

Long-lived particle Anomaly detection with parameterized quantum circuits

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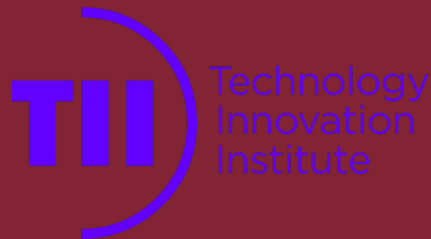
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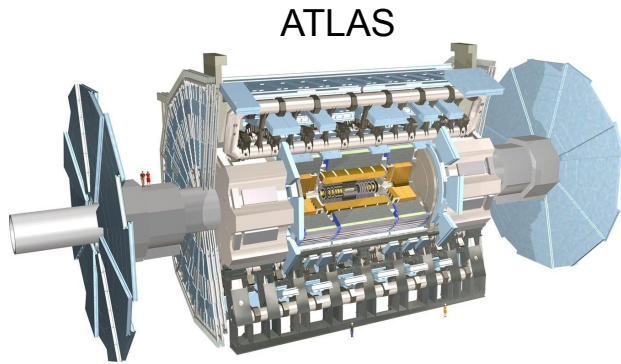


Italiadomani
PIANO NAZIONALE
DI RIPRESA E RESILIENZA



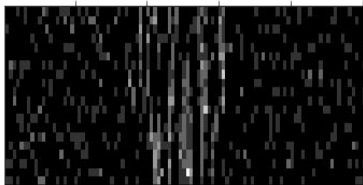
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Motivation

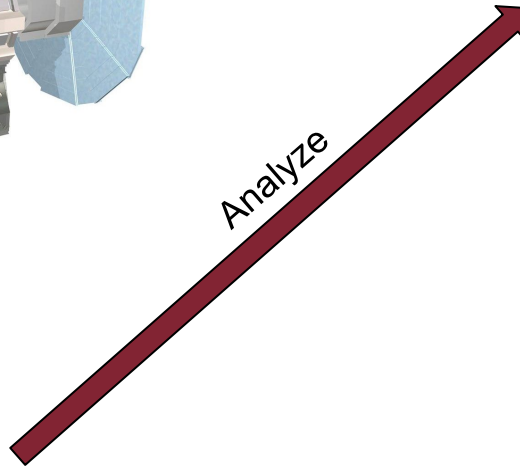
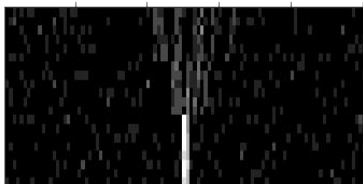


Collect data

Standard

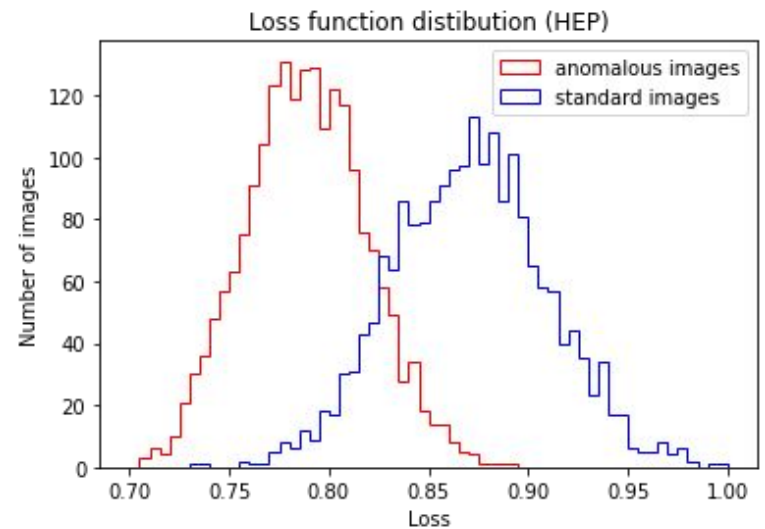
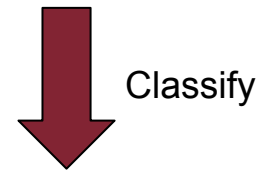
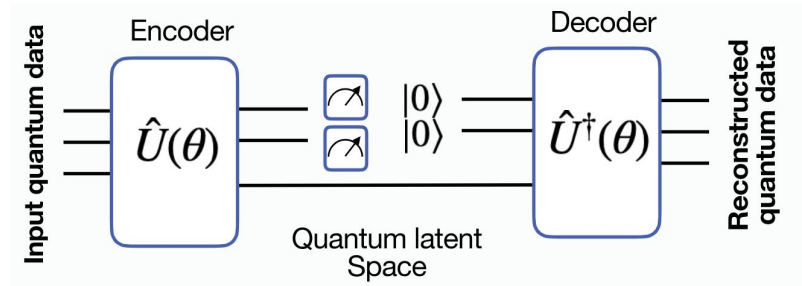


