



The Missing Half: Why AI Needs Quantum to Solve Finance Problems

David Dentelski · Chief Quantum Scientist

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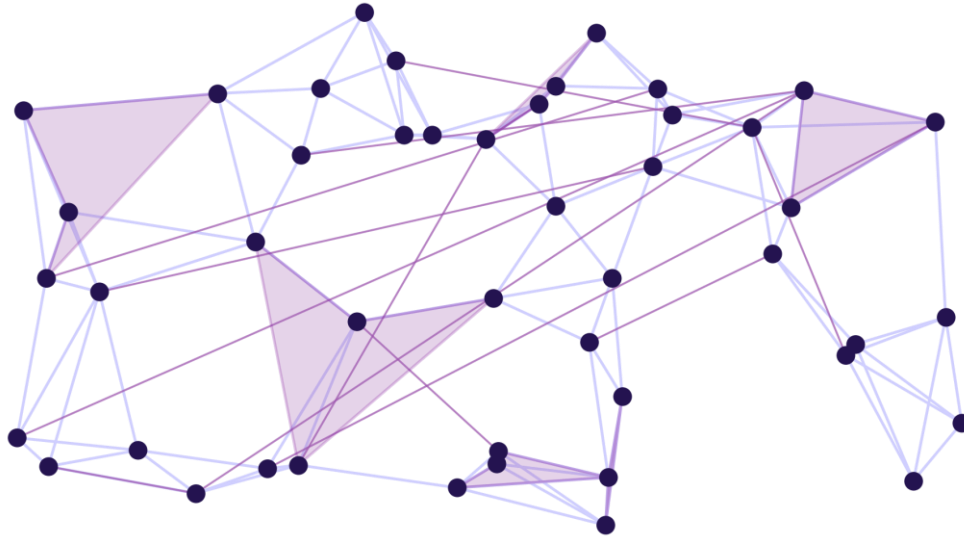


BACKGROUND

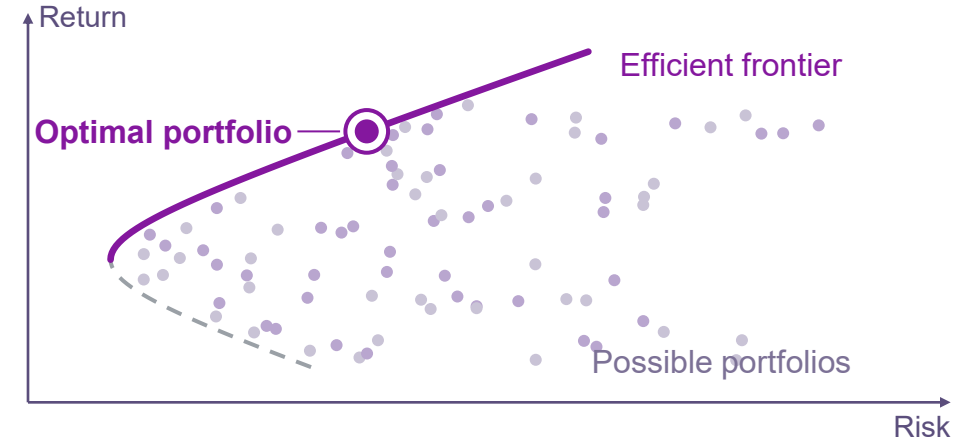
- **BSc in Mathematics and Physics**
Bar-Ilan University
- **MSc in Physics**
Bar-Ilan University
- **PhD in Theoretical Physics, Condensed Matter**
Bar-Ilan University
- **Quantum Error Correction researcher**
Quantum Source
- **Chief Quantum Scientist**
Qlerate



The problem: combinatorial, high-order, correlated



- A stock: hold or not
- Two stocks that move together
- Three stocks that fall together

