Full-Stack Neuromorphic Computing in Delft

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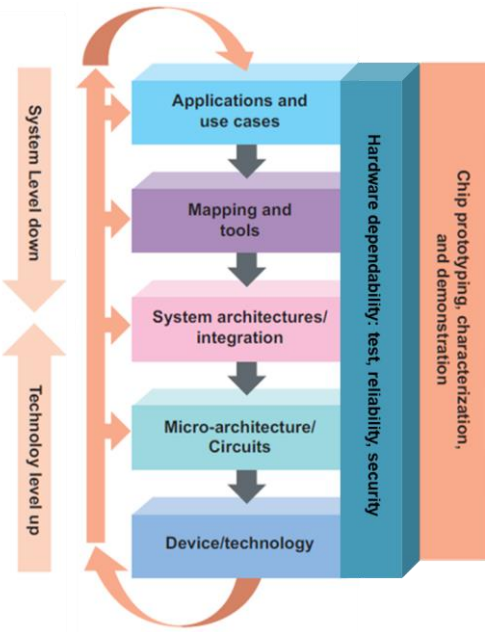
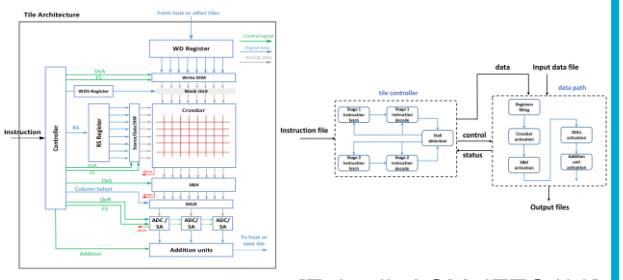
- Invention, design, prototyping and demonstration of disruptive computing
- Focus on energy-constrained edge AI for healthcare and smart environments
- Full stack approach:
  - Devices, micro-architectures and circuits, system architectures, mapping, applications, and dependability

- Awards:
  - DATE, ETS, HPC, HiPEAC, ICCD, ISVLSI, ITC, and others



MNEMOSENE: Tile Architecture and Simulator for Memristor-based Computation-in-memory

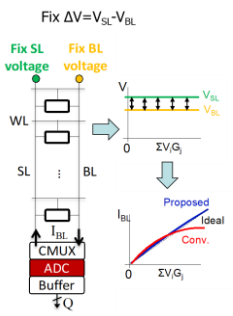
- Generalization of existing CIM tiles for in-memory computing.
- An extensible pipelining approach for digital and analog architectures.
- Definition of a generic in-memory ISA and compiler to obtain maximum flexibility.
- Fully parameterized simulator to execute the new ISA and simulate the CIM tile architecture.

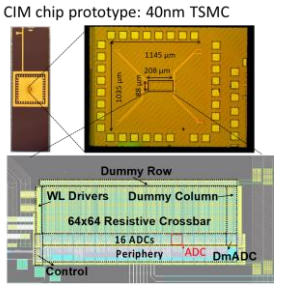


[Zahedi, ACM JETC '22]

A novel ring-oscillator based compact and energy-efficient ADC

- Novel biasing scheme to obtain a linear activation function for accurate A/D conversion.
- Improvement of the area/energy efficiency of the A/D conversion by introducing.
- Novel self-timed technique to address the impact of global design variations, mismatch, and wire delay on computing accuracy.

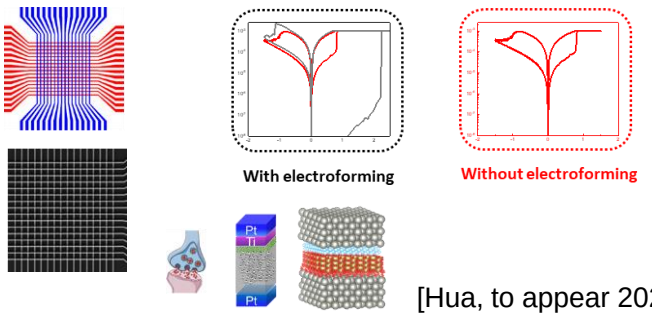




[Singh, AICAS '23]

Novel memristive devices for efficient neuron implementation

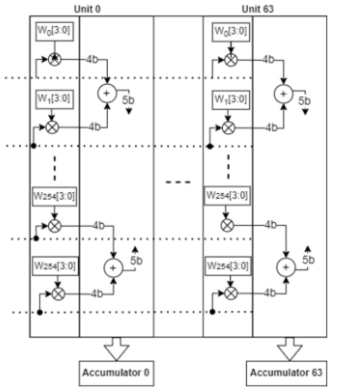
- Volatile & non-volatile memristor fabrication in cleanroom
- Electrical measurements for neuromorphic computing
- Device physics study
- Memristor-based neural networks for various implementations

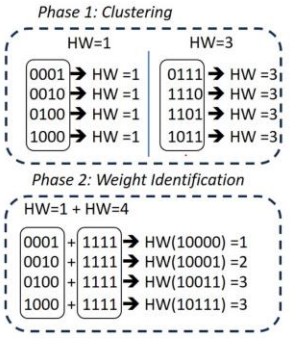


[Hua, to appear 2024]

Extracting Weights of CIM-Based Neural Networks Through Power Analysis of Adder-Trees

- Novel approach to extract weights from digital CIM-based neural networks.
- Implementation of a low-scale variant of the digital CIM macro using 40nm CMOS technology.
- Validation of the proposed attack on the selected digital CIM-based design using gate-level implementation.





[Mir, to appear 2024]

TU Delft Quantum & Computer Engineering

ICOS International Cooperation On Semiconductors