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Multi-dimensional linear diffusion for image enhancement on a type-II quantum computer.[1] GABRIEL COLBURN, MARK COFFEY, Colorado School of Mines — We describe how multi-dimensional linear diffusion with application to image processing could be carried out on a hybrid classical-quantum computer. By using a hybrid approach, a variety of applications are possible that purely quantum computers are not suited for. Although the speed-up over classical computers is not as high as the latter approach, physical realization may be much sooner. One particular hybrid technique utilizes a lattice of quantum computers with relatively few quantum bits per node. Each node is connected by classical communication channels to its nearest neighbors. Such an architecture is referred to as a Type-II quantum computer. This class of architecture is able to efficiently simulate a variety of partial differential equations and is the platform for which our quantum-lattice-gas-based algorithms have been designed. We present the effective finite difference approximations that yield multi-dimensional linear diffusion, and representative simulation results. Additionally we demonstrate an extension to constrained linear diffusion that provides for nonuniform image smoothing. These methods are particularly relevant to image enhancement tasks.

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