Quantum Neural Network

Data Input   Process Data   Extract output

$Rx(\omega_1)$
$Rx(\omega_2)$
$Rx(\omega_3)$

$Ry(\phi_1')$
$Ry(\phi_2')$
$Ry(\phi_3')$

OPTIMIZER
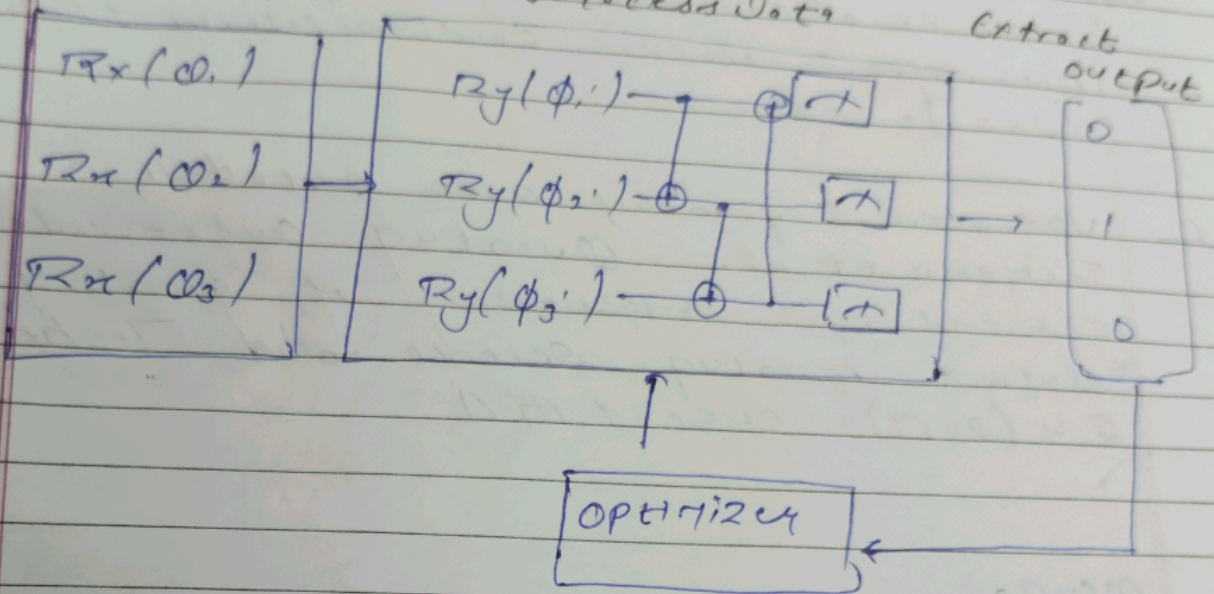
Quantum Machine learning

Quantum Computer

$x \longrightarrow$ [encode] [Process] [Measure] $\longrightarrow \hat{y}$

$|0\rangle$
$|0\rangle$
$|0\rangle$

$U(x)$ $W(\omega_1)$ $W(\omega_2)$ M
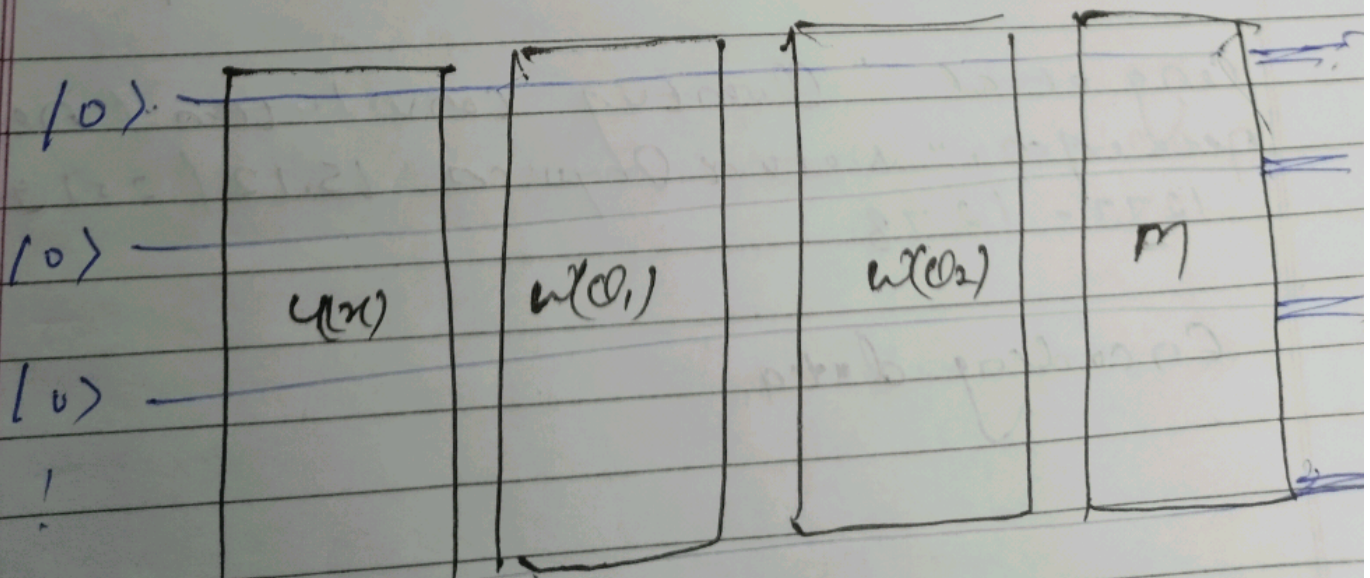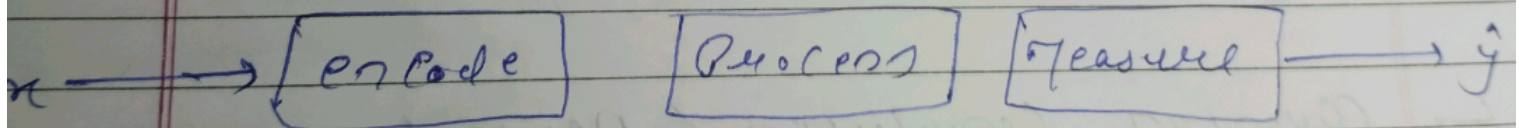
Other QNN architectures

