Fraunhofer IIS - Mikroelektronische und informationstechnische Systemlösungen und Dienstleistungen

The Fraunhofer-Gesellschaft (www.fraunhofer.com) currently operates 76 institutes and research institutions throughout Germany and is the world's leading applied research organization. Around 32 000 employees work with an annual research budget of 3.4 billion euros. The »Quantum Compilation« group at Fraunhofer IIS, part of the »Machine Intelligence« department at our Nuremberg site, is looking for motivated students! Our team members have diverse academic backgrounds from computer science, engineering and physics. Since 2019 our group has delved into cutting-edge topics within the realm of quantum computing, including quantum machine learning, machine learning for quantum compilation, error correction, and quantum-circuit cutting. The master's thesis will be conducted jointly with the »Chair for Quantum Theory« of Prof. Dr. Michael J. Hartmann at Friedrich-Alexander University Erlangen-Nürnberg.

Master's Thesis (m/f/d) – Quantum Circuit Cutting and Quantum Error Correction

City: Nuremberg; Starting date (earliest): At the earliest possible; Remuneration: *

Working field

The field of »Quantum Error Correction« (QEC) is rapidly advancing. It explores encoding fragile quantum states for error detection and correction. Currently proposed methods require significant overhead, making them inaccessible in the near term. »Quantum Circuit Cutting« on the other hand, offers interesting tools aimed at optimal use of available quantum-computing resources by partitioning quantum circuits into smaller components, thus reducing qubit requirements.

In this Master's Thesis, you will explore the potential of combining quantum error correction and circuit cutting. Your main focus will be to explore the interplay between circuit cutting and error correction and (early) fault-tolerant quantum algorithms.

You are interested in quantum computing and would like to further develop your skills? Then have a look at our offer!

What you will do

- You will conduct cutting-edge research on quantum circuit cutting and quantum error correction, guided by an experienced researcher
- You will implement your results in Python
- You will perform experiments to test the developed approaches - first in simulation, later potentially on actual state-of-the-art quantum hardware
- You will write down your findings to constitute your master's thesis, if the results permit, potentially followed up by a publication

Requirements

- You are currently studying physics, computer science, mathematics or a related field
- You have experience with quantum computing, in particular quantum error correction
- You have basic understanding in Python programming, including quantum computing libraries like Qiskit
- You are comfortable communicating in English
- You are able to attend in-person meetings at out site in Nuremberg when necessary, with the option for remote work as well.
- You having experience in quantum information theory or circuit cutting is a definite plus

What we offer

- Flexible working hours
- Open and friendly team work
- Varied tasks with room for creativity
- Exciting seminars and events
- Networking with scientists
- Active contribution in applied research
- Interesting and innovative projects
- Mentoring program »josephine®« for talented female students

We are pleased to offer you the opportunity to write a Master's thesis in collaboration with us on the abovementioned topic. The awarding and execution of the thesis will follow the rules of the university where you are enrolled. After your studies, you have the option of working with us full or part-time.

We value and promote the diversity of our employees' skills and therefore welcome all applications - regardless of age, gender, nationality, ethnic and social origin, religion, ideology, disability, sexual orientation and identity.

Application

Interested? Apply online (https://short.sg/j/51117368) now (PDF: cover letter, CV, transcripts). We look forward to getting to know you!

https://short.sg/j/51117368

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Offer visible until 03/04/25