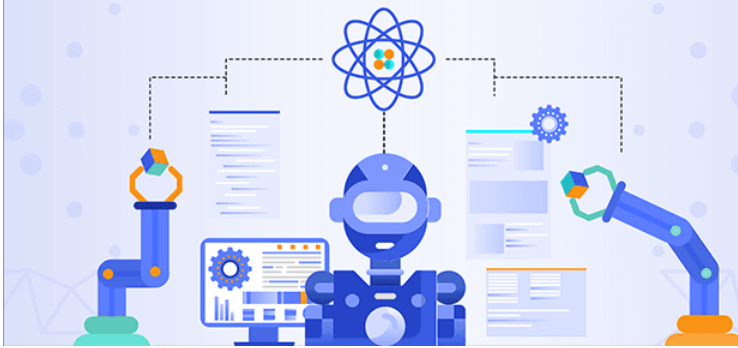


Quantum Machine Learning

By Russell Palma



Quantum Machine Learning



Overview

- Progress of Quantum Computers
- Solving challenges in machine learning
- Quantum Physics + Machine Learning = Quantum Machine Learning



Quantum Machine Learning
Algorithms Based On Grover
Search

- Quadratically Faster
- Searches through a functions input
- Significant for large data vectors

Grover's Algorithm

sorted database
of n items

Goal: Find one
"marked" item

Classically, order n queries to database need

Grover 1996: Quantum algorithm using order
 \sqrt{n} queries

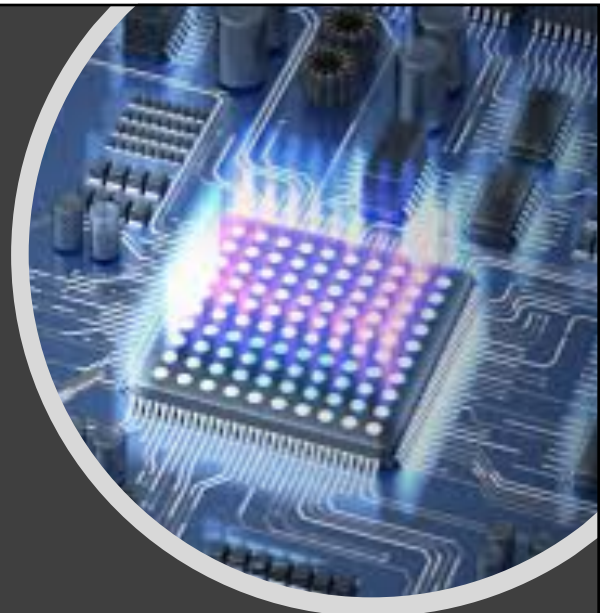


- D-Wave Processors
- Optimization Problems
- Sampling Problems
- Probabilistic Models

