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‘Learning Curves of Quantum Kernel Machines’

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Friday, 27 May 2022, 14h00 SAST

ABSTRACT

Recently, a formal link between the theoretical foundations of quantum computing and classical kernel theory was established. Embedding data in quantum states is known to be equivalent to classical feature maps, and subsequent inner products of the resulting quantum states give rise to quantum kernel functions.

However, the learning behaviours and generalisation properties of quantum machine learning algorithms are not well understood. Recent research has shown that many quantum algorithms that are trained with data can be expressed as a classical kernel machine with a kernel function that is evaluated on a quantum computer. This provides an opportunity to repurpose techniques, originally developed for the analysis of classical kernel machines, to improve our understanding of how quantum algorithms learn.

In this talk I will use methods from the theory of statistical mechanics of learning to explain the learning behaviour of stationary quantum kernels, derive their generalisation performance and illustrate these results with theoretical learning curves. Finally, I will present a curated set of theoretical and numerical tools for quantum kernel analysis and design.

BIOGRAPHY

I am a theoretical physicist by training and entrepreneur by choice.

My interests lie in the intersection of quantum computing, machine learning and the life sciences.

I'm constantly looking for new ways to optimise my productivity and am a big believer in open science and open-source software. I therefore try to embed these values and ideas as much as possible in my talks and workshops.

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