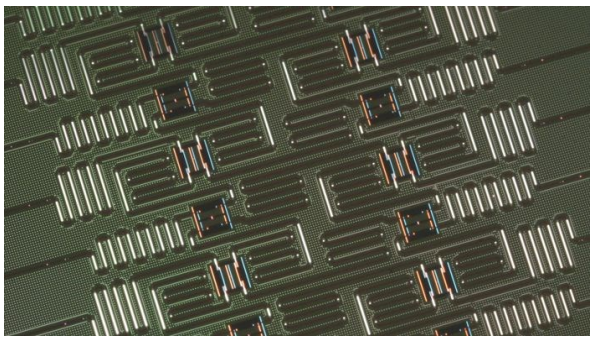
When Sherlock Holmes enters the quantum realm

Algorithms that pit fraudster against detective find a home in quantum computers.



A quantum-computing processor could help to run a pair of neural networks that are pitted against each other. Credit: IBM Research

In a powerful machine-learning technique that has attracted widespread attention, two algorithms compete against each other, one trying to forge data that look real, and the other playing detective, trying to tell fact from fiction. In this method, called generative adversarial learning, the forger rapidly learns how to fool the sleuth.

Seth Lloyd at the Massachusetts Institute of Technology in Cambridge and Christian Weedbrook at Xanadu in Toronto, Canada, have now devised a version of adversarial learning that could run on quantum computers, which are now under development. Whereas classical computers encode data as binary bits that take on a value of either 0 or 1, quantum computers are based on qubits, which can persist in the 0 and 1 states simultaneously. The team's technique can be applied to classical data but is expected to be exponentially faster when applied to quantum data.

If small quantum computers succeed at handling the new technique, it could show that they can perform tasks an ordinary computer cannot, the authors say — supplying evidence for 'quantum supremacy'.

Source:
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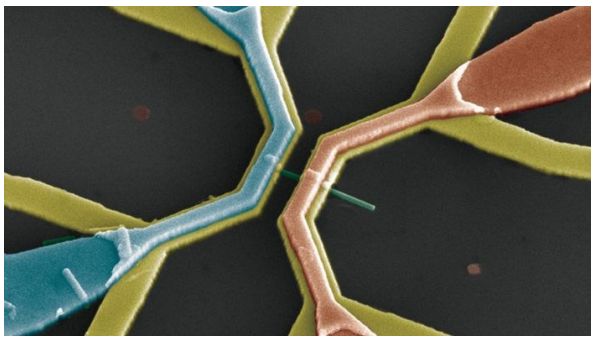
Minuscule heat engine brings power to the nano-world

Device harnesses a 'quantum dot' to produce electric power with high efficiency.



A nanoscale heat engine, shown in false colour, includes a nanowire (green), metallic elements (yellow), a heater (red) and a cold element (blue). Credit: M. Josefsson et al./Nature Nanotechnol

A nanometre-scale engine without any moving parts can convert heat into electricity with an efficiency close to the limit dictated by thermodynamics.

Heat engines harness the flow of heat from a hot place to a cooler one to do work. Internal combustion engines, for example, often exploit the expansion of hot gases to drive pistons. However, heat engines with moving parts are impractical for nanoscale applications.

To make a nanoscale heat engine, Heiner Linke and his colleagues at Lund University in Sweden embedded segments of semiconductor in a nanowire made from a different semiconductor, creating a system called a quantum dot. Electrons were driven between the hot and cold metallic contacts, generating a small amount of electric power. The engine operated at efficiencies on a par with conventional heat engines.

Such devices could be used to cool computer chips or harvest heat energy on quantum scales, the authors write.

Source:
Nature Nanotechnology (2018)