DeTection Inc. x Quandela

Successful Implementation of an Initial Photonic Quantum Classification Workflow

Medical / Biological Benchmark - Perfect Simulation Stage

Executive Summary

DeTection Inc. successfully implemented and executed an initial photonic quantum classification workflow using Quandela's MerLin framework. The work followed Quandela guidance to begin with FidelityKernel and Quantum Reservoir Classifier methods, use angle encoding, test 2-photon and 3-photon configurations, and establish a reproducible perfect-simulation benchmark before moving toward QPU-specific noise modeling and hardware.

Scientific scope: These are simulation results, not Quandela QPU results, clinical validation, or evidence of quantum advantage. The milestone is successful implementation and reproducibility of the photonic workflow.

Dataset Provenance and Attribution

The benchmark data were **not created or populated by DeTection Inc., Google, or Quandela**. The experiment used the **Breast Cancer Wisconsin (Diagnostic)** dataset distributed with scikit-learn. Scikit-learn identifies its copy as originating from the UCI Machine Learning Repository. The dataset contains 569 samples, 30 real-valued features, and two classes (212 malignant and 357 benign).

UCI attribution: Wolberg, W., Mangasarian, O., Street, N., & Street, W. (1993). *Breast Cancer Wisconsin (Diagnostic)* [Dataset]. UCI Machine Learning Repository. DOI: 10.24432/C5DW2B.

UCI lists the creators as William Wolberg, Olvi Mangasarian, Nick Street, and W. Street, and licenses the dataset under the Creative Commons Attribution 4.0 International (CC BY 4.0) license. The scikit-learn packaged copy was used for this experiment; DeTection Inc. then performed the experimental preprocessing, train/test split, PCA feature reduction, scaling/angle preparation, photonic simulations, and benchmark analysis.

Benchmark Design

Element	Implementation
Dataset	Breast Cancer Wisconsin (Diagnostic); scikit-learn copy of UCI WDBC
Dataset creators	William Wolberg; Olvi Mangasarian; Nick Street; W. Street
UCI DOI / license	10.24432/C5DW2B / CC BY 4.0
Samples / raw features	569 samples / 30 numerical features
Photonic representation	6 PCA features; approximately 89.2% explained variance retained
Encoding	Angle encoding; inputs scaled to [0, 1]
Quantum subset	80 training samples / 40 test samples
Photonic configurations	2 photons and 3 photons
Simulation stage	Perfect simulation (shots=0)
Software record	MerLin 0.4.1; Perceval-Quandela 1.3.0

Executed Results

Method	Photons	Accuracy	Status
MerLin FidelityKernel	2	97.5%	Perfect simulation completed
MerLin FidelityKernel	3	97.5%	Perfect simulation completed
Quantum Reservoir Classifier	2	97.5%	Perfect simulation completed

Method	Photons	Accuracy	Status
Quantum Reservoir Classifier	3	95.0%	Perfect simulation completed

Classical Reference Results

On the fixed train/test split, the full 30-feature classical reference models produced approximately **98.60% accuracy** for Logistic Regression and **97.90% accuracy** for an RBF SVM. The photonic simulation results should not be interpreted as demonstrating superiority over these classical baselines.

What Was Successfully Implemented

• A reproducible medical/biological binary-classification benchmark with a fixed data split.

• Photonic-compatible feature reduction and angle-encoding preparation.

• MerLin FidelityKernel execution with both 2-photon and 3-photon configurations.

• Quantum Reservoir Classifier execution with both 2-photon and 3-photon configurations.

• Preservation of benchmark results and an experiment manifest for reproducibility and review.

• A workflow designed to transition from perfect simulation toward Quandela-specific noise/detector modeling and, after Quandela review/access, photonic QPU execution.

Next Technical Stage

The appropriate progression is technical review by Quandela, followed by insertion of live QPU-specific noise and detector parameters, evaluation of hardware-oriented sampling (target approximately 10,000 samples per data point where appropriate), and eventual execution on Quandela photonic hardware.

Interpretation for Research Collaboration

This implementation demonstrates that DeTection Inc. can take a standardized, publicly available medical/biological benchmark through a complete photonic quantum simulation pipeline. It provides a concrete computational foundation for discussions with medical and biological research collaborators while the quantum-computing pathway advances toward hardware evaluation.

References

1. Wolberg, W., Mangasarian, O., Street, N., & Street, W. (1993). *Breast Cancer Wisconsin (Diagnostic)* [Dataset]. UCI Machine Learning Repository. DOI: 10.24432/C5DW2B.

2. scikit-learn, *sklearn.datasets.load_breast_cancer*: packaged copy of the UCI ML Breast Cancer Wisconsin (Diagnostic) dataset; 569 samples, 30 features, binary malignant/benign classification.

Prepared: September 28, 2026 | **DeTection Inc.** | detec.ai
Important limitation: Research benchmark only. Not a clinical diagnostic result, not a QPU hardware result, and not a claim of quantum advantage.