Quantum variational circuits for anomaly detection and generative models

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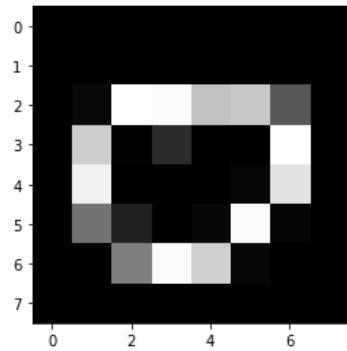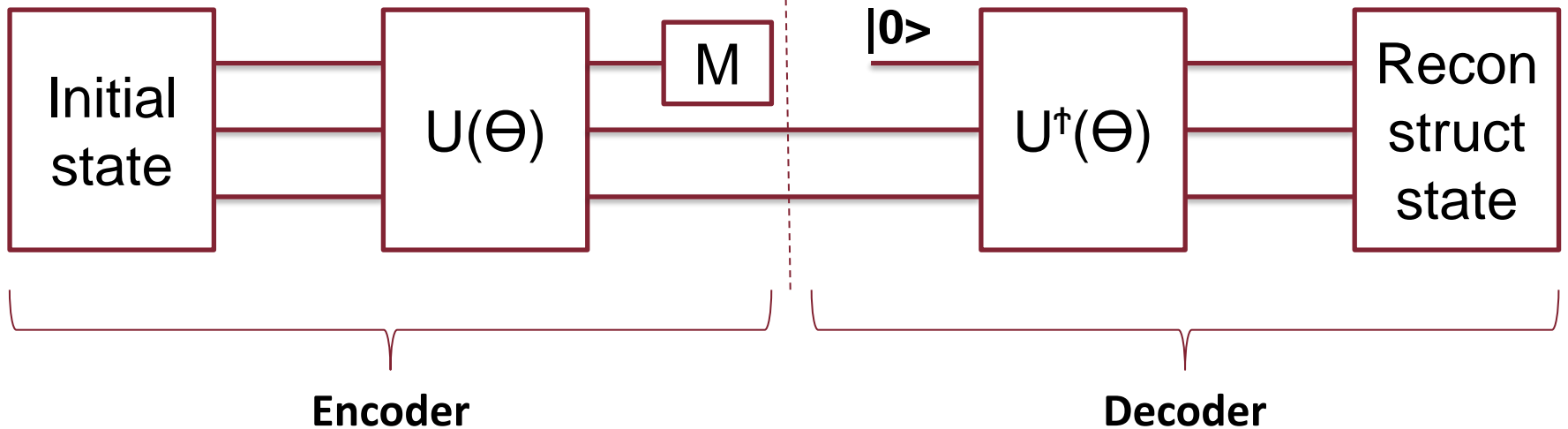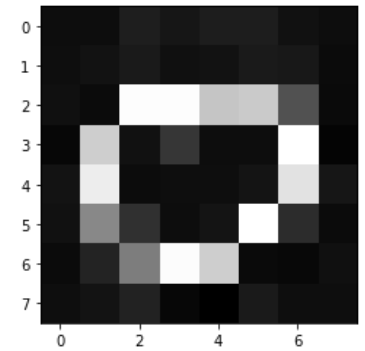Denis Stanev
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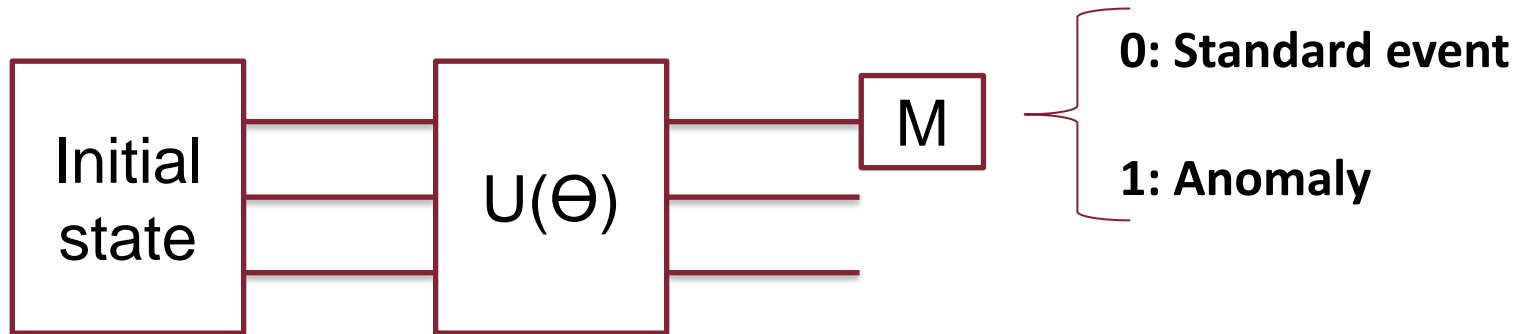
Quantum autoencoder

