Fraunhofer IPA

Fraunhofer Institute for Manufacturing Engineering and Automation IPA

Quantum Computing at Fraunhofer IPA

Source: DP/Adobestock

We focus on method-driven research in the fields of quantum machine learning (QML) and quantum optimization. The core application domains include but are not limited to manufacturing and process industry. We develop methods that are implemented in state-of-the-art NISQ hardware. Our mission is to advance the current state of the technology while preparing the industry for the emerging quantum computing disruption. Fraunhofer IPA is part of the "Fraunhofer Kompetenzzentrum Quantencomputing Baden-Württemberg" that, in collaboration with IBM, provides access to the first commercial quantum computer in Germany. The following provides an overview of our current projects.

For more information, see https://www.ipa.fraunhofer.de/quantencomputing

Source: suebsiri/Adobestock

AutoQML

Automated machine learning (AutoML) aims to make AI-solutions accessible for non-experts in machine learning. The project *AutoQML* extends this idea to quantum-computing-based machine learning algorithms to enable the industry to access state-of-the-art QML resources such as kernel methods and quantum neural networks. The developed methods are benchmarked on use-cases from industry partners from the domains of manufacturing and automotive.

AQUAS

The goal of *AQUAS* is to simulate the catalysis of electrolysers with quantum computers. These simulations are crucial for material discovery and process analysis to increase the efficiency of hydrogen production. Within the project, Fraunhofer IPA investigates regression based QML algorithms to complement these simulations by constructing surrogate models.

H2Giga – DEGRAD-EL3-Q

In *DEGRAD-EL3-Q*, we investigate how quantum computing methods can be used to analyze the longevity of electrolysers. The project is part of the Leitprojekt H2Giga that has the goal of advancing the industrial manufacturing process of electrolysers. We research how quantum neural networks can solve differential equations and how quantum computing helps to simulate the chemical processes causing the degradation in electrolyzes.

SEQUOIA End-to-End

SEQUOIA End-to-End aims to make the existing constraints across the entire quantum software development process transparent. At Fraunhofer IPA, we focus on the automated construction and evaluation of suitable encodings for conventional data on quantum computers (feature maps) and investigate use cases from the areas of production and verification of neural networks.

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