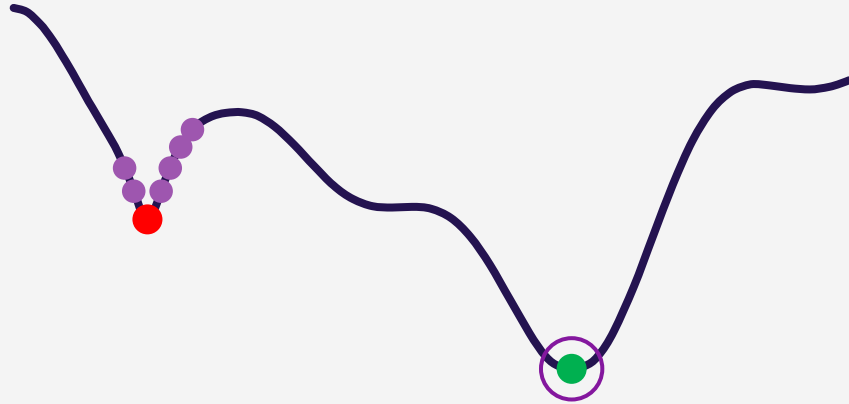


Possible portfolios from S&P 500

$$2^{500} \approx 10^{150}$$

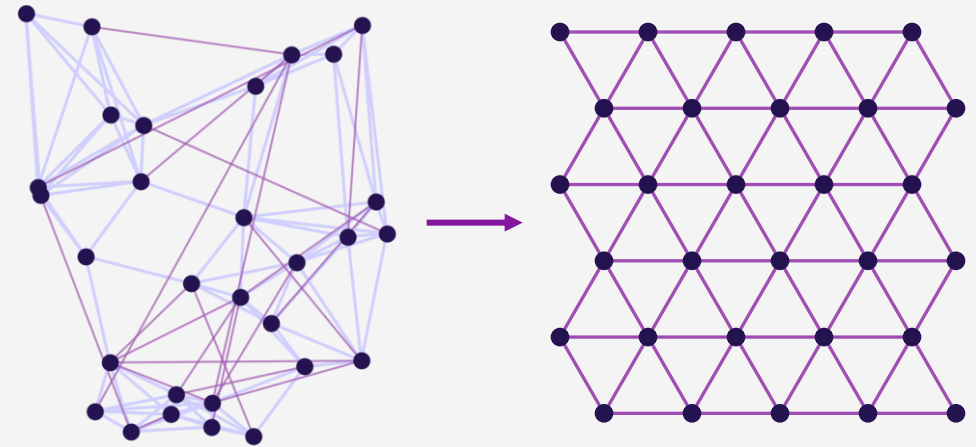
AI: bad at search, good at representation

WEAK



Does not know how to search the domain

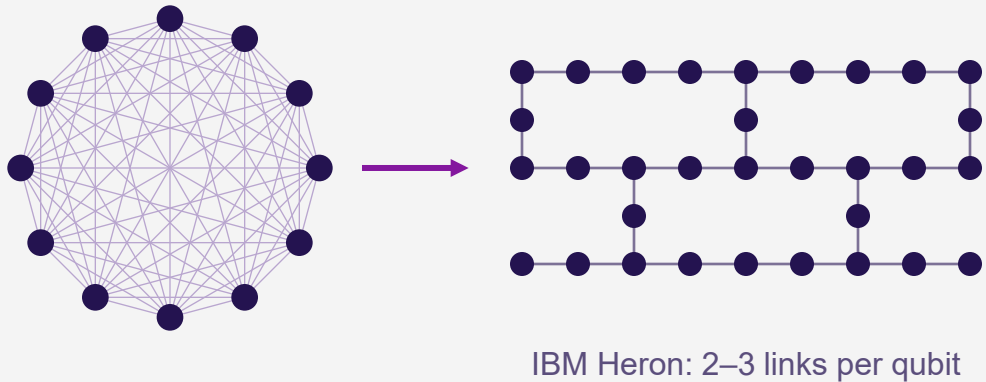
STRONG



Projects the problem into a better space

Quantum: bad at representation, good at search

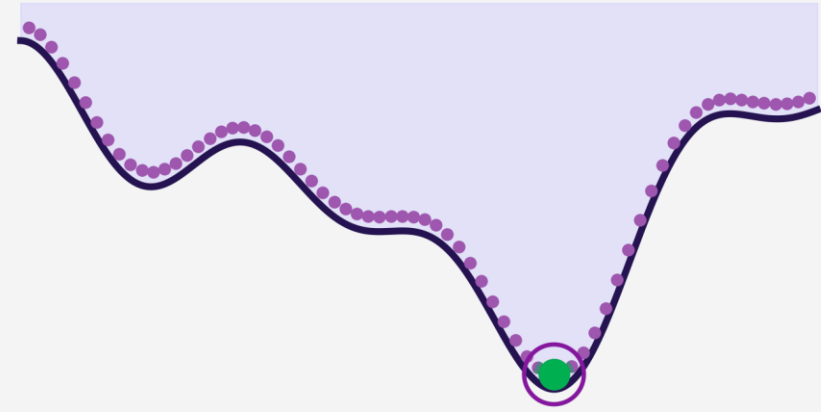
WEAK



Cannot take the problem as it is

It must arrive prepared, with the correct connectivity and mathematical structure

