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Neuromorphic Computing: Innovations and Future Prospects

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Abstract: *This review aims to provide a comprehensive analysis of neuromorphic computing, a novel brain-inspired paradigm designed to address the limitations of traditional computing architectures, particularly those associated with Moore's law memory wall phenomenon. Neuromorphic computing is an innovative field that emulates the neural structures and processing capabilities of biological brains to enhance computational performance and energy efficiency. This review explores the various projects and methodologies developed in both industry and academia, focusing on digital, analog, and hybrid systems, as well as on-chip and external learning mechanisms. It examines different neuromorphic chip architectures and their implementation of spiking neural networks (SNNs), which facilitate parallel and asynchronous data processing similar to biological neural activity. The review addresses the challenges inherent in current systems, such as memory integration complexities and data exchange inefficiencies. Additionally, it proposes future directions, including the integration of quantum computing principles, to further advance neuromorphic computing technology and overcome existing limitations, aiming to achieve greater performance and energy efficiency*

Keywords: neuromorphic computing architecture; spiking neu-ral networks; non-Von Neumann computer; brain-inspired chip; artificial intelligence; machine learning.

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