Anomaly detection

Application:
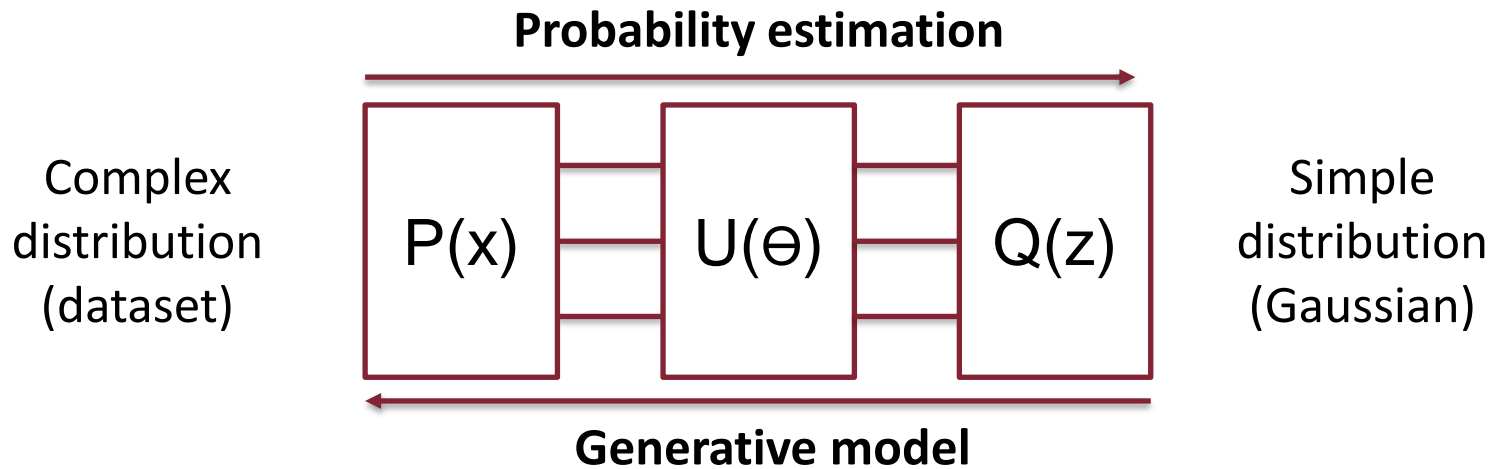
Identification of long life particles in ATLAS detector

Advantages:

- Amplitude encoding: good scaling with input size

- No decoder is needed

Generative model (quantum normalising flow)

Probability estimation

Complex distribution (dataset)

P(x)   U(Ө)   Q(z)

Simple distribution (Gaussian)

Generative model

Applications:

- Simulation of interactions of particles with matter for hig energy physics detector

- Simulation of low energy interaction processes for adrotherapy

Projects with IBM-Q

- Anomaly detection: tests on quantum hardware of pre-trained algorithm, end of september (1-2 hours)

- Generative model: tests on quantum hardware of pre-trained models on october-november (1-2 hours)

- Performance evaluation of the proposed quantum algorithms in presence of real noise, if possible training of the quantum variational circuits on quantum hardware (10-20 hours)