FRAUNHOFER-INSTITUT FÜR TECHNO- UND WIRTSCHAFTSMATHEMATIK ITWM

PRESS RELEASE

Develop Quantum Computers and their Applications
Fraunhofer ITWM becomes Part of the DLR QCI-Project QUANT²AI

Quantum computers offer enormous opportunities. With their superior computing power, they have the potential, for example, to solve complex problems in chemical reactions, machine learning or cryptography. To bring them into use more quickly, the German Aerospace Center (DLR) is developing quantum computers, enabling technologies and applications together with partners from industry and research in the DLR Quantum Computing-Initiative (DLR QCI).

The Fraunhofer Institute for Industrial Mathematics ITWM is now also involved in the DLR QCI as a contractor: The partners are pooling their expertise to advance quantum technology in the »QUANT²AI" project, which is supported by the German Federal Ministry for Economic Affairs and Climate Protection.

Although interest in AI methods on quantum hardware for practical applications is steadily increasing, the appropriate algorithms are still in their infancy. With QUANT²AI, DLR QCI and its partners are evaluating the advantages of quantum AIs in a practical way by performing reproducible comparisons. This so-called benchmark enables developers to test their methods in a standardized way and helps users to identify suitable algorithms for their field of application.

Multiplying Benefits of Quantum Technology for AI Systems

QUANT²AI's approach looks at the entire pipeline – from collecting the data to evaluating the results. The team uses both conventional and quantum computers to process the data. But it also optimizes parameters, hyperparameter searches and approximation steps. Since the selection of a suitable machine learning pipeline is based on many requirements, an evaluation method must take all dimensions into account in order to provide a qualified statement in this regard.

The major goal here is to make the complete end-to-end pipeline of quantum AIs comparable, to multiply quantum advantages, to develop a demonstrator as well as to initiate a standardization in the quantum AI environment.

Combined Expertise for a Quantum-Computing Ecosystem

»Our industrial partners bring a unique combination of academic and industrial experience. QUANT²AI thus brings together very different perspectives on quantum computing, Artificial Intelligence and data«, explains QUANT²AI project manager Hans-Martin Rieser from the DLR Institute for AI Security. As subcontractors from Fraunhofer ITWM, CONET Solutions, JoS QUANTUM and Data Cybernetics are also involved in the project.

»During our intensive research in the field of quantum AIs, we noticed the lack of comparability between them. That is why this project is so special: together, we are building a standard for benchmarking here – an important step forward for the whole and our own research«, describes Dr. Pascal Halffmann, project manager at Fraunhofer ITWM. In the future, the departments »Financial Mathematics« and »Image Processing« as well as the division »High Performance Computing« will be part of the cooperation.

A doctoral student from the DLR Institute for AI Security is also working on the coding of classical data on quantum computers as part of the DLR Quantum Fellowship Program of the DLR QCI. The research results can then be incorporated into the preprocessing steps of QUANT²AI.

Benefits for Research, Industry and Ecosystem

Above all, application projects that will use quantum AI in the future will benefit from the project. But the partners also gain knowledge and experience for the future industrial use of quantum machine learning. Likewise, the project partners intend to market the research results in new products and services. In doing so, they will provide industry, business, and research with access to quantum-accelerated computing methods.

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»We also like DLR QCI's motivation as a client to support the establishment of a quantum computing ecosystem. This helps us, the Fraunhofer ITWM, but also our partners in the consortium to establish themselves as providers of quantum computing expertise«, Halffmann affirms.

Visuals

The Project Partners at the Kick-off

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About the Fraunhofer Institute for Industrial Mathematics ITWM

The Fraunhofer Institute for Industrial Mathematics ITWM in Kaiserslautern is one of the largest research institutes for industrial mathematics worldwide. We see our task in further developing mathematics as a key technology and providing innovative impetus. Our focus is on the implementation of mathematical methods and technology in application projects and their further development in research projects. The close cooperation with partners from industry guarantees the high practical relevance of our work.

Their integral components are consulting, implementation and support in the application of high-performance computer technology and the provision of tailor-made software solutions. Our various competencies address a wide range of customers: automotive industry, mechanical engineering, textile industry, energy and finance. This also benefits from our good networking, for example in the High performance center "Simulation- and software-based innovation".