Anomalous



With the development of **quantum sensing** in particle detectors we may expect future instruments to output quantum data

Quantum autoencoder



Result obtained with a simulation

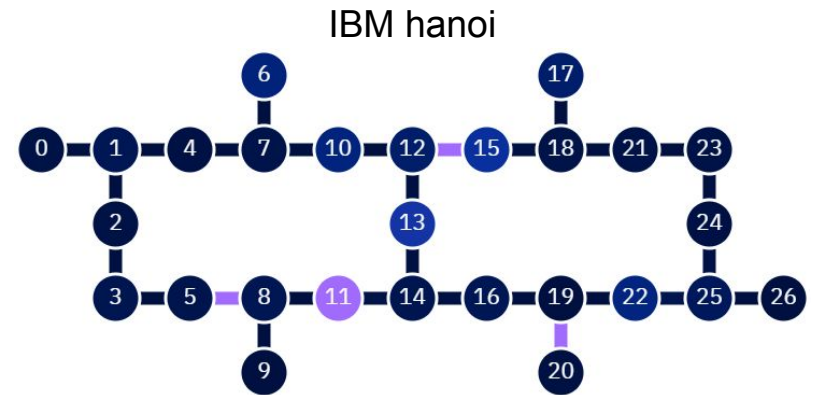
Quantum hardware implementation

NISQ devices limitations:

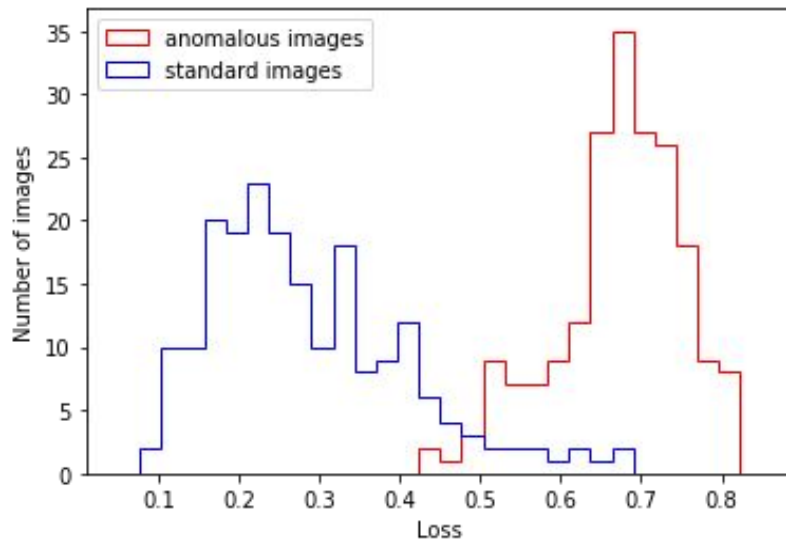
- High level of noise, short decoherence times.
- Qubits connectivity.
- Amplitude encoding.

Adaptations:

- Reduce circuit and task complexity.
- Match hardware connectivity.
- Train circuit to approximate encoding



Simulation (no noise)



Hardware

