qDerm

Detecting Skin Cancer with **Quantum Machine Learning**

Quantum Computing

100M x faster

1000 x less energy

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Skin Cancer
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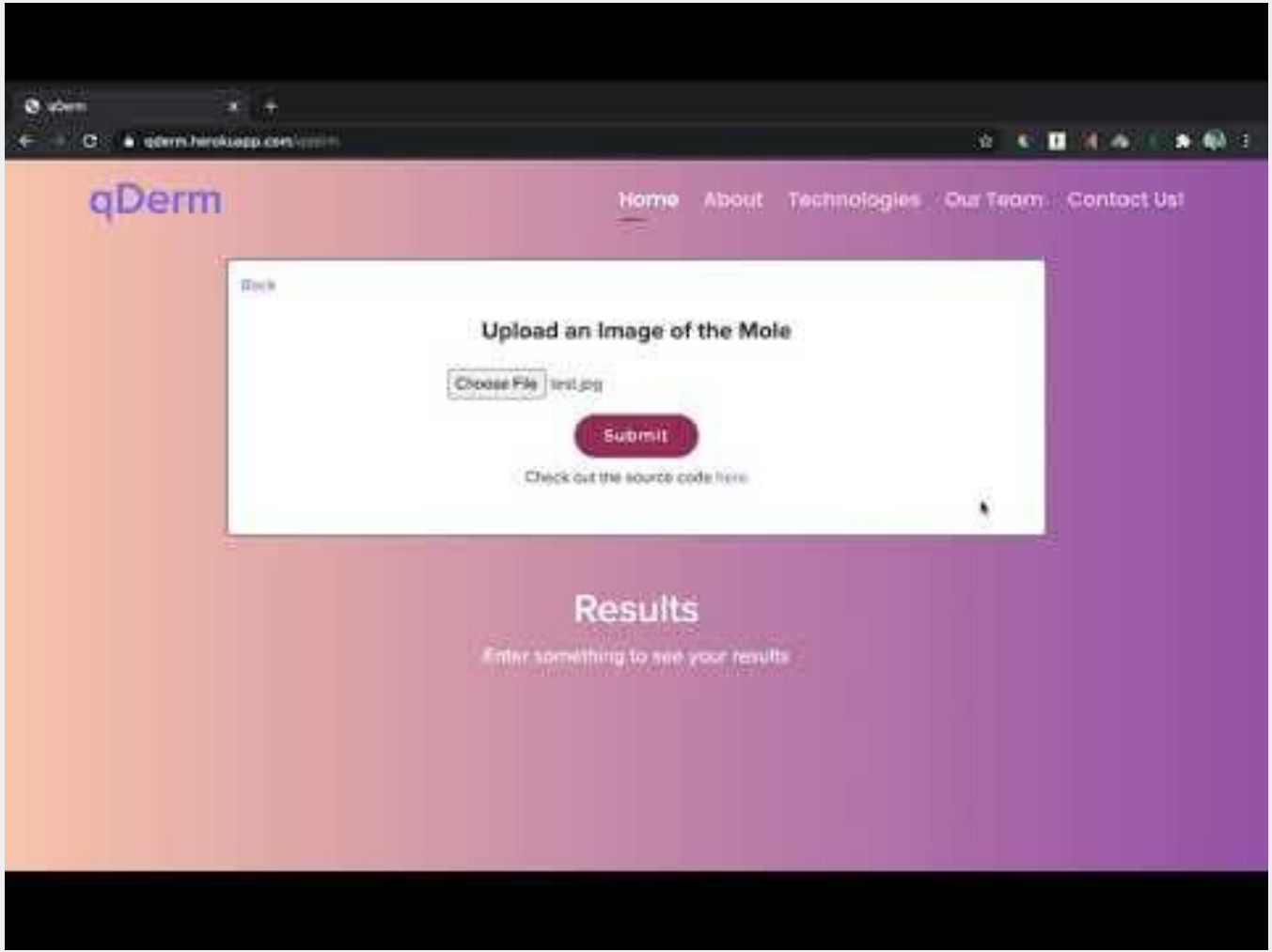
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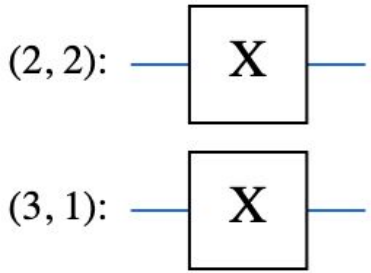
Upload an Image of the Mole
Choose File
test.jpg
Submit
Check out the source code here
Results
Enter something to see your results

