Universität Konstanz

Computer and Information Science

Fachbereichs-kolloqium

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Title

Classical certification of quantum computation and promise problems

Speaker and Title

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https://www.informatik.tu-darmstadt.de/qc/quantum_computing_group/team_qc/team_details_qc_118337.en.jsp

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Time and Room

April 24th (Wednesday)
1:30pm - 3:00pm
ZT 1204 (Data Theatre)

Abstract

Certification of quantum computing components can be crucial for quantum hardware improvements, the calibration of quantum algorithms, and gaining trust in quantum cloud computers. In the series of works, we propose an efficient method for certifying quantum computation in a black-box scenario under the dimension assumption. The certification is guaranteed by structures of promise problems, solution of which demands a larger dimension of classical devices, than their quantum counterpart. Based on such promise problems, we devise a protocol that tests deterministic outcomes of quantum computation for predetermined gate sequences. Quantum gates are certified based on input-output correlations, with no auxiliary systems required. We show that the set of universal gates can be certified. Moreover, we analyze in detail the certification of the S gate, for which the required sample complexity grows inverse linearly with respect to the average gate infidelity parameter. Our approach is first to bridge the gap between strong notions of certification from self-testing and practically highly relevant approaches from quantum system characterization.