Five reasons quantum computing is the future for traders

by Dan Butcher (http://news.efinancialcareers.com/us-en/en/author/dbutcher/) About a day ago

Quantum computing is the wave of the future in financial services.

Quantum computers are the wave of the future in trading and investment management, and savvy bankers and quantitative hedge fund professionals are already using them to solve some of the hardest problems in financial services.

Presenting at the Trading Show conference in New York last week, Marcos Lopez de Prado, senior managing director and manager of several multibillion-dollar internal funds at Guggenheim Partners, defined quantum computing (QC) as algorithms and systems that apply physics and quantum phenomena to the solution of complex mathematical problems. He noted that deterministic computers (DCs) – i.e. the ones that most of us use on a daily basis – cannot efficiently simulate a probabilistic system like the financial markets, but QC can.

Here are five reasons that quantum computing represents the future for investment managers, research analysts and traders on the buy-side and the sell-side, according to Lopez de Prado.

1. Quantum computing can help traders, analysts and their firms overcome financial research challenges

Academia lacks labs, only have the markets – finance is not like the empirical sciences, because academics cannot repeat experiments or test theories under controlled conditions.

Most financial models are too simplistic and/or the assumptions behind them are unrealistic. Complex systems such as the markets are better analyzed using sophisticated math.

In addition, multiple testing is pervasive, and there is no true verification of financial models. Thus, most claimed research findings in financial economics are likely false, according to Professor Campbell Harvey, the president of the American Finance Association.

For finance to serve society, it needs to evolve beyond "simple toy models," as Lopez de Prado put it.

Just as modern physics cannot advance without facilities like the Large Hadron Collider (LHC), a useful finance that takes into consideration the true randomness and complexity of the markets requires machinery that is up to the task, Lopez de Prado said.

2. Instead of a simple either/or dichotomy, QC evaluates all possible solutions simultaneously

DCs process information as a binary digital system – either 0 or 1 – whereas QCs rely on qubits, which are memory elements that may hold a linear superposition of both states – 0 and 1 – known as parallelism. That allows them to evaluate and store all feasible solutions simultaneously, Lopez de Prado said. Hence, QCs typically require an exponentially smaller number of operations to reach a solution, meaning they're much faster.

3. QCs treat the universe as a computing device

Or put another way, QCs use physics to solve mathematical problems.

Lopez de Prado said that nature solves hard mathematical problems all the time, instantly, for free.

In order to keep external disturbances to a minimum, the 1000-qubit D-Wave 2X quantum computer (http://www.dwavesys.com/quantum-computing) is cooled to 15 mK – about 180 times colder than interstellar space – and operates in a near vacuum shielded from electromagnetic fields.

"This makes the D-Wave machine one of the coolest things in the galaxy … quite literally!" Lopez de Prado said.

4. QCs make financial problems previously deemed impossible to solve manageable

Many financial problems require a number of calculations that greatly exceed the capabilities of the fastest supercomputers, Lopez de Prado said. For example:

- Dynamic portfolio optimization to compute an optimal trajectory for its underlying holdings.

"Better portfolios means less rebalancing and cost," Lopez de Prado said. "It would also starve high-frequency algos."

- Scenario analysis

– Often investors would like to evaluate the distribution of outcomes under an extremely large number of scenarios, generated at random.

"Current approaches, like copulas, are too unrealistic or restrictive," Lopez de Prado said.

- Option pricing

"Some complex derivatives are path-dependent." Lopez de Prado said. "Evaluating a large number of paths can be computationally expensive."

- Clustering algorithms

Lopez de Prado said that QCs can complete a brute-force search over an unfathomably large number of combinations. Good clustering methods have applications for risk management and regression analysis.

"Efficient clustering methods have been shown to boost out-of-sample Sharpe ratios substantially, compared to standard mean-variance methods," Lopez de Prado said.

5. The relevance for investment managers, analysts and traders

DCs are deterministic machines, hence they are ill-equipped to model stochastic – in laymen's terms, random and unpredictable – systems such as financial markets.

DCs simulate random variables. In contrast, QCs operate with random variables.

If your head is spinning, don't worry. The first rule of quantum mechanics is: "If you think you understand quantum mechanics, then you don't understand quantum mechanics."

The bottom line?

"QCs are better suited than DCs to solve financial problems," Lopez de Prado said.

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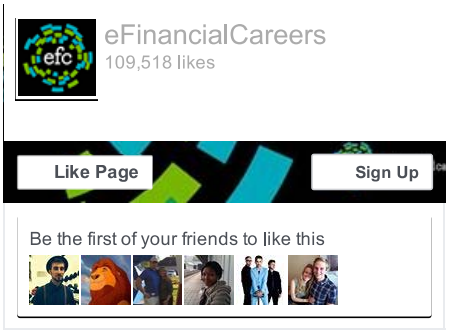

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