Quantum Optical Classifier with Superexponential Speedup

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We present a quantum optical pattern recognition method for binary classification tasks. Without direct image reconstruction, it classifies an object in terms of the rate of two-photon coincidences at the output of a Hong-Ou-Mandel interferometer, where both the input and the classifier parameters are encoded into single-photon states. Our method exhibits the same behaviour of a computational neuron of unit depth. Once trained, it shows a constant O(1) complexity in the number of computational operations and photons required by a single classification. This is a superexponential advantage over a classical neuron, that is at least linear in the image resolution. We provide simulations and analytical comparisons with analogous neural network architectures.