Quantum reservoir computing on random regular graphs

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Quantum reservoir computing combines the inherent dynamics of many-body quantum systems with classical learning techniques. Notably, this approach differs from variational quantum algorithms on noisy systems, which are susceptible to the well-known barren plateaus phenomenon. Here, we introduce a strongly interacting spin model on random regular graphs as the quantum component, and investigate the interplay of static disorder, graph connectivity, learnability, and memory capacity. We address linear and non-linear tasks such as delayed decision making, logical multitasking, and the reconstruction of entangled states, and discuss optimal learning and memory performance regimes in terms of various encoding schemes, interactions, localization, and the many-body structure of the static Hamiltonian.

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