Seminar of SFB 910

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Progress toward favorable landscapes in quantum combinatorial optimization

The performance of variational quantum algorithms relies on the success of using quantum and classical computing resources in tandem. In this talk, I explore how these quantum and classical components interrelate. In particular, I focus on algorithms for solving the combinatorial optimization problem MaxCut, and study how the structure of the classical optimization landscape relates to the quantum circuit used to evaluate the MaxCut objective function. In order to analytically characterize the impact of quantum features on the landscape critical point structure, I consider a family of quantum circuit ansätze composed of mutually commuting elements. I identify multiqubit operations as a key resource, and show that overparameterization allows for obtaining favorable landscapes. Namely, I prove that an ansatz from this family containing exponentially many variational parameters yields a landscape free of local optima for generic graphs. However, I further show that these ansätze do not offer superpolynomial advantages over purely classical MaxCut algorithms. I then present a series of numerical experiments illustrating that non-commutativity and entanglement are important features for improving algorithm performance.

For information on how to access the event, please contact: henning.reinken@itp.tu-berlin.de

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