

Industrial applications of Quantum Computing

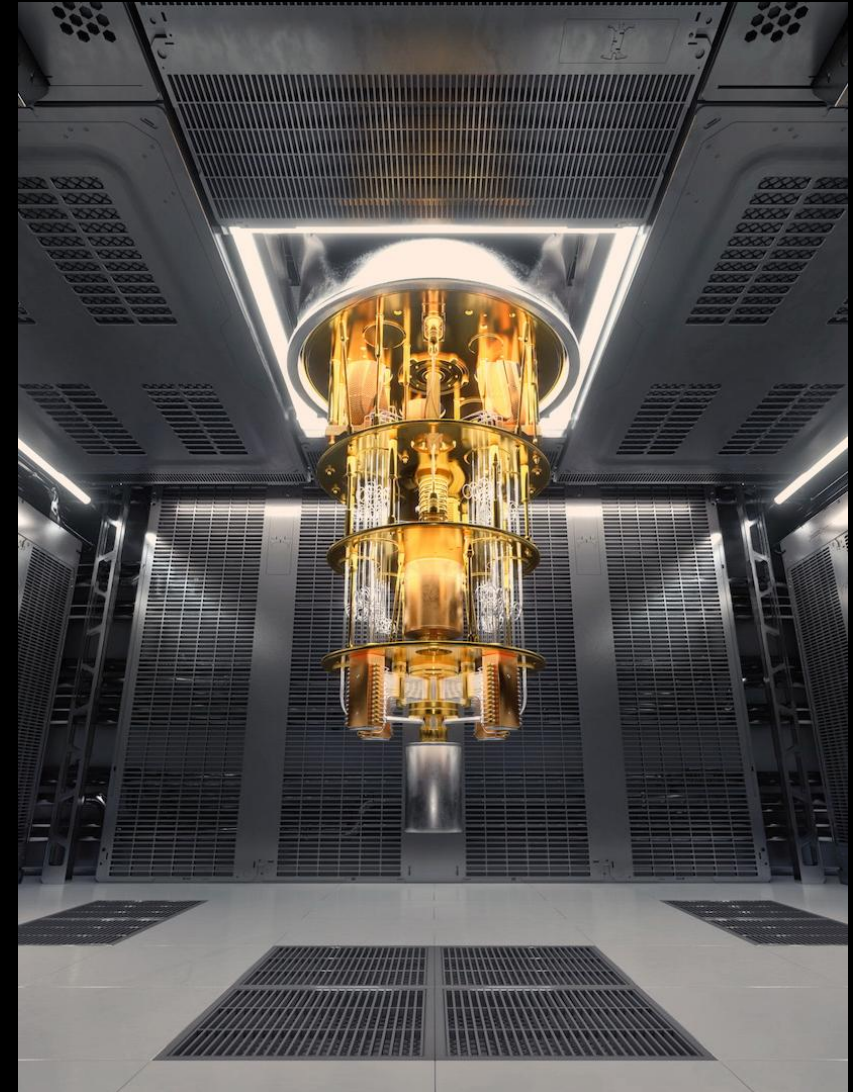
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Introduction: What is quantum computing?

- Quantum computing is a revolutionary technology that harnesses the principles of quantum mechanics.
- It processes information in ways that classical computers cannot.
- Using qubits that can exist in multiple states at once, it explores countless possibilities simultaneously.
- This power opens new frontiers in drug discovery, finance, cryptography and artificial intelligence.
- Quantum computing promises to transform industries and redefine what technology can achieve.



From bit to qubit – the main differences

Bit(Classical computers)

- Basic unit of classical data
- It can be either 0 or 1
- Based on binary logic
- Uses transistors to store information
- Processes 1 possibility at a time

Qubit(Quantum computers)

- Basic unit of quantum data
- It can be 0 and 1 at the same time
- Based on quantum mechanics
- Uses atoms, protons and ions to store information
- Processes many possibilities simultaneously

