

Convergence: The Promise and Reality of AI & Quantum

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Towards Quantum Acceleration and Augmentation of ML

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Target: General, Flexible, Quantum ML

Acceleration of optimization

Speed up the optimization routines that power classical ML

Linear Systems, SDP and Cone Programs, **Convex Optimization, Matrix Games, Sampling**

Design of “Quantum Native” Learning Algorithms

Generative and supervised learning using quantum heuristics: VQE, QNN

How do we employ these in complex pipelines?
Examples in **GANs, Time Series, Reinforcement Learning.**

Hardware Scaling of Quantum Heuristics

Gain empirical understanding by pushing the scale of hardware experiments.

Possible improvements to circuit pruning, **efficient encodings**, pulse optimization, efficient ansatzes.
(Tradeoff with desirable learning properties?)

Explanatory Theory for Quantum Heuristics

Inspiration from deep learning theory, statistical physics; partial theory to inform heuristic design

Expressivity (2-way separations), Optimization and Parameter Landscape, Generalization