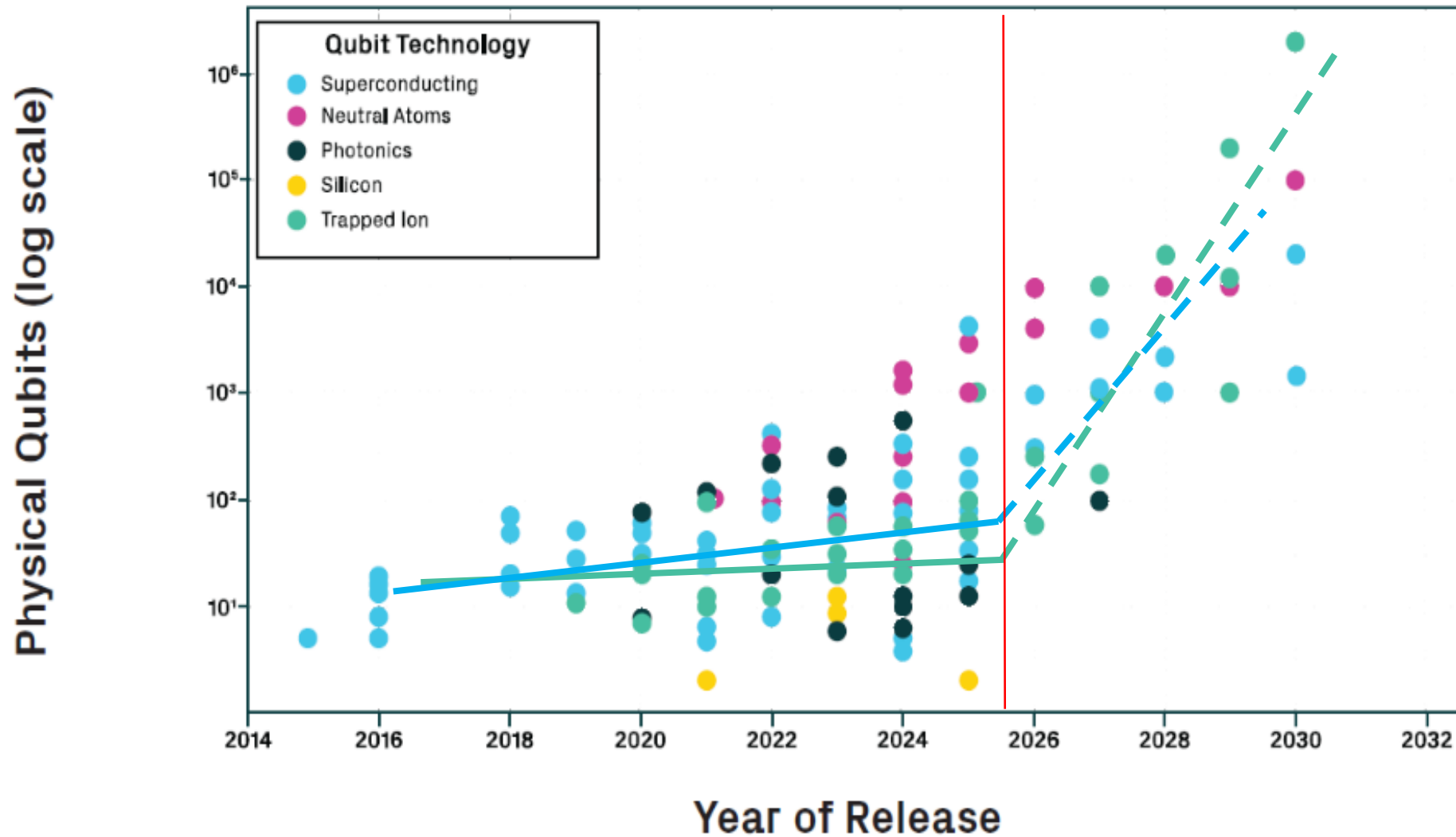
STRONG



Superposition: the whole domain at once

Constraints and correlations stay inside the search.