Quantum chips

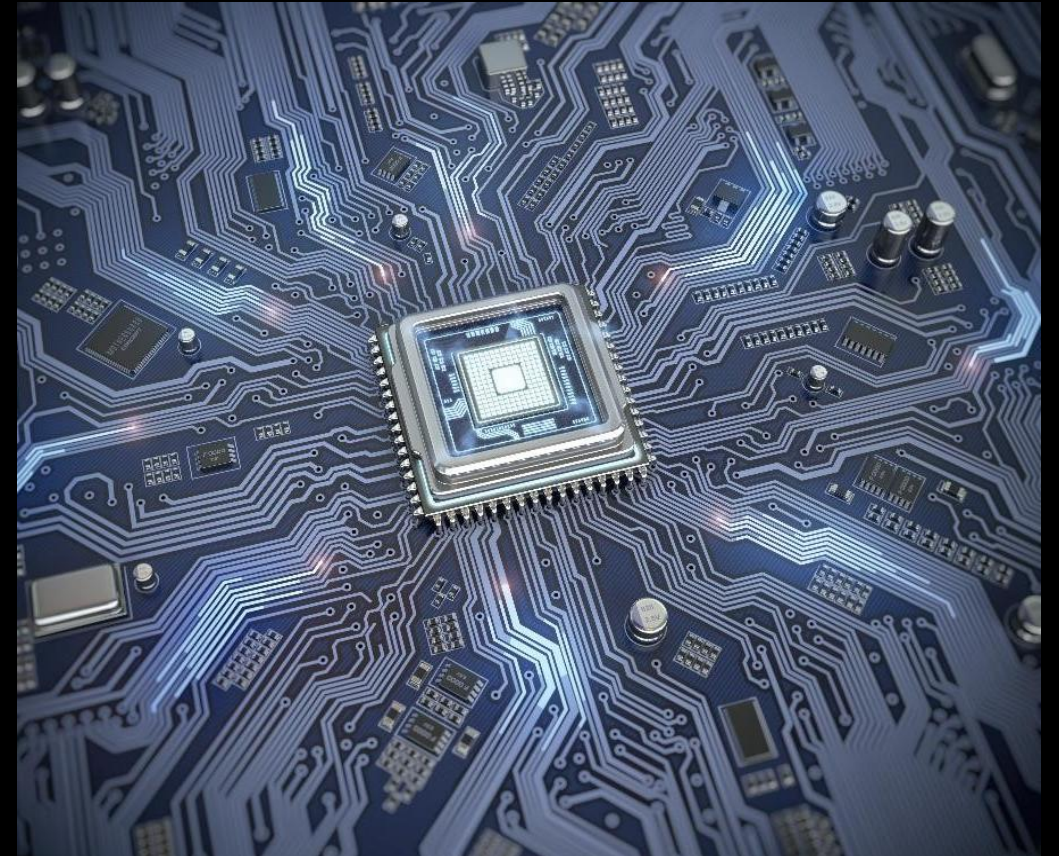
- "A quantum chip is a specialized processor that uses qubits to perform computations based on the principles of quantum mechanics."

There are 3 main types of quantum chips:

Superconducting-circuit chips: These chips use superconducting materials cooled to near absolute zero to create qubits via tiny electrical circuits.

Trapped-ion quantum chips: These chips trap charged atoms (ions) in electromagnetic fields, and use lasers to manipulate them as qubits.

Photonic quantum chips: These utilize photons (particles of light) as qubits, often travelling through optical circuits or waveguides.

