

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

AIQRC proudly celebrates *the first anniversary of the AIQRC Newsletter*, marking one year since its launch on October 10, 2025.

Contents

- [1] **Upcoming event – International Physical AI & Robotics Symposium**
 [2] **Recent activities**
 [3] **Triple-Negative Breast Cancer Meets Quantum Machine Learning: Where Things Stand in 2026**

[1] Upcoming event, Dec. 3 – 4, 2026

About the Symposium

AI is moving beyond chatbots and software — into robots, factories, vehicles, and autonomous systems that sense, reason, and act in the real world. This is Physical AI, and it represents the next great competitive frontier for enterprise technology.

Physical AI & Robotics Symposium 2026 brings together the pioneers building this future — engineers, researchers, and enterprise leaders working at the intersection of AI, robotics, and industrial automation. Over two days, attendees will explore how intelligent machines are reshaping manufacturing, healthcare, logistics, and human-machine collaboration, and what it truly takes to move Physical AI from experimentation

Click [here](#) for more details.



[2] Asia University and AIQRC, supported by the Ministry of Education's Taiwan Global Pathfinders Grant Program, provide Taiwan students with world-class experiential learning opportunities through programs in IBM quantum technologies, UCLA academic exchange, quantum finance, humanoid robotics, and astronaut mission training.



(A) IBM dream program

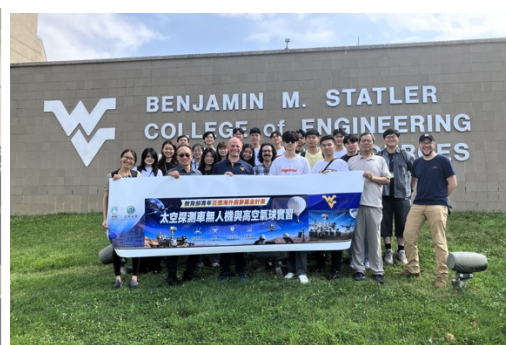
(B) UCLA elite program



(C) Quantum finance program



(D) Humanoid robot program



(E) Astronaut mission training program

Prepared and Edited by

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[3] Triple-Negative Breast Cancer Meets Quantum Machine Learning: Where Things Stand in 2026

Why TNBC?

Triple-negative breast cancer (TNBC) lacks estrogen, progesterone and HER2 receptors, so it has fewer targeted options than other breast cancers and recurs more often. Treatment is changing quickly. In 2026 the FDA approved datopotamab deruxtecan for metastatic TNBC patients who can't receive PD-1/PD-L1 inhibitors, with a response rate of 64% versus 30% for chemotherapy. A month later it approved sacituzumab govitecan as first-line therapy, alone or with pembrolizumab.

New drugs make a hard question harder: which patient should get which therapy? Only about half of TNBC patients respond well to neoadjuvant chemotherapy. A 2026 Nature study profiled 427,857 single cells from 101 patients, plus spatial data from 44, and tied response to specific cancer-cell programs and macrophage states. These datasets are large per cell, but small per patient, and that mismatch is where computation matters.

Classical machine learning has made progress, but not reached the clinic

TNBC machine learning is now a high-output field. A 2026 landscape analysis counted 394 articles from 2011 to 2026, concentrated on radiomics, deep learning and multi-omics biomarker discovery, and its title points to a “translational chasm” between publications and clinical use. Recent examples include a model that estimates survival for patients whose tumors achieved pathological complete response (pCR), since pCR alone does not capture risk differences. Prospective evidence supports the point: a 2026 ASCO sub-study of the PARTNER trial found that post-surgery circulating tumor DNA (ctDNA) predicted distant recurrence in early TNBC better than pCR status.

