

Quantum Finance



Solutions of financial problems via Quantum algorithms

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Why Quantum solutions ?



- Financial institutions employ statistical models and algorithms to predict future outcomes. Such techniques are fairly effective but not infallible.
- In a world where huge amounts of data are generated daily, computers that can perform predictive computations accurately are becoming a predominant need. For this reason, several financial institutions are turning to quantum computing, given its promise to analyze vast amounts of data and compute results faster and more accurately than any classical computer has ever been able to do.
- Financial institutions believe that once they are capable of leveraging quantum computing, they are likely to see important benefits.
- According to a report, a McKinsey & Co. [report](#) , finance is estimated to be the first industry sector to benefit from quantum computing (Section 2), largely because of the potential for many financial use cases to be formulated as problems that can be solved by quantum algorithms suitable for near-term quantum computers.

Applications



These problem are based on **optimisation** and can be solved using **variational algorithms**.

- Portfolio optimisation
- Hedging and Swap netting
- Optimal Arbitrage
- Credit scoring
- Financial crash prediction

These problems involve machine learning, hence **quantum machine learning** can be used to solve this problem.

- Anomaly detection
- Asset pricing
- Implied volatility calculation

These problem involve stochastic modelling which requires **quantum PDE solver** and **quantum machine learning**

- Derivative pricing
- Risk analysis

Optimisation problem



Solutions of optimisation problems via Quantum variational algorithms

Quantum Variational Algorithms



- Combinatorial Optimization (CO) is one of the most important areas in the field of optimization, with practical applications found in every industry, including both the private and public sectors
- A CO problem can be converted into a QUBO and remarkable array of NP-hard problems can be converted into the QUBO form, Lucas (2014) more recently has observed that such problems can be converted into the Ising form
- This Ising problem can be solved using quantum variational algorithms such as VQE and QAOA

Applications

- **Logistics**
- **Finance**
- **Supply chain management.**
- **The tail assignment problem**
- **Portfolio optimisation**