SONDERSEMINAR

Montag, den 22.01.2019 um 10:00 Uhr in Raum 46-576

Quantum Cloud Computing

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Recent years have seen a stunning progress in the control of quantum systems and the scalable manufacturing of semi-conducting quantum hardware. Along with this progress came a focus shift in the study of quantum algorithms giving rise to new hybrid quantum/classical algorithms that can be run on near-term quantum devices without immediate need for fault-tolerance. These algorithms focus on short-depth parameterized circuits and use quantum computation as a subroutine in a larger classical optimization loop. At Rigetti, we build a computing platform targeting such applications via a flexible cloud API. This talk reviews the physics behind the Rigetti Quantum Processor based on super-conducting transmon qubits and their parametrically-driven entangling gate. I introduce Quil, the Quantum Instruction Language, as a programming language abstraction akin to quantum assembler dialects, to enable gate based quantum computations via the cloud API. Finally, I show how the full computing stack can be used to run a hybrid quantum/classical algorithm for unsupervised machine learning on a 19-qubit processor.

References:

- Smith et al., A Practical Quantum Instruction Set Architecture, arXiv:1608.03355
- Didier et al., Analytical modeling of parametrically-modulated transmon qubits, arXiv:1706.06566
- Caldwell et al., Parametrically Activated Entangling Gates Using Transmon Qubits, arXiv:1706.06562
- Reagor et al., Demonstration of Universal Parametric Entangling Gates on a Multi-Qubit Lattice, arXiv:1706.06570
- Otterbach et al., Unsupervised Machine Learning on a Hybrid Quantum Computer, arXiv:1712.05771