What quantum machine learning offers

QML runs part of a learning task on quantum circuits. Current devices are noisy and small, so most work is hybrid, with classical and quantum computing combined to cope with decoherence on near-term machines. The main ideas relevant to biomarkers are:

- **Quantum kernels and quantum support vector classifiers (QSVC).** Data are mapped into a high-dimensional quantum feature space where classes may separate more easily. An early study classified eleven cancer types from gene expression in 4,495 samples.
- **Quantum neural networks (QNN).** Our group's 2025 PLOS One paper used neural quantum embedding with kernel-based classifiers on gene expression data for clear cell renal carcinoma metastasis. Another recent study applied a QNN to lung adenocarcinoma versus squamous carcinoma using methylation-informed gene sets.
- **Quantum optimization for feature selection.** Choosing a small gene panel from thousands is a combinatorial problem. A hybrid approach described in a US quantum workshop report frames feature selection as a binary optimization problem and splits it into pieces the quantum computer can handle.

What the breast cancer literature actually shows

Most quantum work in breast cancer addresses imaging, not TNBC biology:

- A 2026 comparison of six classical and quantum-assisted deep learning set-ups on histopathology patches tested them for invasive ductal carcinoma classification.
- A preprint on thermographic images reports a 17% accuracy gain for a hybrid quantum network. This is not peer reviewed, and such gains depend heavily on the baseline.
- A “quantum-based” gene optimizer reached an F1 score near 99% in finding breast cancer biomarkers, but this is a quantum-inspired algorithm run on ordinary computers, not a quantum device.

A 2026 hybrid pipeline for breast cancer diagnosis is candid about the main limitation. Its authors chose an eight-qubit comparison on an easy dataset and say future work should use harder benchmarks where classical methods are not already near ceiling, such as TCGA-BRCA gene expression or multi-centre digital pathology. In other words, high accuracy on easy data does not show a quantum advantage.

Where QML might matter for TNBC

TNBC fits several conditions that make quantum approaches worth testing, though none is proven:

- **Few patients, many features.** Single-cell, spatial and bulk omics data give thousands of variables per sample but only hundreds of patients. Kernel methods are a natural fit for this regime, and small quantum models could act as compact classifiers.
- **Panel design.** Choosing a minimal gene or protein panel to predict ADC or chemo-immunotherapy response is a feature-selection problem that quantum optimization could target.
- **Multimodal integration.** Combining spatial, single-cell, ctDNA and imaging data into a single response predictor is hard, and hybrid architectures are one candidate.

What a credible next step looks like

- **Use public, hard benchmarks.** I-SPY2 expression data (GEO: GSE194040) has pCR labels for 987 patients across several arms, and single-cell atlases such as GSE176078 can serve as references.
- **Compare against strong classical baselines,** including regularized regression and gradient boosting, with the same features and cross-validation.
- **Validate externally** on a separate cohort, report confidence intervals, and test with noise models or real hardware.
- **Measure what matters:** calibration, decision-curve benefit and stability of selected genes, not accuracy alone.

- **Be clear about claims.** An advantage in runtime or sample efficiency would be a result. Matching classical accuracy is not.

Outlook

TNBC treatment is advancing faster than the biomarkers meant to guide it, and its data are small, noisy and high-dimensional. Quantum machine learning is an interesting tool for that setting, but today it is a hypothesis, not a proven method. The most useful contributions in the coming years will probably be careful benchmarks on hard, public TNBC datasets, showing where quantum models help and where classical methods are enough.

Reference:

[Datopotamab deruxtecan approval, OncLive](#)
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[Nature 2026: Ecotypes of TNBC in response to chemotherapy](#)
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[PLOS One 2025: hybrid quantum-classical biomarker classification](#)
[QML for classification of eleven cancers \(bioRxiv\)](#)
[Quantum AI for cancer biomarker discovery \(arXiv\)](#)
[NQI workshop report on hybrid quantum algorithms \(arXiv\)](#)
[Robustness-oriented quantum-classical pipeline for breast cancer](#)
[Classical vs quantum models, breast histopathology \(Mathematics 2026\)](#)
[HQNN breast thermography \(arXiv 2604.16953\)](#)
[Quantum-based avian navigation optimizer for breast cancer biomarkers](#)

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