Brain Inspired Computing for the post Von-Neumann Era

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In this talk I will introduce the concept of neuromorphic computing, highlighting why it is a promising approach for the post Von-Neumann computing era.
Why is our brain so outstanding and why do we want to mimic it? While computers might be great at carrying out relatively simple tasks at super-fast speeds, the human brain is still much more sophisticated when it comes to advanced tasks like pattern recognition and creative thinking consuming not more than 20 Watts. Among others, these two tasks define the anatomy of AI workloads. In this scenario, deep artificial neural networks (ANN) come into play. Nonetheless, solving AI tasks on today's computers is heavily time and energy inefficient due to the data transfer between the physically separated processing and memory units. This concept is known as Von-Neumann bottleneck. For example, the training of neural networks can range from days to weeks even on the best supercomputers and it can consume up to MWatts.
In the neuromorphic computing paradigm, a promising solution are crossbar arrays of non-volatile analogue memories, also known as memristors. In this architecture the physical separation between memory and processing unit is closed, allowing to implement operation with ANN at potential O(1) time complexity.