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Towards quantum advantage with photonic state injection

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We propose a new scheme for near-term photonic quantum device that allows to increase the expressive power of the quantum models beyond what linear optics can do. This scheme relies upon state injection, a measurement-based technique that can produce states that are more controllable, and solve learning tasks that are not believed to be tackled classically. We explain how circuits made of linear optical architectures separated by state injections are keen for experimental implementation. In addition, we give theoretical results on the evolution of the purity of the resulting states, and we discuss how it impacts the distinguishability of the circuit outputs. Finally, we study a computational subroutines of learning algorithms named probability estimation, and we show the state injection scheme we propose may offer a potential quantum advantage in a regime that can be more easily achieved that state-of-the-art adaptive techniques. Our analysis offers new possibilities for near-term advantage that require to tackle fewer experimental difficulties.

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Short summary

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