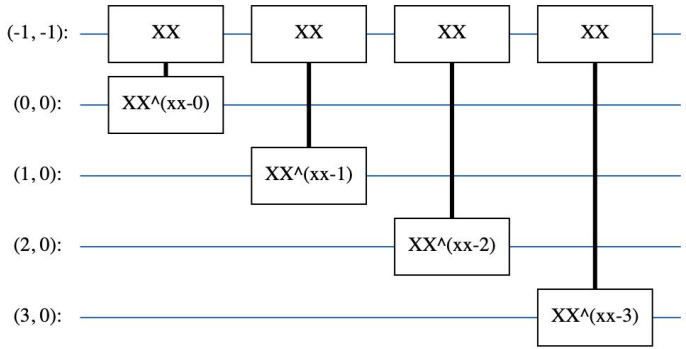
```
[ ]
def convert_to_circuit(image):
    """Encode truncated classical image into quantum datapoint."""
    values = np.ndarray.flatten(image)
    qubits = cirq.GridQubit.rect(10, 10)
    circuit = cirq.Circuit()
    for i, value in enumerate(values):
        if value:
            circuit.append(cirq.X(qubits[i]))
    return circuit
```




```
x_train_circ = [convert_to_circuit(x) for x in gray_X_train]
x_test_circ = [convert_to_circuit(x) for x in gray_X_test]

#convert cirq circuits to tensors for tfq:
x_train_tfcirc = tfq.convert_to_tensor(x_train_circ)
x_test_tfcirc = tfq.convert_to_tensor(x_test_circ)
```

+ Code

```
[ ] #QNN Implementation: classification is based on the expectation of t

class CircuitLayerBuilder():
    def __init__(self, data_qubits, readout):
        self.data_qubits = data_qubits
        self.readout = readout

    def add_layer(self, circuit, gate, prefix):
        for i, qubit in enumerate(self.data_qubits):
            symbol = sympy.Symbol(prefix + '-' + str(i))
            circuit.append(gate(qubit, self.readout)**symbol)
```

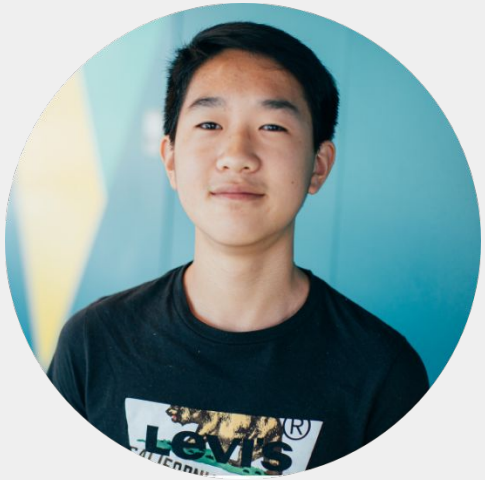


Results

```
[21] EPOCHS = 3
     BATCH_SIZE = 8

     NUM_EXAMPLES = 10

     x_train_tfcirc_sub = x_train_tfcirc[:NUM_EXAMPLES]
     y_train_hinge_sub = y_train_hinge[:NUM_EXAMPLES]

     qnn_history = model.fit(
           x_train_tfcirc_sub, y_train_hinge_sub,
           batch_size=8,
           epochs=EPOCHS,
           verbose=1,
           validation_data=(x_test_tfcirc, y_test_hinge))

     qnn_results = model.evaluate(x_test_tfcirc, y_test)
```

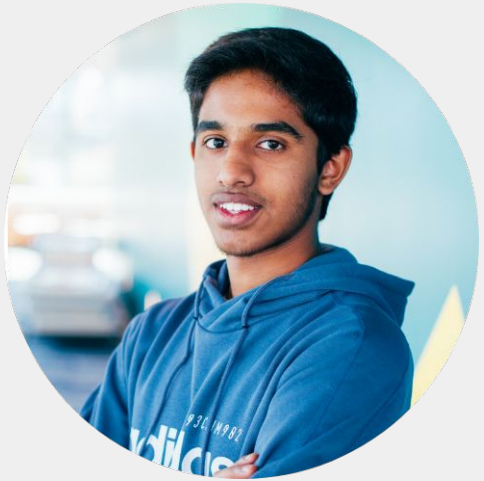
```
Train on 10 samples, validate on 660 samples
Epoch 1/3
10/10 [==============================] - 8s 793ms/sample - loss: 1.0000 - hinge_accuracy: 0.2500
Epoch 2/3
10/10 [==============================] - 7s 680ms/sample - loss: 1.0000 - hinge_accuracy: 0.2500
Epoch 3/3
10/10 [==============================] - 7s 679ms/sample - loss: 1.0000 - hinge_accuracy: 0.2500
```

Thank You!