Quantum Annealing

Quantum Sampling Techniques

- Quantum Supremacy
- BosonSampling
- IQP Circuit Models



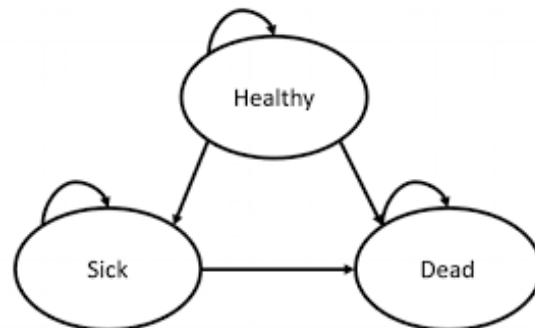
Quantum Neural Networks

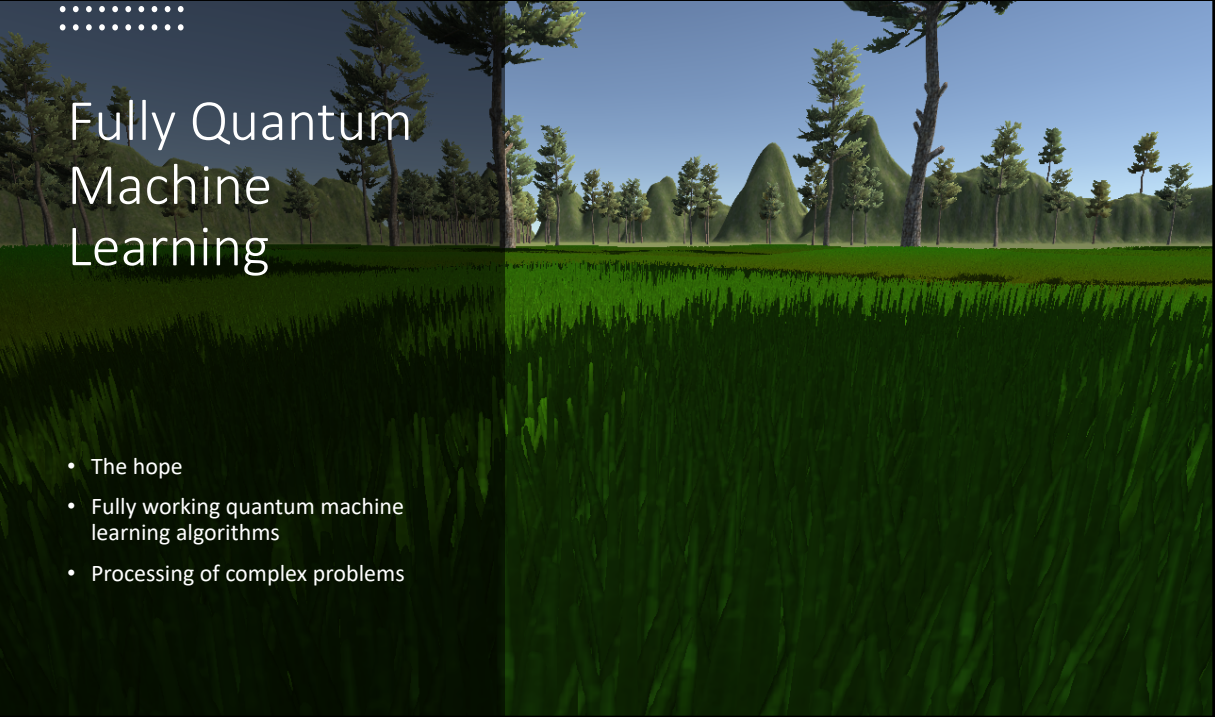


- Fully functioning quantum learning tasks
- Universal Quantum Computation
- Efficient quantum implementations

Hidden Quantum Markov Models

- Quantum Probabilistic Graphical Models
- Simulating circuits
- Developing more precise quantum algorithms







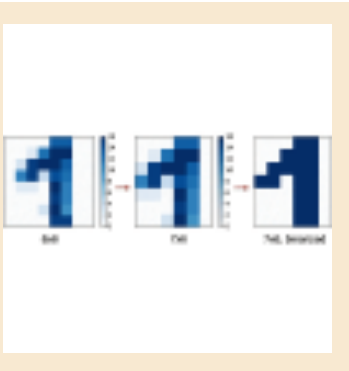
.....

Fully Quantum Machine Learning

- The hope
- Fully working quantum machine learning algorithms
- Processing of complex problems

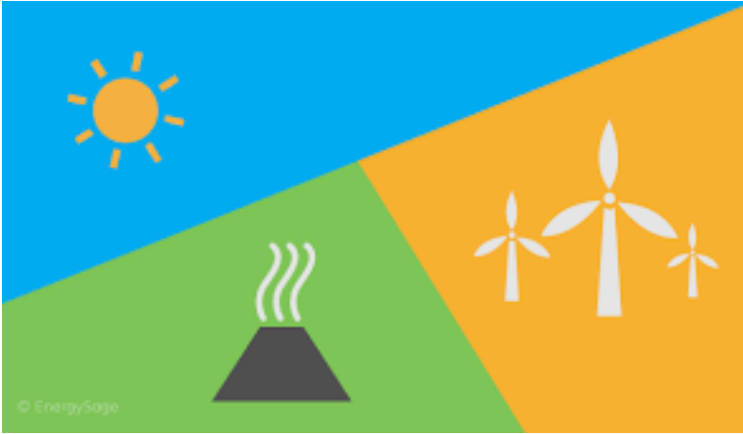
Implementations and Experiments

- D-Wave's quantum computer
- Google and NASA's implementation D-Wave's computer



Conclusion

- Quantum Machine Learning is essential
- Upgrade Hardware to Utilize Software
- Increase Qubits

© EnergySage

Sources

- <https://singularityhub.com/2019/03/17/finally-prove-that-quantum-computing-can-boost-machine-learning/>
- <http://proceedings.mlr.press/v94/srinivasan18a/srinivasan18a.pdf>
- <https://www.nature.com/articles/s41467-020-14454-2>
- <https://www.nature.com/articles/s41534-017-0018-2>
- https://docs.dwavesys.com/docs/latest/c_gs_2.html
- <http://dkopczyk.quantec.co.uk/prover-search/>