OpenFermion practice tool for quantum computer coding

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Credit: Leiden Institute of Physics

In a global effort, researchers are working toward quantum computers. In the meantime, they have to learn how to write code for these devices, which are fundamentally different from conventional computers. A collaboration of scientists led by Google, and including physicists from Leiden University and TU Delft, have developed a practice tool for chemists called OpenFermion.

Companies and universities around the world are working hard on developing a quantum computer. Instead of a collection of conventional bits, which can take on two values, a quantum computer is a collection of linked qubits, which entangle to process a much larger set of information. For each extra qubit added to the quantum computer, its

power compared to a regular computer doubles. This exponential increase makes even a relatively small quantum computer able to solve problems that are impossible for conventional computers. This goes only for specific problems, such as decryption, modelling molecules for medicine, or designing new catalysts for cleaner fuel burning.

Software

To actually make use of quantum computers, we also need software. And while most scientists know how to write code for ordinary computers, they are completely new to the quantum coding scene. To let the community ease into this new discipline, tools such as Project Q, quantumsim, qHiPSTER, QISKIT, Q#, and Liquid have already been developed for scientists to practice coding on simulated quantum computers and small real devices.

OpenFermion

A collaboration of scientists led by Google, and including Ph.D. students Tom O'Brien and Mark Steudtner from the groups of Prof. Carlo Beenakker and Stephanie Wehner, have now launched a software tool specifically for chemistry research: OpenFermion. On the one hand, it supports chemists towards writing quantum code to simulate complicated chemistry, for example new medicine or catalyst molecules. On the other hand, it allows coding experts to work on a chemical problem even though they have no background in that field.

In an accompanying paper, the collaboration provides examples of quantum code and elaborates on their open source philosophy.

Provided by Leiden Institute of Physics