Kevin Wang

Alice Liu



Sohail Mohammed

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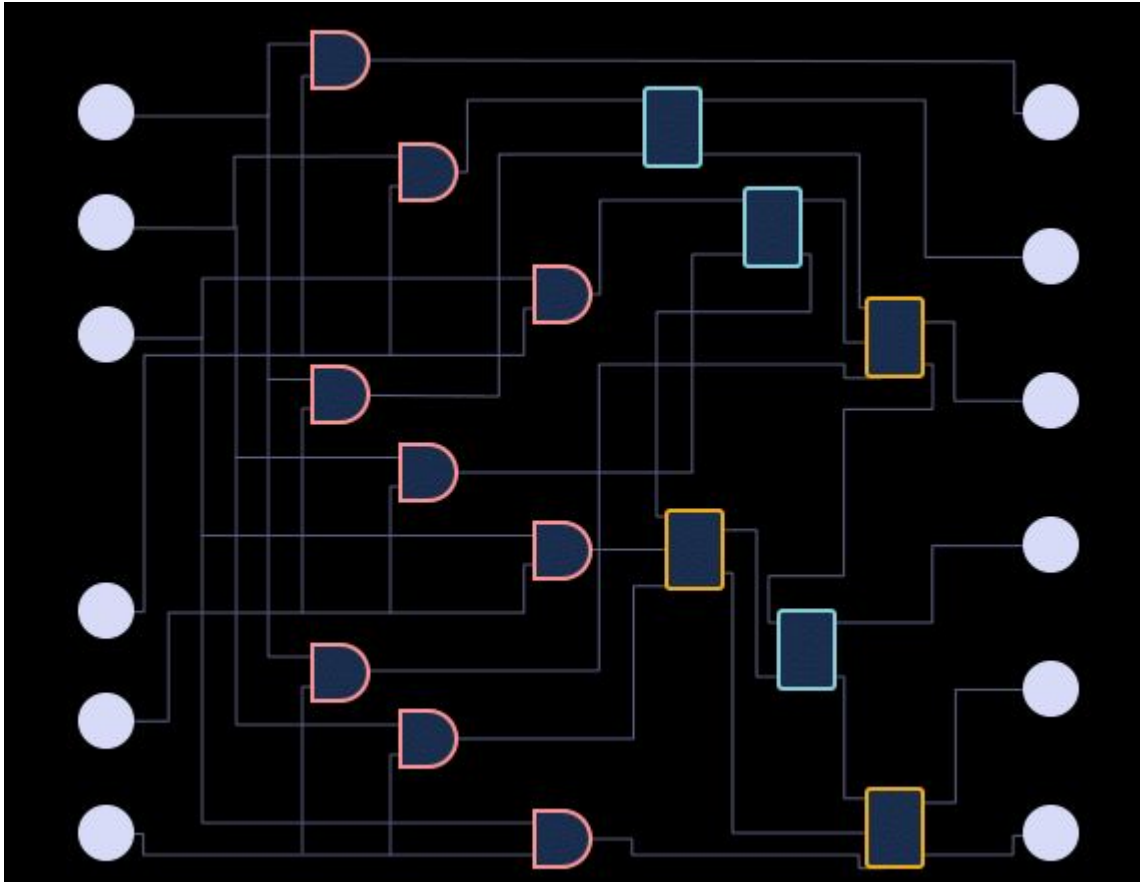
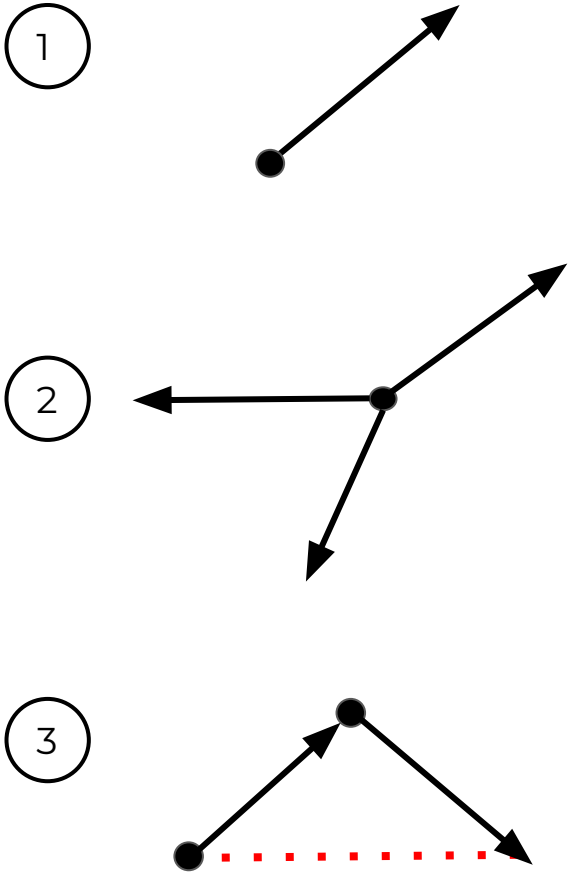
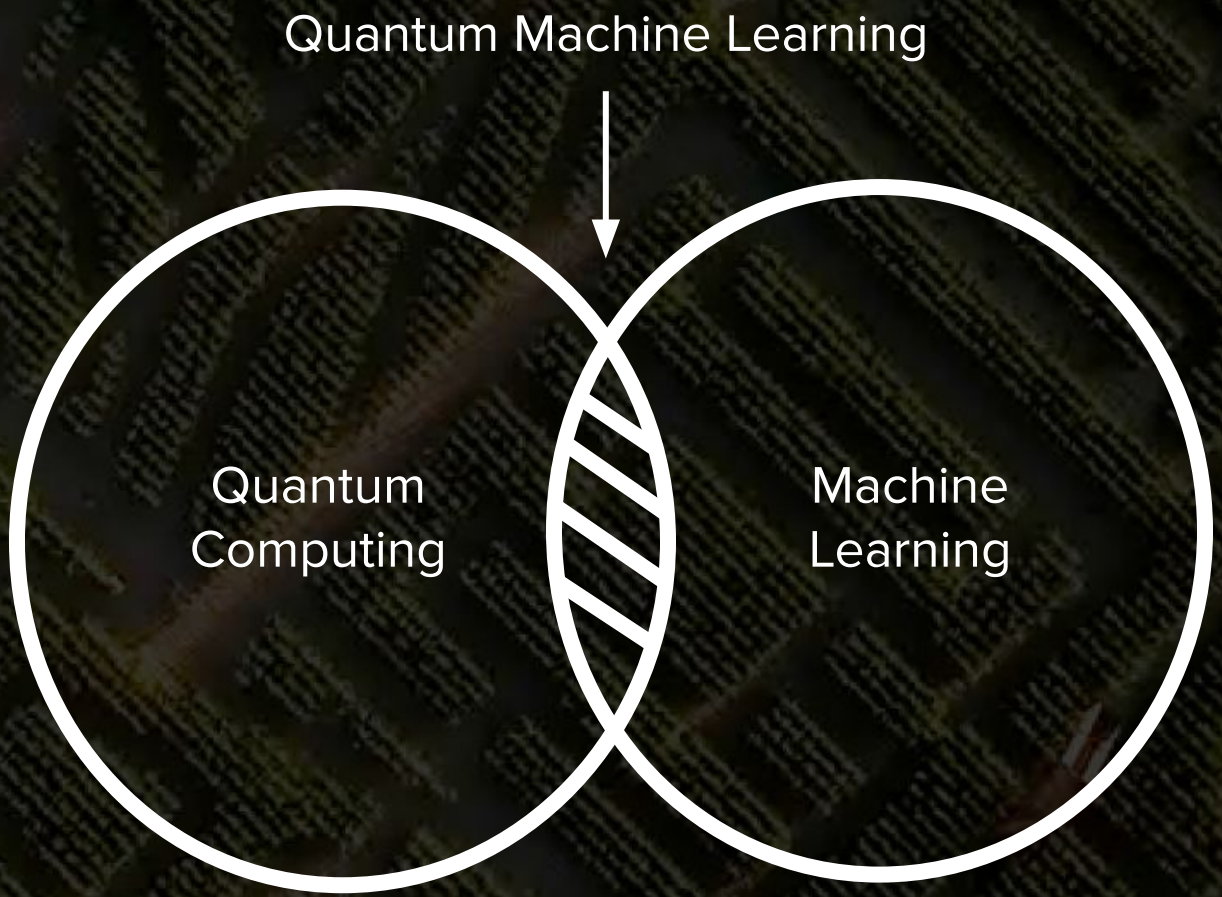




