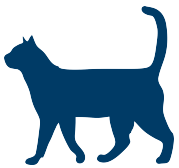
QAMP 2025
Qiskit-QCBMs

Qiskit Module for Quantum Circuit Born Machines

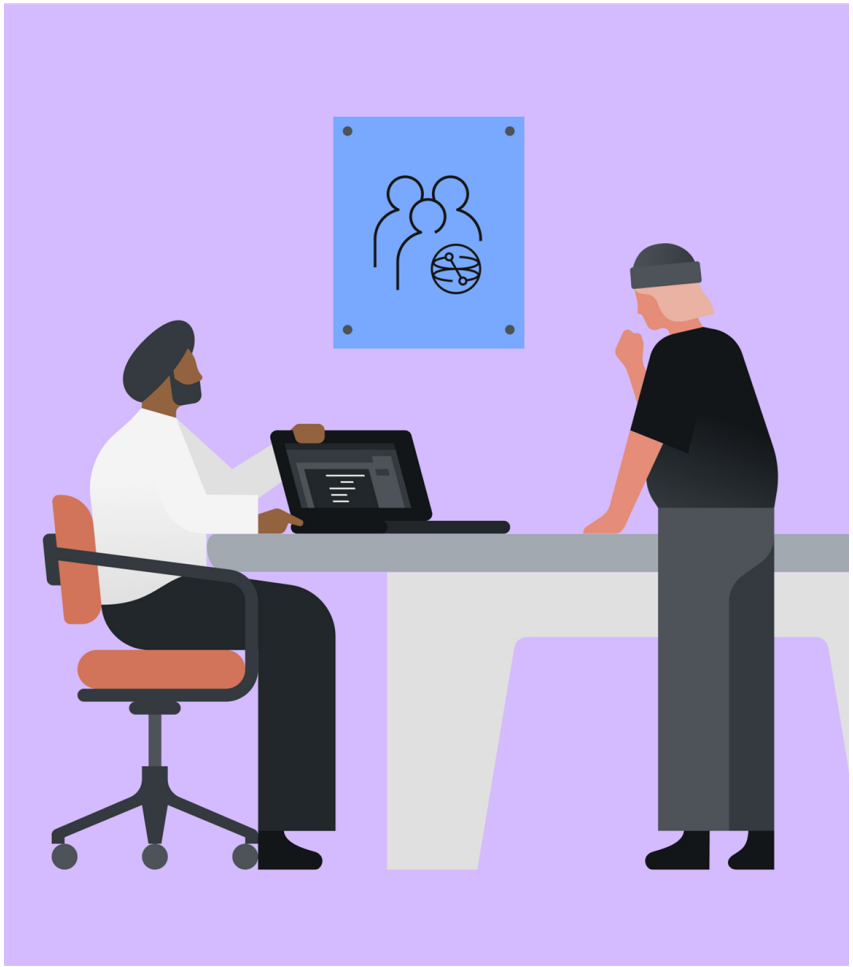
64



QAMP 2025

Qiskit-QCBMs

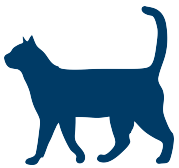
64



Speaker name: Jorge Plazas

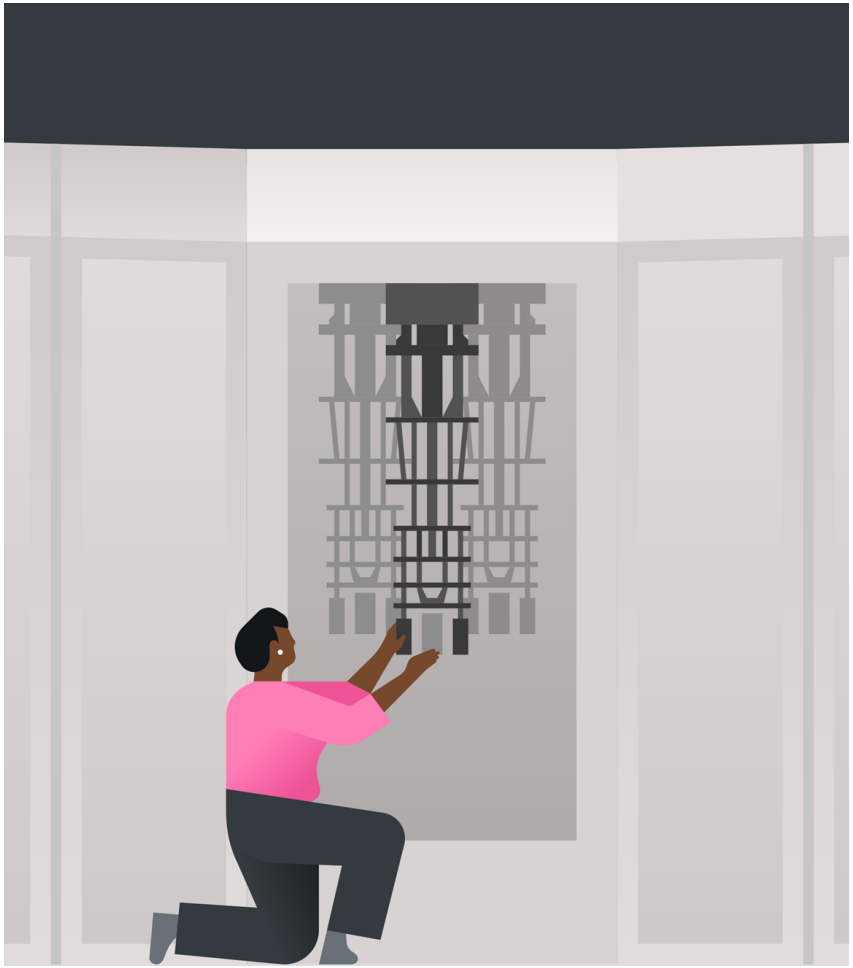
Team members: Debshata Choudhury

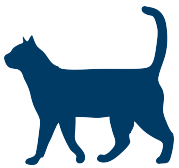
Mentor: Natalie Hawkins



Agenda

- Scope
- Deliverables
- Progress





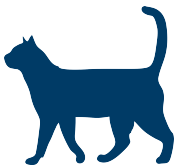
Scope: background

Quantum Circuit Born Machines

QCBMs are generative models that use quantum circuits to represent probability distributions.

Distribution of data $\rightleftarrows$ quantum state

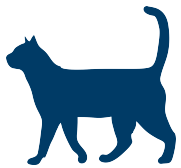
$$\pi(X) \quad \sim \quad \langle X|\psi_\theta\rangle$$



Scope: goal

Project # 64

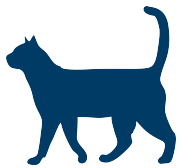
This project aims at developing a set of tools for implementing Quantum Circuit Born Machines using Qiskit.



Deliverables

Minimal Viable Product (MVP):

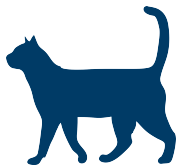
A jupyter notebook serving as a primer on QCBMs with examples of their implementation within the framework of Qiskit patterns.



Deliverables

Primary Deliverables

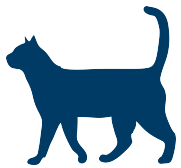
- A python module based on Qiskit for the implementation of QCBMs.



Deliverables

Primary Deliverables

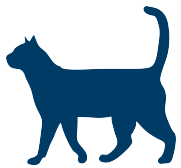
- A python module based on Qiskit for the implementation of QCBMs.
