

PRESS RELEASE

Cambridge, United Kingdom
Thursday, July 22 2021

CAMBRIDGE QUANTUM
algorithm solves optimisation
problems significantly faster,
outperforming existing
quantum methods.



A NOVEL COMBINATORIAL OPTIMISATION ALGORITHM SETS a new quantum computing standard at the heart of the modern economy

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In a development that is likely to set a new industry standard, scientists at Cambridge Quantum ([CQ](#)) have developed a new algorithm for solving combinatorial optimisation problems that are widespread in business and industry, such as travelling salesman, vehicle routing or job shop scheduling, using near-term quantum computers.

Mathematical conundrums like these lie at the heart of a vast range of real-world optimisation challenges such as designing manufacturing processes, filling delivery trucks or routing passenger jets. As the level of automation in modern global businesses increases year over year, optimisation algorithms running on even the most powerful classical computers are forced to trade accuracy for speed.

In this [paper](#) published on the pre-print repository arXiv, CQ scientists introduce the Filtering Variational Quantum Eigensolver (F-VQE) to make combinatorial optimisation more efficient. Using the Honeywell System Model H1 quantum computer, the new approach outperformed existing “gold standard” algorithms such as the Quantum Approximate Optimisation Algorithm (QAOA) and the original VQE, reaching a good solution 10 to 100 times faster.

The paper has been authored by CQ’s research team comprising Michael Lubasch, Ph.D., David Amaro, Ph.D., Carlo Modica, Ph.D., Matthias Rosenkranz, Ph.D., and Marcello Benedetti, Ph.D.. The scientists are part of CQ’s Machine Learning and Quantum Algorithms team headed by Dr. Mattia Fiorentini.

F-VQE leverages a method published in this [paper](#) by CQ in September 2020, which demonstrated how a quantum circuit can be decomposed into smaller circuits and run using fewer qubits without losing quantum advantage. As a result, a 23-qubit problem was solved by using only up to 6 hardware qubits at time. CQ’s scientists also demonstrated that the new approach is highly adaptable for use



F-VQE COULD HAVE A TRANSFORMATIVE IMPACT, HELPING to solve previously intractable problems across business and industry.

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with noisy intermediate-scale quantum (NISQ) era machines. These advancements increase the scale of the optimisation problems that are within reach of today's NISQ computers.

“Our scientists are honing in on a range of workable methods for today's quantum computers. We want enterprises and governments to achieve quantum advantage for general purpose tasks more quickly, and our experience of working with large industrial partners facilitates a deep understanding of the needs of practitioners today.” said Fiorentini. “F-VQE has distinct advantages over previous quantum algorithms: it finds good candidate solutions faster and uses quantum hardware much more efficiently. F-VQE could have a transformative impact, helping to solve previously intractable problems across business and industry.”

Ilyas Khan, CEO of CQ, said, “Our team of scientists is relentlessly focused on closing the gap between the real-world limits of classical computation and the quantum advantage that will be available in the NISQ era. They are establishing new standards in quantum computing and their research will inspire rapid further progress.”

Tony Uttley, President of Honeywell Quantum Solutions, said, “This project illustrates the exciting advances occurring in quantum computing. By developing algorithms that do more with fewer qubits and running them on the best hardware possible, we are making significant progress toward solving real-world problems sooner than expected.”



ABOUT CAMBRIDGE QUANTUM

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We set out our vision to positively transform the world using the power of quantum computing back in 2014. Today, we are recognised as one of the foremost quantum computing companies, delivering science-led, enterprise-driven solutions to tackle hard problems across a diverse range of industries.

Cambridge Quantum designs, engineers and deploys algorithms and enterprise application libraries, translating cutting-edge research into industry leading technologies through a product-centric focus. Tket, our hardware-agnostic software development platform, and other technologies are currently utilised by an expansive and ever-growing user base.

The team at Cambridge Quantum has been developing the theoretical foundations of quantum computing for over 25 years, forging ahead with breakthroughs in the fields of quantum chemistry, quantum artificial intelligence, quantum cybersecurity and quantum algorithms.

At present, we have the deepest roster of researchers, developers and engineers, working to democratise quantum computation and realise the benefits for the greatest possible number of people.

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