Amplitudes → Optimization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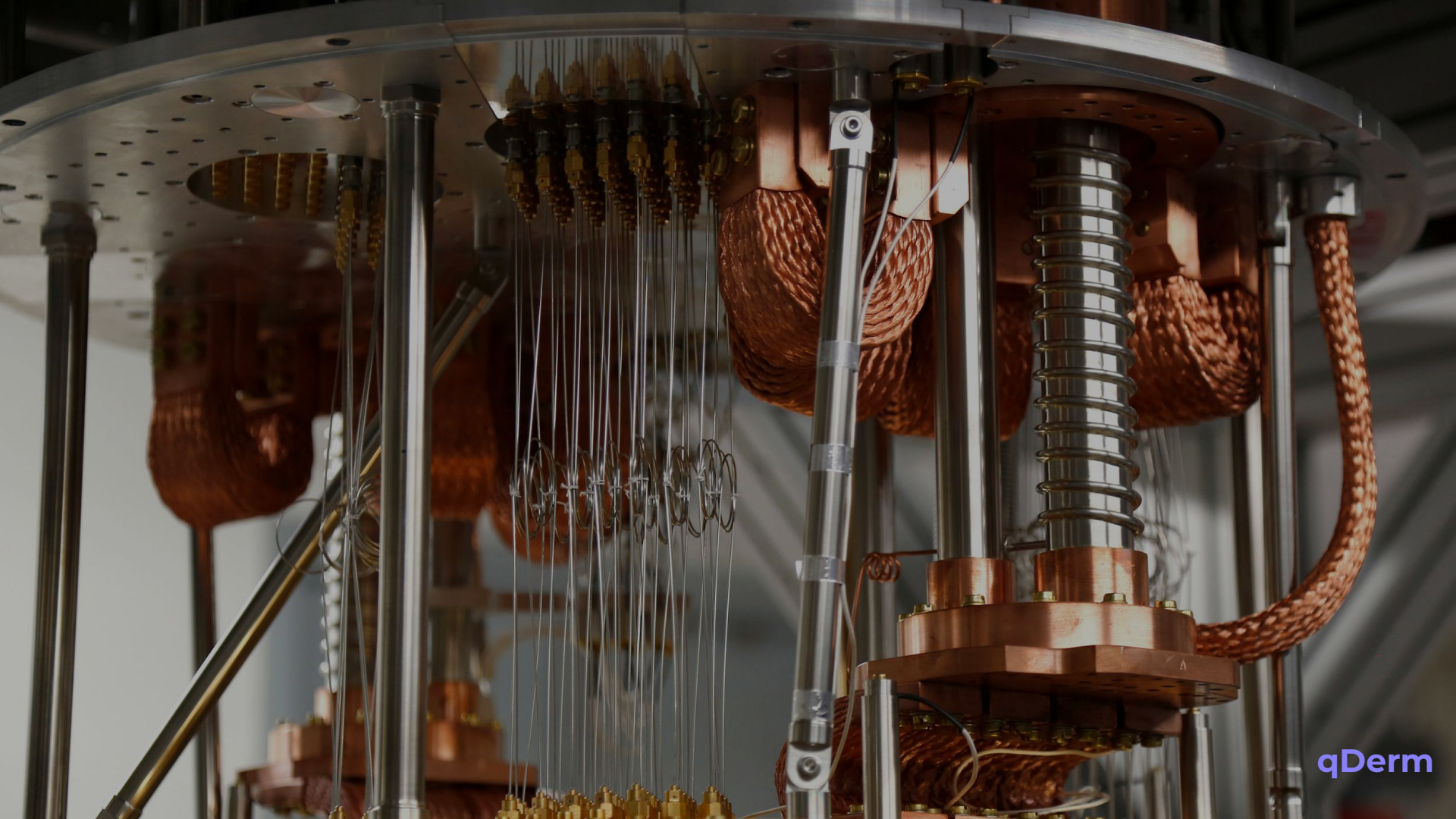
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Appendix