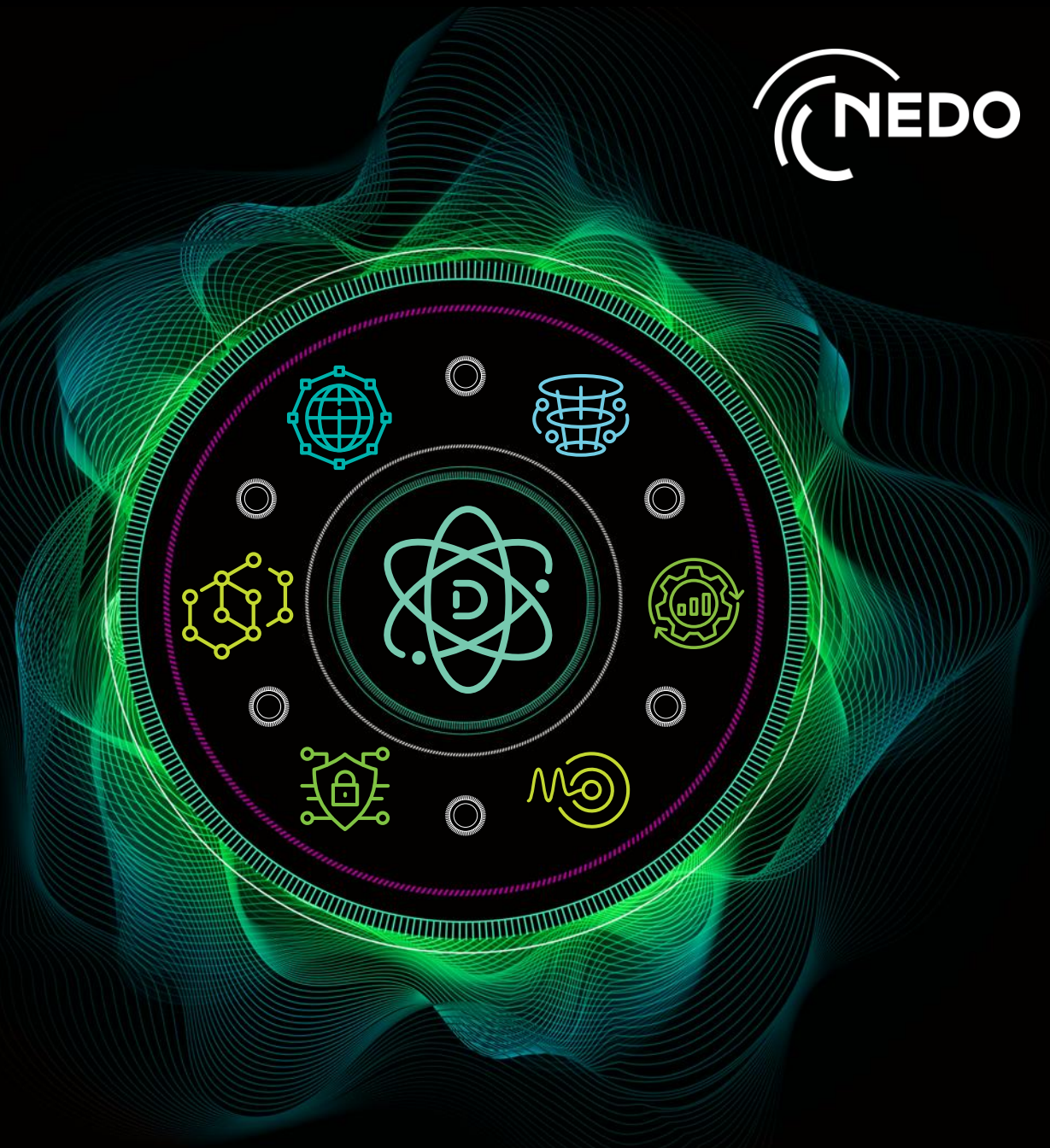
Quantum Computing Use Cases

Driving risk prediction based on vehicle sensor data

Aioi Nissay Dowa (USA) , AWS



New Energy and Industrial Technology Development Organization (NEDO)

Aioi Nissay Dowa (USA)・AWS: Driving risk prediction based on vehicle sensor data [2021/05]

Concept

Industry	Finance
Process	Insurance
Method	AI
Category	Gate*

Background

- Aioi Nissay Dowa (USA) is promoting the **development of data science-based products and services for the transportation industry.**
- Since vehicles are equipped with a number of sensors that collect data, we would like to perform **vehicle driving risk assessment using sensor data.**
- In order to assess risk, **a method using a binary classifier** is being considered for classifying data by assigning binary labels (0 or 1, Safe or Fail, etc.) to input data.

Issues and motivation to be solved

- One machine learning technique used to classify data is deep learning, and **it is an open question whether quantum neural networks (QNN) powered by quantum technology have a practical computational advantage over classical neural networks.**
- Aioi Nissay Dowa (USA) and AWS conducted **a validation to predict driving risk using vehicle telematics data using quantum machine learning**

Problem setting as a quantum computer

- **Using vehicle telematics data, perform machine learning and validate to predict driving risk** with autonomous driving levels L1 and L2*
- **QNN using quantum technology** is used as the machine learning circuit
- The machines are powered by **Amazon Braket,** AWS's quantum computing service.

Expected business benefits

- Using quantum machine learning, **By combining QNN with the Amazon Braket quantum computing service, we were able to show how to analyze vehicle telematics data**.

*L1 is the driving assistance (Automatic braking, follow the car in front of you (ACC), stay out of the vehicle (LKAS)) and L2 is the automated driving function under specific conditions (L1 combination)
Reference: AWS"Using Quantum Machine Learning with Amazon Braket to Create a Binary Classifier" (https://aws.amazon.com/jp/blogs/quantum-computing/aioi-using-quantum-machine-learning-with-amazon-braket-to-create-a-binary-classifier/), Magnica "What are the levels of autonomous driving? Explains all the way up to level 0~5" (https://www.macnica.co.jp/business/maas/columns/135343/)
*Gate（gate-based）: A computing approach in which operations are applied sequentially to qubits to perform calculations. Similar in concept to logic circuits in classical computers, it can address a wide range of problems.

More use cases are available on our website. We invite you to explore them.
https://www.quantum-computing-use-cases.nedo.go.jp/english/

More Use Cases

New Energy and Industrial Technology Development Organization (NEDO)
AI and Robotics Department (e-mail: quantum_ai@ml.nedo.go.jp)

This collection of use cases was obtained as a result of the work commissioned by the New Energy and Industrial Technology Development Organization (NEDO) "Cyber-Physical Development Business of Quantum/Classical Hybrid Technology/Study of Use Case of Quantum Technology" and the “Post-5G Information and Communications System Infrastructure Reinforcement R & D Project (Quantum Industrialization)/Comprehensive Study for Promoting the Industrialization of Quantum Computers”.