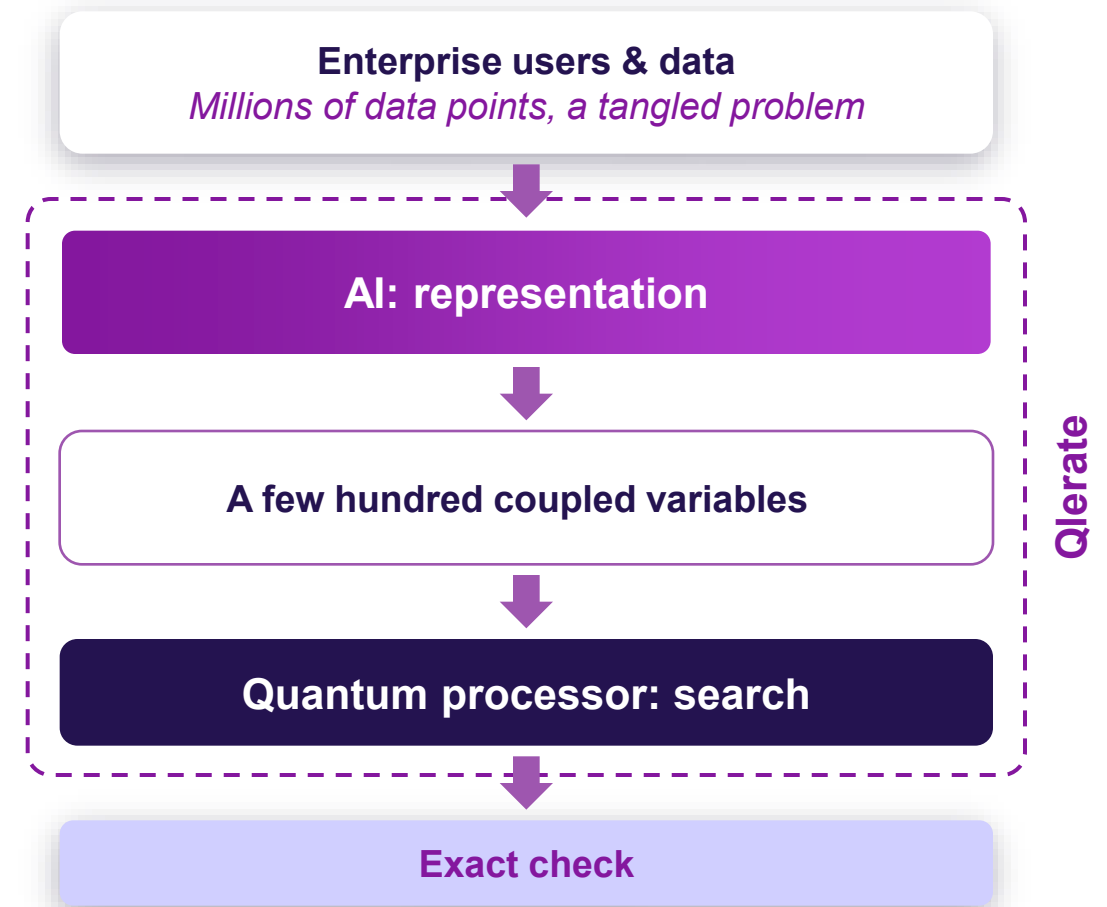
Physical Qubits vs Year of Release



Combine them:

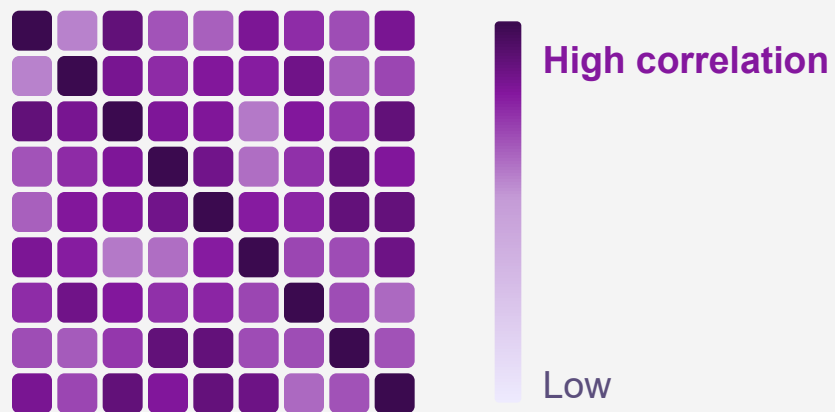
Each one's weakness is the other's strength

	AI	Quantum processor
Many variables	STRONG	WEAK
Represent the problem	STRONG	WEAK
Search	WEAK	STRONG



Quality and Speed

A · PORTFOLIO: HIGHLY CORRELATED DATA



$$\max_x \underbrace{\mu^\top x}_{\text{Gain}} - \underbrace{\lambda x^\top \Sigma x}_{\text{Risk}} \quad \text{s.t.} \quad \underbrace{\sum_i x_i}_{\text{Assets}} = K$$

Many assets, every pair correlated

B · FRAUD RINGS: SPEED



Nodes are accounts, edges are transactions. We are looking for cycles in the graph.
D-Wave anneals in microseconds.

The Data Gateway of the Quantum Era

Turns enterprise problems into quantum-ready form

