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Benchmarking Quantum, Classic, Electronic Optocoupler Neurons and Neural Networks

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Abstract: Quantum computing opens new frontiers for modeling intelligence at the physical level. This paper investigates Quantum Neural Networks (QNNs) not just as tools for classification, but as circuit-based analogues of biological neurons, inspired by classical transistor-based implementations. Starting with reviewing current QNN architectures, and then focusing on quantum perceptrons and variational quantum circuits, in order to have benchmarking performance against external criteria, and to explore how they simulate neuronal operations such as weighted summation and thresholding. The paper analyzes the parallels between quantum gates and transistor logic, proposing hybrid designs that transpose neuron-inspired behaviors into quantum logic circuits. Through simulations and literature review, the authors examine the feasibility of such quantum-neuromorphic architectures and discuss their implications for future hardware-efficient, brain-inspired quantum learning systems. This work aims to bridge neuroscience, electronics, and quantum computing, highlighting a novel pathway for scalable, interpretable quantum AI. Also, the paper compares performance among various neural networks deployed as physical transistors, software running in Tensor Processing Unit (TPUs) and QNNs also analyzing the bridging technologies among them.

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