亞洲大學
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QUANTUM

Newsletter issue 8-2025, Nov. 28, 2025

AI and Quantum Research Center (AIQRC), Asia University, Taiwan

Activity

Time/Place: Nov. 13-14, 2025, Asia University, Taichung

The International Symposium on Quantum AI and the Future of Life took place at Asia University on November 13–14. The event gathered leading domestic and international scholars and experts in artificial intelligence, quantum technology, biomedicine, and traditional Chinese medicine to explore the latest advances in Quantum AI (QAI) and its applications in medicine, life sciences, and longevity technologies.

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Quantum Machine Learning in Biomedical Research: Applications, Challenges, and Future Perspectives

Quantum Machine Learning (QML) is reshaping biomedical research by enabling efficient analysis of complex multi-omics datasets. As highlighted by (Biamonte et al. 2017, PRX Life, 2025) QML handles exponentially large data states by mapping biological features into quantum Hilbert space, revealing hidden biomarker correlations for precision medicine (Quantum Machine Intelligence, 2025). Recent studies show that quantum-enhanced models analyze high-dimensional omics networks more effectively than conventional techniques, advancing biomarker discovery, causal inference in immune response, and disease risk prediction (IBM Research, 2024) in cardiovasular disease (MDPI, 2025).

In bioinformatics and computational biology, quantum circuits are being used for gene regulatory network inference and multi-omics integration, enabling scalable pathway mapping between signaling cascades and epigenetic regulators while identifying novel therapeutic targets and population-specific molecular signatures that classical algorithms fail to resolve. In biostatistics, quantum-enhanced survival models integrate genomics, imaging, and electronic health records, achieving more accurate risk stratification beyond Cox regression while addressing critical challenges including high dimensionality, multiple testing corrections, non-linear interaction detection, rare variant analysis, and robust handling of missing data in clinical datasets.

However, QML faces significant limitations. Current quantum hardware remains in the NISQ era with noise, limited qubits, high error rates, and restricted circuit depth constraining practical applications (Preskill, 2018). Infrastructure scarcity and expertise barriers limit accessibility, while inconsistent benchmarking and unproven quantum advantage across biomedical applications remain challenges. Despite these obstacles, QML's potential is increasingly promising. As quantum hardware improves and hybrid quantum–classical methods develop, alongside quantum-resistant cryptographic protocols protecting patient data from future quantum attacks (IBM Research, 2024), QML will advance biomarker discovery, drug response prediction, and multi-omics integration, paving the way for a secure, scalable quantum-powered future in precision medicine.

References:

Biamonte, J., et al. (2017). Quantum machine learning. Nature, 549(7671), 195-202.

IBM Research Quantum Computing Applications in Healthcare (2024).

MDPI (2025).

Preskill, J. (2018). Quantum Computing in the NISQ era and beyond. Quantum, 2, 79

PRX Life (2025).

Quantum Machine Intelligence (Springer, 2025).

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