QML Revision Summary with References

ALL Notes + QCA Notes + QCA Qiskit Programs + References

Unit-1 (Quantum Computational Model):

Our Notes + QCA Workshop Notes [Lecture 3, Lecture 4] + References [R1, R2.1 – Section III (Basics), R4 & R5 & R6 & R7 & R8 (QML Theory & Basics)].

Introduction to Quantum computing, Quantum Computer Architecture, the basics of the quantum circuit model, Qubit and Quantum State, working with one qubit and the Bloch sphere, working with two qubits and entanglement, Working with multiple qubits and universality.

Unit-2 (Essential Quantum Encoding and Algorithms):

Our Notes + QCA Workshop Notes [Lecture 7, Lecture 12, Lecture 14] + References.

Encodings of Data **(RB1 – Section 3.1 & 3.2)**, Quantum Encoding Methods – Basis Encoding, Angle Encoding, Amplitude Encoding, Qsample Encoding **(R4 – Section 5.2, B4 – Section 9.2.2, R5 – Section V-D)**; Essential Quantum Routines for QML – Harrow-Hassidim-Lloyd algorithm **(Lecture 14, R2.2 – Section 3.4, R2.3 – Section V, R3 – Section 5)**, Grover's Algorithm and Quantum Counting **(Lecture 12, Lecture 14, R2.1 – Section IV-A, R2.3 – Section II)**, Quantum phase estimation **(Lecture 7, R1 – Page 290-291, R2.1 – Section IV-D, R2.2 – Section 3.3)**, Variational or Parameterized quantum circuit **(R4 – Section 6.1.4, R5 – Section IV-B, R6 – Section 3.2.4, R7 – Section 3.1.5, R8 – Section IV-B-1)**.

Unit-3 (QML Toolkit and Quantum ML Methods): Our Notes + References

QML toolkit **(RB1 – Chapter 5)**: Hamiltonian simulation, SWAP test **(RB1 – Section 5.3, R2.1 – Section V-A, R2.2 – Section 3.2)**, Qdist routine **(RB1 – Section 5.4)**. ML Vs. QML **(R6 – Section 4)**. Quantum principal component analysis **(RB1 – Section 6.1, R2.1 – Section V-D, R2.2 – Section 4.3, R2.3 – Section XIV)**, Quantum Linear Regression **(R9 – Section 4.2)**, Quantum classification: Distance-based quantum classification **(RB1 – Section 7.1)**, Quantum K-nearest neighbours **(RB1 – Section 7.2, R7 Section 3.1.8)**, Quantum support vector machine **(RB1 – Section 7.3, R2.1 – Section V-C, R2.2 – Section 4.1, R2.3 – Section XV, R3 – Section 6)**.

Unit-4 (Quantum Clustering and Neural Networks): Our Notes + References

Quantum clustering: Quantum K-Means Clustering **(RB1 – Section 6.2, R2.1 – Section V-A, R2.2 – Section 4.2)**, Quantum K-medians **(RB1 – Section 6.3, R2.1 – Section V-B)**, Quantum neural networks **(RB1 – Section 9.1, R2.1 – Section V-E, R2.2 – Section 4.4, R5 – Section IV-D, R8 – Section IV-B-2)**: Quantum Convolutional Neural Network (QCNN) **(RB1 – Section 9.5, R5 – Section IV-D, R8 – Section IV-B-2)**, CNN s. QCNN.