Decision Making by Photonics

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ABSTRACT

Modern society is becoming increasingly reliant on artificial intelligence (AI). AI today is based on computer algorithms and digital computing, and suffers from a theoretical limitation known as the von Neumann bottleneck as the design of conventional digital computing devices anticipates the end of Moore's law. Consequently, the utilization of unconventional physical processes and architectures for intelligence, referred to as natural intelligence, is attracting increasing attention. Here we demonstrate a *decision making* capability physically achieved by photonics. Specifically, we experimentally show that the wave-particle duality of single photons can solve the multi-armed bandit problem, which constitutes the foundation of machine learning and decision making. Its theoretical backgrounds and other photonic implementations are also discussed.

Key words: Decision making, Photonic intelligence, Single photon