



Der Fachbereich Informatik der Johannes Kepler Universität Linz¹ lädt in Zusammenarbeit mit der Österreichischen Gesellschaft für Informatik (ÖGI) zu folgendem Vortrag ein:

Topic: Training Quantum Embedding Kernels on Near-Term Quantum Computers

Presenter: Paul K. Fährmann, MSc

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Date: Friday, June 4th 2021, 10:00

Location: <u>https://jku.zoom.us/j/94257661501?pwd=bzZVY25LV1pBMEtXck43SIZrMUlxQT09</u>

Abstract:

In this work, originating from our winning project at this year's QHACK quantum machine learning hackathon, we have investigated the transfer of classical kernel methods to the realm of quantum computing, with a focus on kernels arising from embedding data into the Hilbert space of a quantum computer, called quantum embedding kernels. Since these are still well defined even under device noise, they are especially suited towards implementations on noisy near-term quantum devices. We take a holistic approach to quantum embedding kernels and address practical issues arising when realizing them noisy near-term quantum devices.

As an important step towards practical applications, we propose to enrich a quantum embedding kernel with variational parameters. These variational parameters can be fitted to a given dataset by increasing the kernel-target alignment, a heuristic connected to the achievable classification accuracy. We further show under which conditions noise from device imperfections influences the predicted

kernel and provide strategies to mitigate these detrimental effects. We also address the influence of finite sampling and derive bounds that provide guarantees on the quality of the kernel matrix. Furthermore, we discuss both numerical experiments and tests on actual quantum hardware.

This is joint work with Thomas Hubregtsen (FUB), David Wierichs (University of Cologne), Elies Gil-Fuster (FUB), Peter-Jan H.S. Derks (FUB) and Johannes Jakob Meyer (FUB)

Short Bio:

Paul K. Faehrmann received his Master's degree in Physics in 2019 from the Free University of Berlin (FUB), Germany (topic: resource-based perspectives on near and long-term quantum computing). He is currently working as a PhD student at the Dahlem Center for Complex Quantum Systems at FUB with Prof. Jens Eisert, addressing topics in quantum information with a focus on quantum simulation and algorithms for near-term quantum devices.

Einladende: Assist.-Prof. Dr. Richard Küng, Univ.-Prof. Dr. Robert Wille Institut für Integrierte Schaltungen Abteilung Integrierter Schaltungs- und Systementwurf

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