

Sharper vision, lighter compute.

Together with Toyota Motor and Toyota Tsusho, ORCA Computing completed a benchmarking study to demonstrate that ORCA's PT-2 photonic quantum accelerator can reduce AI energy consumption.

IMAGE CLASSIFICATION

1. The computational burden

Image classification models, from Convolutional Neural Networks (CNNs) to Vision Transformers, are expensive to train and run, consuming significant energy and GPU capacity. As models grow to handle real-world vision tasks, those computing costs climb with them.

The challenge is to reduce this computational burden without sacrificing classification accuracy, and to find approaches that scale to larger datasets and more powerful models.

2. The value that ORCA delivers

By using ORCA's quantum prior as an input into the classical model, ORCA lowered classical computational requirements and improved model performance without major changes to existing machine-learning pipelines.

Quantum features in CNN layers delivered a 25% reduction in classical computing requirements at the same model accuracy, and replacing CNN layers with a quantum reservoir pushed this further to an 85% reduction with only slightly reduced accuracy.



The ORCA partnership is essential for providing our customers with access to industry-leading quantum computing systems, enabling them to harness the power of quantum computing in areas such as automotive, chemicals and Industry 4.0."

Takashi Matsuda, Enterprise IT Department, Toyota Tsusho

21%

reduction in energy consumption, with quantum-accelerated Vision Transformers and CNNs outperforming classical baselines

85%

reduction in classical computing requirements

25%

reduction in classical computing requirements at the same model accuracy using quantum features in CNNs

USE-CASE IMPLEMENTATION

Hybrid solution

PT-2 photonic quantum accelerator
(48 qumodes)

Classical HPC with NVIDIA GPUs

ORCA SDK with Python and PyTorch
compatibility

AI approach

Quantum-accelerated CNNs and Vision
Transformers for image classification