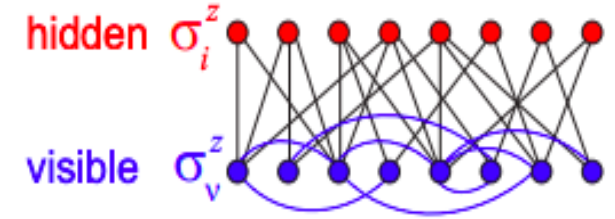


Quantum Boltzmann Machine (QBM) [Link to the QBM paper](#)

- The Boltzmann machine (BM) is a machine learning technique which serves as the basis of powerful deep learning models such as deep belief networks.
- It has two layers named visible layer(input layer) and hidden layer.
- The Hidden layer can tell us the relation between variables of visible layer, which can be used for contextual understanding of words in a sentence using Boltzmann distribution.
- The superposition attribute of a quantum system can be easily exploited to speed up the training process of a Boltzmann machine.



Quantum Gradient Descent [Link to the paper](#)

- As shown in the figure a quantum circuit can be effectively represented by a fully connected quantum network like the conventional neural network.
- It is seen during quantum backpropagation in complex-valued vector space, only real values remain after partial derivation w.r.t to weights of quantum gates.

$$\frac{\partial L}{\partial \theta} = 2\text{Re} \left[\frac{\partial L}{\partial p_{\theta}^j} \frac{\partial p_{\theta}^j}{\partial c_{\theta}^j} \frac{\partial c_{\theta}^j}{\partial \theta} \right].$$

- These real values can be directly used to update the weights using weight update formula, $wt \rightarrow wt - \alpha * \text{Loss}$

