In-memory Multibit Multiplication and Accumulation Based on an Automatic Pulse Generation Circuit

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Abstract

Computing in-memory technology is a promising way of solving the "memory wall" problem when processing large-scale data,accelerating data processing, and improving energy efficiency. However, calculations in the analog domain are limited in terms of accuracy and sensitivity to process, voltage, and temperature (PVT) changes. In this study, we proposed a computing in memory multiply-and-accumulate (CIM MAC) circuit which could generate pulses automatically and which endows the time-domain approach with a digital character. The MAC result was reflected by the pulse edge and converted into the final digital output using a dual-edge counter quantization circuit, improving the accuracy of the MAC operation and reducing the difficulty of quantization. The performance of the proposed CIM circuit was evaluated using a 28-nm process. It could achieve 4-bit multiplication without errors with an energy efficiency of 40.34 to 883.37 TOPS/W.

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