R&D expected impacts

MNEMOSENE targets a scientific and experimental foundation of a fundamental new computing paradigm for data-intensive applications, where a radically new concept of tightly integrated computation-in-memory (CIM) is used and is based on recent and expected achievements in the realization of feasible memristive devices.

MNEMOSENE's work on memristors will create impact on technology and innovation through:

- Transforming computer science into using new highly parallel CIM architectures and technologies.
- Driving silicon technology into using new memristor based devices and circuits.
- Improving computing energy and area efficiency by orders of magnitude.
- Enabling computation of currently unfeasible big data applications, fuelling important societal changes including healthcare, social media, finance and large scientific/engineering experiments.
- Enable novel applications towards low power electronics such as Internet of Things.
- Support breakthrough development in Neuromorphic Computing and Quantum Computing.

Consortium

Coordinator:

TU Delft

Partners:

TU/e Technische Universiteit Eindhoven University of Technology

RWTH AACHEN UNIVERSITY

Inria inventeurs du monde numérique

IBM Research

arm

intelligentsia consultants

ETH zürich

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MNEMOSENE

Computation-in-Memory Architecture based on Resistive Devices

www.mnemosene.eu

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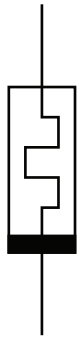
About memristors

Emerging IT applications (e.g. Big Data, Internet of Things) are extremely demanding in terms of storage and computing power, requiring the development of alternative computing architectures and device technologies.

Memristors (two-terminal resistive-switching devices first proposed in the 70s, but whose manufacture become feasible only in recent years), are promising candidates for enabling such novel computing paradigms. They can be used to build both non-volatile storage and information processing and are compatible with CMOS (Complementary Metal Oxide Semiconductor) technology, which they could complement and/or replace.

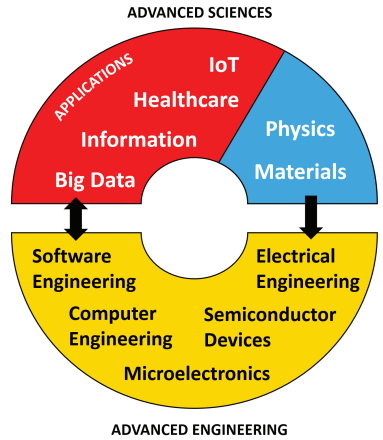


The MNEMOSENE Project

MNEMOSENE is a three-year, EU-funded RIA project with the aim of demonstrating a new architecture concept together with its required programming flow and interface.

The overall goal of the MNEMOSENE project is to develop, design, and demonstrate a computation-in-memory (CIM) architecture based on crossbar topology (CIM architecture) for specific applications using emerging non-volatile resistive switching devices (memristors).

As a highly interdisciplinary R&D project led by TU Delft (Netherlands), the international collaboration betweeen four university and five industry partners will create a synergy in different advanced sciences and cutting edge engineering disciplines, turning the ideas presented in this project to viable basis for a radically new computation paradigm for data intensive applications.



Project objectives

1.Develop new algorithmic solutions for targeted applications for CIM architecture;

2. Develop and design new mapping methods integrated in a framework for efficient compilation of the new algorithms into CIM macro-level operations;

3: Develop a macro-architecture based on the integration of group of CIM tiles, including the overall scheduling of the macro-level operation, data accesses, inter-tile communication and the partitioning of the crossbar;

4: Develop and demonstrate the micro-architecture level of CIM tiles and their models;

5: Design a simulator (based on calibrated models of memristor devices and building blocks) and FPGA emulator for the new architecture (CIM device combined with a conventional CPU) to demonstrate its superiority.

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