Fraunhofer IIS - Mikroelektronische und informationstechnische Systemlösungen und Dienstleistungen

Fraunhofer IIS

Das Fraunhofer-Institut für Integrierte Schaltungen IIS in Erlangen ist eine weltweit führende anwendungsorientierte Forschungseinrichtung für mikroelektronische und informationstechnische Systemlösungen und Dienstleistungen. Es ist heute das größte Institut der Fraunhofer-Gesellschaft. Unter anderem mit der maßgeblichen Beteiligung an der Entwicklung der Audiocodierverfahren mp3 und MPEG AAC ist das Fraunhofer IIS weltweit bekannt geworden. In enger Kooperation mit den Auftraggebern betreiben die Wissenschaftler internationale Spitzenforschung in den Forschungsfeldern Audio und Medientechnologien, Bildsysteme, Energiemanagement, IC-Design und Entwurfsautomatisierung, Kommunikationssysteme, Lokalisierung, Medizintechnik, Sensorsysteme, Sicherheitstechnik, Versorgungsketten sowie Zerstörungsfreie Prüfung.

Master’s Thesis (m/f/d) – Quantum Error Correction / Fault-Tolerant Quantum Computing

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

Working field

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 as a joint project with the »Chair for Quantum Theory« at Friedrich-Alexander University Erlangen-Nürnberg, under the supervision of Prof. Dr. Michael J. Hartmann.

Quantum Error Correction (QEC) is a fast-evolving field aimed at achieving large-scale Fault-Tolerant Quantum Computing (FTQC). It focuses on encoding fragile quantum states to detect and correct errors before they affect the information. Current methods have high overhead, making them impractical in the near term. Thus, developing alternative and more efficient approaches is essential.

- You will conduct cutting-edge research on quantum error correction and fault-tolerant quantum computing, guided by an experienced researcher in the field
- You will develop and implement techniques to reduce the overhead of quantum error correction.
  Utilize tools from machine learning and reinforcement learning.
- You will perform experiments to test the developed approaches - first in simulation, later eventually 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 interested in machine learning, mathematical optimization, or similar tools
- 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.

What we offer

- Flexible working hours
- Open and friendly team work
- Varied tasks with room for creativity
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- Interesting and innovative projects

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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

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