AI changing the way scientists carry out experiments

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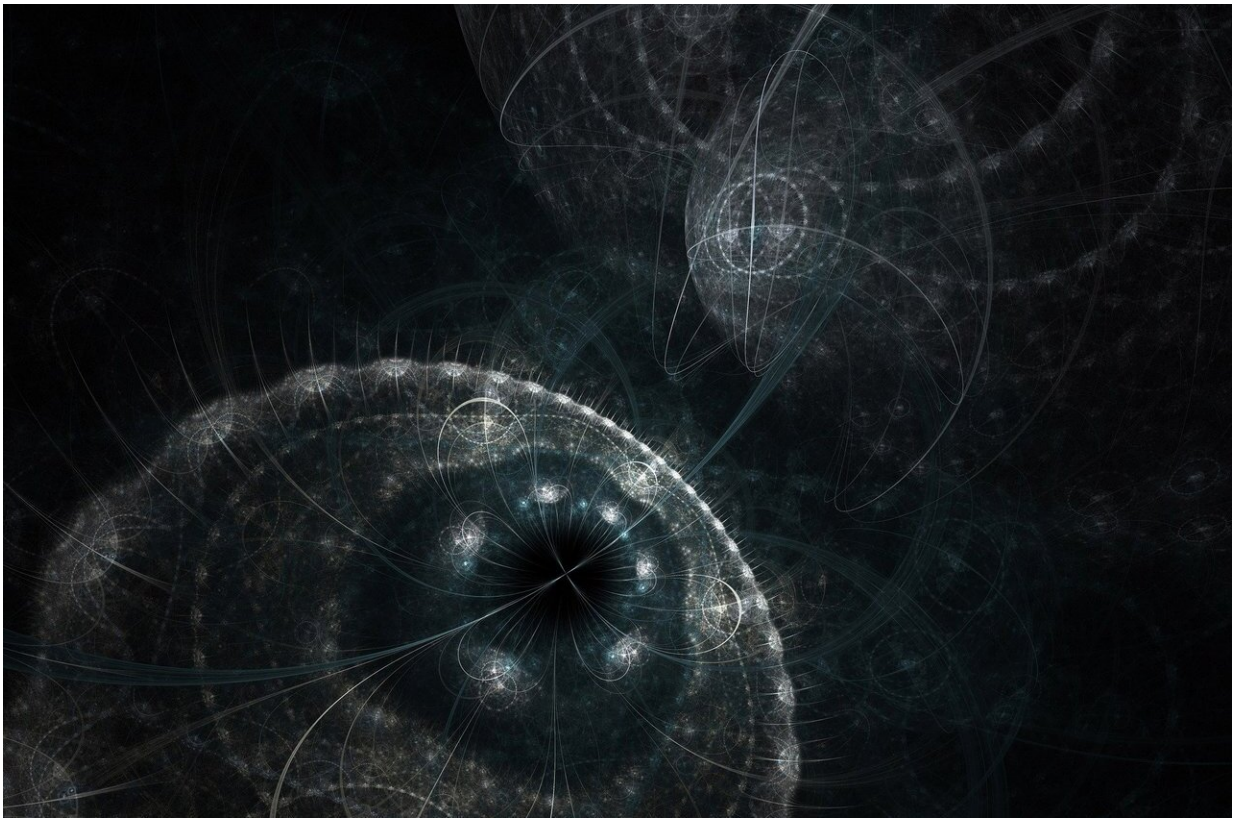

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There's plenty of speculation about what artificial intelligence, or AI, will look like in the future, but researchers from The Australian National University (ANU) are already harnessing its power.

The group from the ANU Department of Quantum Science has been experimenting with trapping atoms at very cold temperatures, in their efforts to build a quantum communication network.

Now they've developed an artificial neural network with AI to help them run their experiments. Based loosely on the human brain, neural networks allow computers to "learn" to perform tasks.

"We use AI to control a large number of inputs to our experiment—the different laser and magnetic field settings—to seek out the best possible experimental conditions," said Dr. Geoff Campbell, post-doctoral fellow at the Centre for Quantum Computation and Communication Technology.

"Because we have so many inputs we can only make educated guesses based on our understanding of what works best, but the AI is better at it than we are."

Cold atoms are an important part of new technology like precision sensors and atomic clocks.

This latest research has demonstrated the potential for AI to optimise cold atomic systems. The solution found by the AI can trap twice as many cold atoms in half the time.

"The AI in our experiment found a solution that is highly effective and defies our intuition. One hundred students working for 100 years would probably never find it," said Associate Professor Ben Buchler.

"Our main research focus is to develop a quantum repeater, a device that can be used to send quantum information over long distances. For that to work, we need to trap as many cold atoms in it as possible. The difficulty is that it's almost impossible to build a complete model of how the atoms

interact with each other, so we need to optimise the experiment by trial and error. The AI lets us do that more effectively."

While this AI was used for a specific task, the researchers are confident it could have much broader applications.

"AI is being used in an ever-increasing number of roles, from optimising the performance of our mobile devices to large-scale data analysis," said Professor Lam.

"It's only going to become more commonplace as it gets developed into a general tool that can free up scientists from tedious optimisation of experimental settings in the lab."

The team believe the program could be used to improve a variety of experiments with a lot of input parameters, not just in the quantum information field.

Looking beyond pure research, they say it could also have a big impact on industrial and manufacturing processes by increasing efficiency and reducing cost.

"This is an example of a bigger trend where AI is becoming less exotic and soon will be seen as one more tool that the scientific community can use," said Professor Lam.

Provided by Australian National University

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