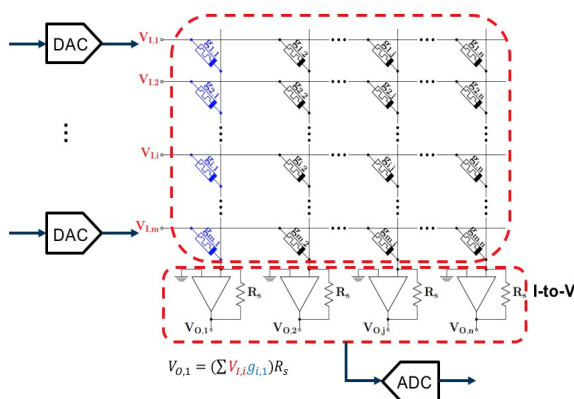


Figure 1: RRAM-based crossbar.

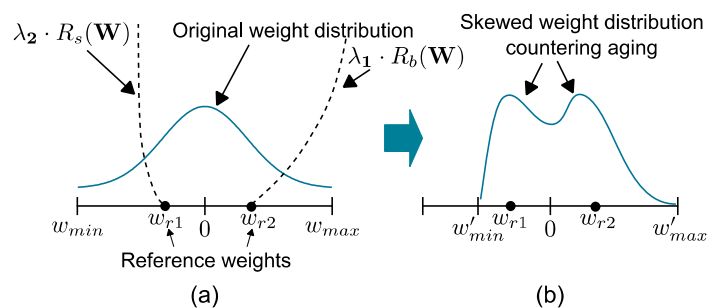


Figure 2: (a) The weight distribution after traditional software training. (b) The weight distribution after modified training considering aging effects.

If you are interested in this topic for master thesis, please contact:

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