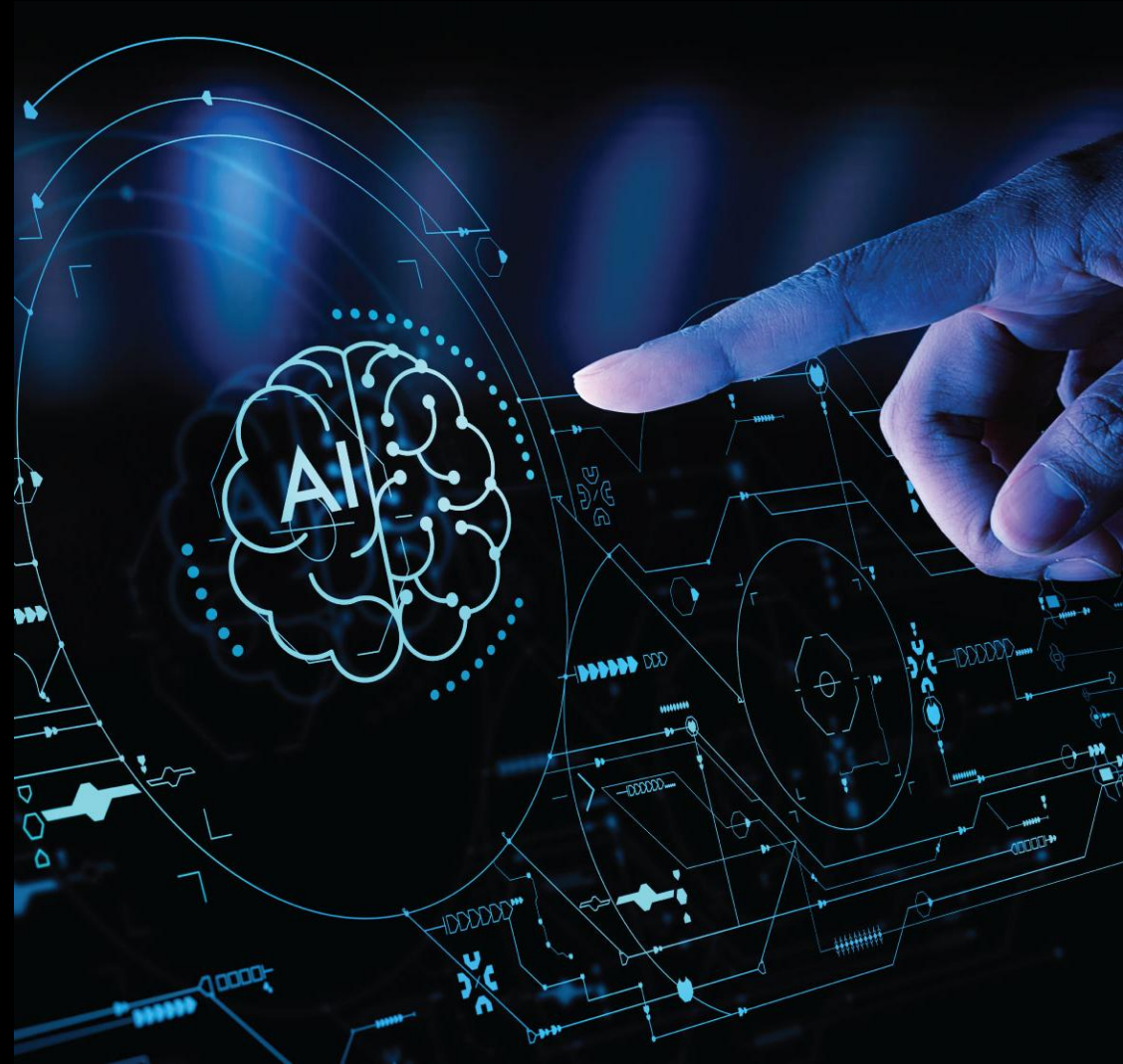


Industrial applications



Quantum computing in AI

- Quantum computing enhances AI by using qubits to process vast amounts of data in parallel.
- It can speed up machine learning algorithms, optimize large models, and handle complex data patterns that classical computers struggle with.
- Quantum algorithms, like Quantum Support Vector Machines and Quantum Neural Networks, aim to make learning faster and more accurate.
- This technology could revolutionize pattern recognition, data analysis, and decision-making in fields like healthcare, finance, and robotics.
- Although still in early stages, quantum AI represents a powerful step toward creating more intelligent and efficient computational systems.



Pharmaceutical quantum computing

- Simulates complex molecules with quantum-level accuracy.
- Speeds up drug discovery by testing compounds virtually.
- Predicts protein–drug interactions more precisely.
- Reduces R&D time and development costs.
- Enables breakthroughs in personalized medicine and targeted therapies.



Finance

- Optimizes portfolios by analyzing vast possibilities at once.
- Accelerates risk analysis and Monte Carlo simulations.
- Improves fraud detection with quantum-enhanced machine learning.
- Enables faster and more accurate pricing of complex financial products.
- Supports smarter decision-making in trading and investment strategies.



Cryptography

- Can break traditional encryption methods like RSA and ECC.
- Drives the need for post-quantum cryptography to secure future systems.
- Enables quantum key distribution (QKD) for near-unbreakable communication.
- Strengthens data protection through quantum-safe algorithms.
- Pushes governments and industries to upgrade global cybersecurity standards.



Thank you for your time!

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