↳ QDNNs

Beer et al. "Training deep quantum networks." Nature Communications 11.1 (2020): 1-6.

↳ Variational quantum auto encoder

Romero et al. "Quantum autoencoders for efficient compression of quantum data." Quantum Science and Technology 2.4 (2017): 045001. APA
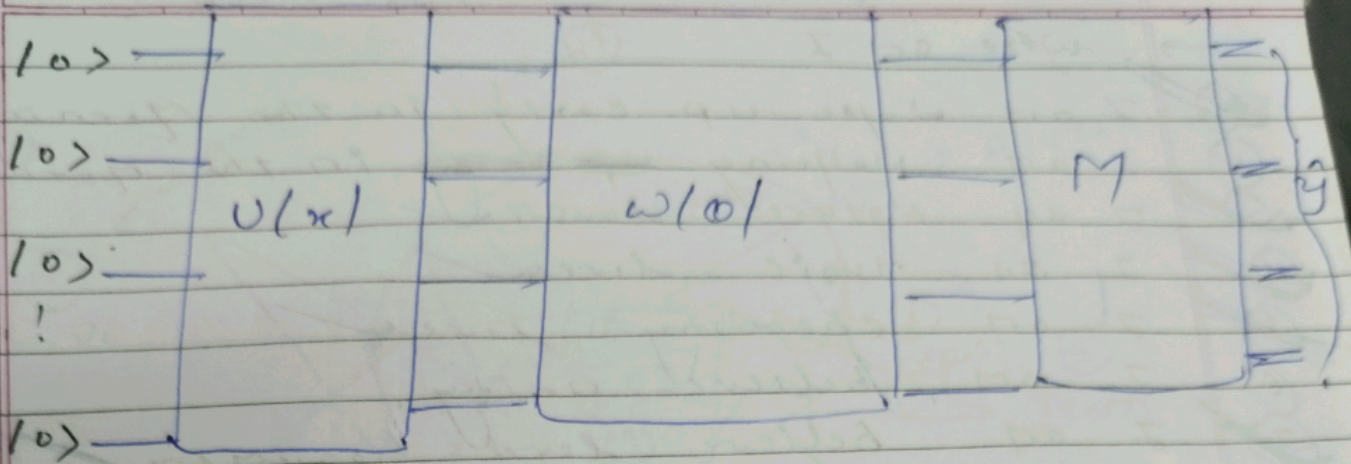
↳ QGAN

Zoufal et al. "Quantum generative adversarial networks for learning and loading random distributions." npj Quantum Information 5.1 (2019): 1-9

→ Quantum convolutional neural network

Cong et al. "Quantum convolutional neural networks." Nature Physics 15.12 (2019) 1273-1278

Encoding data.

$|o\rangle$ ——

$|o\rangle$ ——

$|o\rangle$ ——

!

$|o\rangle$ ——

U(x)   W(θ)   M   } y

Angle encoding

$$x' = \begin{bmatrix} 0.888 \\ -1.25 \end{bmatrix}$$

Optimisation

$$\boxed{\theta^* = \theta^i - \eta \frac{\partial c}{\partial \theta i}}$$