PAUL SCHERRER INSTITUT

SCD Colloquium

Friday, October 29, 2021, 11:00, WHGA/001

We have the possibility of a live talk in the Auditorium with live participation.
The number of attendees is limited to 50. Wearing a mask is compulsory.

Please register here: https://doodle.com/poll/bww2g395pzc6p5ri

Zoom participants please join Zoom ID:
https://psich.zoom.us/j/61304195272?pwd=SmViNUk0cTA4djFyTDhHUnlnU1F4UT09
Meeting-ID: 613 0419 5272
Pass code: 992610

Many-body variational state preparation in the age of machine learning and quantum computing

Giuseppe Carleo

Assistant Professor EPFL, Computational Quantum Science Laboratory

In this seminar I will discuss several approaches to the fundamental problem of efficiently preparing many-body quantum states. I will present both classical and quantum algorithms for this task, focusing on the respective advantages and limitations.
In the context of quantum algorithms, I will consider variational states based on parameterised quantum circuits.
I will introduce the concept of Quantum Natural Gradient [1] and its efficient implementation [2] using the Simultaneous Perturbation Stochastic Approximation.
I will also discuss an efficient variational quantum algorithm named “projected – Variational Quantum Dynamics” (p-VQD) realizing an iterative, global projection of the exact time evolution onto the parameterized manifold [3].

In the context of classical algorithms, I will show instead how variational parameterisations based on neural network quantum states [4] can be used to simulate NISQ-scale quantum computers, and show the example of QAOA [5].

[1] James Stokes, Josh Izaac, Nathan Killoran, and Giuseppe Carleo, Quantum 4, 269 (2020)
[2] Julien Gacon, Christa Zoufal, Giuseppe Carleo, and Stefan Woerner, arXiv:2103.09232 (2021)
[3] Stefano Barison, Filippo Vicentini, and Giuseppe Carleo, arXiv:2101.04579 (2021)
[4] Giuseppe Carleo, and Matthias Troyer, Science 355, 602 (2017)
[5] Matija Medvidović, and Giuseppe Carleo, npj Quantum Inf 7, 101 (2021)

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