- A set of jupyter notebooks implementing use cases of QCBMs within the qiskit patterns framework.



Deliverables

Primary Deliverables

- A python module based on Qiskit for the implementation of QCBMs.
- A set of jupyter notebooks implementing use cases of QCBMs within the qiskit patterns framework.
- A report on performance metrics and comparisons with classical counterparts as benchmarks.

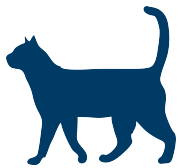


Progress

Approach

- Review of the state of the art

  Theory & Implementations



Progress

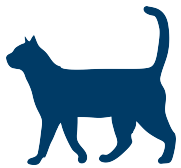
Approach

- Review of the state of the art

  Theory & Implementations

- Recast the above within

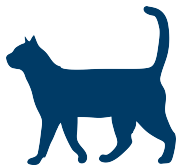
  Qiskit 2.x & Qiskit Patterns



Progress: methodology

Our methodology so far...

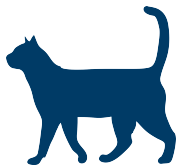
- Implementation of various components as functions.



Progress: methodology

Our methodology so far...

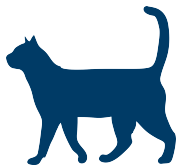
- Implementation of various components as functions.
- Various initial experiments.



Progress

Next Steps

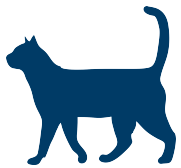
- Run larger experiments in current hardware.



Progress

Next Steps

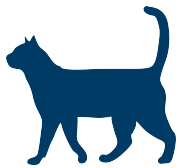
- Run larger experiments in current hardware.
- Structure the implemented tools as a module.



Progress

Next Steps

- Run larger experiments in current hardware.
- Structure the implemented tools as a module.
- Study scalability of the proposed implementation.




QISKIT ADVOCATE
2025
2025
MENTORSHIP PROGRAM