



From Theory to Impact

Real-World Results in Quantum Machine Learning

Quantum Machine Learning is making a pivotal leap from abstract research to tangible business outcomes. Paired with the power of classical AI, these hybrid solutions are fast-tracking the arrival of Quantum Advantage, proving the era of quantum-derived business value is now a present reality.



What we've achieved here is a testament to the power of convergence. By combining KPMG's business-centric approach with Kipu's algorithmic ingenuity and IBM's state-of-the-art quantum systems, we've collectively pushed beyond the theoretical and set a new bar for what's possible in the era of quantum-enhanced machine learning.

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Demonstrating Quantum Results

For years, the promise of quantum computing has been one of revolutionary, future potential. Today, that future is arriving. The conversation is shifting from the theoretical to the tangible, as new research demonstrates that quantum computers can offer a practical, measurable advantage for complex business problems now. A recent collaboration between KPMG, IBM, and the quantum software provider Kipu Quantum has produced one of the first clear, reproducible demonstrations of quantum-enhanced machine learning, achieving results on a real-world problem that outperform today's most robust classical computers.

The Challenge: Pushing the Boundaries of Classical ML

In our data-rich world, businesses increasingly rely on Artificial Intelligence (AI) to find signals in the noise. From analyzing satellite imagery for climate risk and agricultural planning to detecting sophisticated financial fraud, the complexity of these tasks is pushing even the most powerful classical AI to its limits.

The research addressed a challenge representative of this complexity: classifying fifteen different types of trees using multi-sensor satellite data. This is an incredibly difficult task, as different species can appear structurally similar, and the data comes from varied sources (high-resolution aerial photos, multi-spectral imagery, and radar). The established industry standard, a powerful deep-learning model (ResNet50), achieved a strong but limited accuracy of 84%. In high-stakes environments, where small accuracy gains can translate into millions of dollars or significantly improved outcomes, this is where the next leap is needed.

The Solution: Enhancing, Not Replacing, with Quantum

Instead of replacing proven classical methods, our approach was to enhance them. We developed a hybrid quantum-classical workflow that uses the best of both worlds:

- 1. Classical Feature Extraction:** First, we used the powerful classical AI model to do what it does best—perform an initial analysis of the satellite images to extract the most important features.
- 2. Quantum Feature Enhancement:** These classical features were then "fed" into an IBM quantum processor. By encoding this information into a quantum state and leveraging the unique principles of quantum dynamics, the quantum computer was able to analyze the relationships between the features in a fundamentally new way. This process uncovered more subtle, complex, and high-dimensional patterns which were invisible to the classical computer alone.
- 3. Final Classical Analysis:** The result of the quantum processing was a new, richer set of "quantum-enhanced" features. These features were then used to train a final machine learning model, which made the ultimate classification.

The Result: Clear and Present Quantum Results

The results were a clear and unambiguous success, demonstrating a consistent and reproducible advantage.

- **Accuracy Boost:** The hybrid quantum-classical method increased the classification accuracy to 87%, a 3% absolute improvement over the best-in-class classical model.
- **Proven on Real Hardware:** Crucially, this was not a simulation. These results were achieved on commercially available IBM quantum computers, proving that this advantage is attainable today with near-term quantum devices.
- **Consistent Performance:** The accuracy uplift remained consistent across various quantum hardware platforms, validating the robustness and reliability of the quantum enhancement technique.
- **This 3% improvement is far from trivial.** In domains like credit risk modeling, supply chain optimization, or medical diagnostics, such a gain in predictive power represents a significant source of new value and a powerful competitive differentiator. It marks a pivotal moment where we can confidently say quantum is demonstrating practical commercial use cases.

Why This Matters for Your Business

This research moves quantum computing beyond the hype and into the realm of usable business application. The key takeaways for leaders are clear:

- **A New Competitive Edge is Here:** The question is no longer if quantum will impact business, but how and when. This study is a proof point that quantum-enhanced workflows can unlock superior performance and a tangible competitive edge.
- **Broad Applicability:** While this experiment focused on satellite imagery, the underlying method—using quantum to find hidden patterns in complex data—is broadly applicable. It can be adapted to enhance solutions in fraud detection, customer segmentation, risk modeling, medical imaging, and materials discovery.
- **The Time to Get “Quantum Ready” is Now:** The barrier to entry for exploring quantum’s potential is lowering.

Companies which begin to identify high-impact use cases and build a quantum-ready strategy today will be best positioned to lead their industries tomorrow.

How can KPMG Quantum Research help?

At KPMG, we believe the quantum future is something you build, not just something you prepare for. Our Quantum Research initiatives focus on translating cutting-edge science into real-world business applications. We collaborate with clients to navigate this new landscape, identify high-impact use cases, and co-develop a strategic roadmap to harness quantum advantage as it emerges.

The journey to quantum value is a marathon, not a sprint, but this result proves we have taken a major leap forward. It's time to explore what a quantum-enhanced future could look like for your business.

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