SUPPLEMENTARY MATERIALS:

A Selection of Quantum Use Cases

The following list is driven by interactions with enterprise customers, Zapata's domain expertise, and our proprietary IP. These use cases suggest ways Zapata expertise can be applied to industry applications using Orquestra®. All use cases can be addressed with quantum and quantum-inspired techniques.
## A Selection of Quantum Use Cases:

### Aerospace / Defense / Automotive

#### Optimization
- Identifying failure modes through fault-tree analysis as combinatorial optimization
- Manufacturing process optimization
- Autonomous vehicle route optimization
- Inbound/outbound communications traffic optimization
- Flight route optimization

#### Machine Learning
- Predictive maintenance using variational quantum classifier
- Object identification for autonomous vehicles
- Anomaly detection by time series analysis using quantum Boltzmann machine
- Image and audio generation and classification using quantum-enhanced machine learning
- Generating augmented datasets to train autonomous vehicles

#### Simulation & Modeling
- Variational methods for general linear PDEs arising in engineering design
- Computational Fluid Dynamics (CFD) for aerodynamic design
- Heat transfer related PDE-constrained optimization for engine design
- Wave equation simulation using variational linear systems solver

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Green represents use cases for which Zapata IP could be applied.
A SELECTION OF QUANTUM USE CASES:

BioPharma

Optimization
- Molecular structure analysis by combinatorial optimization
- Protein design using unconstrained discrete optimization
- Manufacturing process optimization
- Dosage optimization

Machine Learning
- Patient feature selection for clinical trial data
- Quantitative structure-activity relationship (QSAR) using quantum-enhanced supervised learning
- Natural language processing for automated literature search
- Molecular screening and generation in drug discovery using generative modeling
- Generative modeling for clinical trial data analysis

Simulation & Modeling
- QM/MM method for molecular binding affinity prediction in drug discovery
- Ab initio transition state analysis for catalytic reaction simulation
- Ab initio determination of the crystalline structure of organic molecules
- Preclinical drug chemoinformatics and candidate screening

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A SELECTION OF QUANTUM USE CASES:

**Chemicals & Materials**

### Optimization
- Process optimization in chemical reaction networks for maximizing yield
- Prediction of alloy ground state orderings from cluster expansions
- Manufacturing process optimization

### Simulation & Modeling
- Singlet-triplet transition energy prediction for OLED molecules
- Quantum-enhanced force-field methods for chemical dynamics simulation
- Homogeneous and heterogeneous catalysis modeling using electronic structure calculations
- Predicting chemical kinetics using electronic structure calculation
- Ab initio simulations to accelerate materials discovery (e.g., Li-ion electrolytes/electrodes, photovoltaics, catalysts, alloys)

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Consumer / FMCG

Optimization

- Consumer goods delivery optimization
- Inventory optimization (including upstream raw materials)
- Manufacturing process optimization

Machine Learning

- Modeling market demands for various product lines
- Generative modeling for anomaly detection in quality control
- Generative modeling for new visual content and design

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# A Selection of Quantum Use Cases:

## Energy / Oil & Gas / Utilities

### Optimization
- Finite time-window scheduling in energy allocation for smart grids
- Flow optimization in chemical processes
- Distribution and delivery optimization
- Battery usage optimization

### Machine Learning
- Predictive maintenance of energy pipelines
- Upstream exploration and production

### Simulation & Modeling
- Simulation of solar cell materials
- Turbulent mixing simulation in predictive environmental modeling for climate change
- Quantum-accelerated stochastic simulation of Reynolds-Averaged Navier-Stokes (RANS) systems

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## A SELECTION OF QUANTUM USE CASES:

### Finance / Banking / Investing / Insurance

<table>
<thead>
<tr>
<th>Optimization</th>
<th>Machine Learning</th>
<th>Simulation &amp; Modeling</th>
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</thead>
<tbody>
<tr>
<td>• Sampling from risk-neutral probability measure for asset pricing</td>
<td>• Improved graph clustering analysis for anomaly and fraud detection</td>
<td>• Quantum-assisted Monte Carlo for derivative pricing, credit valuation adjustment</td>
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<tr>
<td>• Portfolio optimization and asset allocation</td>
<td>• Feature selection for predicting financial data</td>
<td>• Accelerated sampling from stochastic processes for risk analysis</td>
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<tr>
<td>• Optimize ATM cash replenishment for maximal efficiency</td>
<td>• Time series analysis of financial data using quantum Boltzmann machines</td>
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<td>• Dimensionality reduction for financial data using quantum-classical hybrid optimization</td>
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<td></td>
<td>• Financial data augmentation with generative ML to improve financial simulation by increasing the size of the dataset</td>
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Healthcare

A SELECTION OF QUANTUM USE CASES:

Optimization

- Optimal healthcare resource allocation e.g., patient treatment matching and priority scheduling of doctors and therapies

Machine Learning

- Augment datasets or synthetic data creation
- Generative modeling for improving imaging analysis

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A SELECTION OF QUANTUM USE CASES:

**Manufacturing**

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<tr>
<td>• Factory floor automation</td>
<td>• Predictive maintenance using variational quantum classifier</td>
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<tr>
<td>• Design process optimization</td>
<td>• Generative modeling for anomaly detection in quality control</td>
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<td>• Inventory optimization</td>
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<tr>
<td>• Distribution and supply chain optimization</td>
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<td>• Manufacturing process optimization</td>
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# A SELECTION OF QUANTUM USE CASES:

## Operations & Logistics

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<tr>
<td>• Improving timing in job scheduling</td>
<td>• Irregular operation (IROP) prediction using quantum-enhanced supervised learning</td>
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<tr>
<td>• Disruption management by optimized traffic re-routing</td>
<td>• Modeling market demand for replenishment</td>
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<td>• Supply chain optimization</td>
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<td>• Workforce optimization and scheduling</td>
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<td>• Fuel/energy optimization</td>
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<tr>
<td>• Reverse logistics optimization (recycling, reuse, disposal, recalls)</td>
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<tr>
<td>• Generating efficient transportation routes for vehicle fleets with improved qubit cost</td>
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A SELECTION OF QUANTUM USE CASES:

Telecommunications / Media / IT / Security

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<tr>
<td>• Display advertising optimization for maximizing clickthrough rate (CTR)</td>
<td>• Hybrid quantum-classical generative modeling for content creation</td>
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<td>• Hash collision for proof-of-work cryptocurrency mining</td>
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<tr>
<td>• Inbound/outbound communications traffic optimization</td>
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<tr>
<td>• Network optimization</td>
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