

Speeding up artificial intelligence

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A group at Politecnico di Milano has developed an electronic circuit able to solve a system of linear equations in a single operation in the timescale of a few tens of nanoseconds. The performance of this new circuit is superior not only to classical digital computers, but also to quantum computers. It will be soon possible to develop a new generation of computing accelerators that will revolutionize the technology of artificial intelligence.

Solving a system of linear equations means finding the unknown vector X which satisfies the equation $Ax = b$, where A is a matrix of coefficients and b is a known vector. To solve this problem, a conventional digital computer executes an algorithm that takes several operations, thus translating into considerable time and [energy consumption](#).

The new circuit, which has been developed in the frame of the ERC European project Resistive Switch Computing Beyond CMOS (RESCUE), solves systems of linear equations ($Ax=b$) thanks to an innovative method of in-memory computing, where the coefficients of matrix A are stored in a special device called a memristor. The memristor is able to store analogue values, so a memristor matrix can physically map a coefficient matrix A within the circuit, thus strongly accelerating the computation.

The memristor circuit has been tested and validated on a wide set of algebraic problems, such as the ranking of internet websites and the solution of complicated differential equations including the Schrödinger

[equation](#) for the computation of the quantum wavefunction for an electron. All these problems are solved in a single operation.

These results have been published in the *Proceedings of the National Academy of Science*.

More information: Zhong Sun et al. Solving matrix equations in one step with cross-point resistive arrays, *Proceedings of the National Academy of Sciences* (2019). [DOI: 10.1073/pnas.1815682116](https://doi.org/10.1073/pnas.1815682116)

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