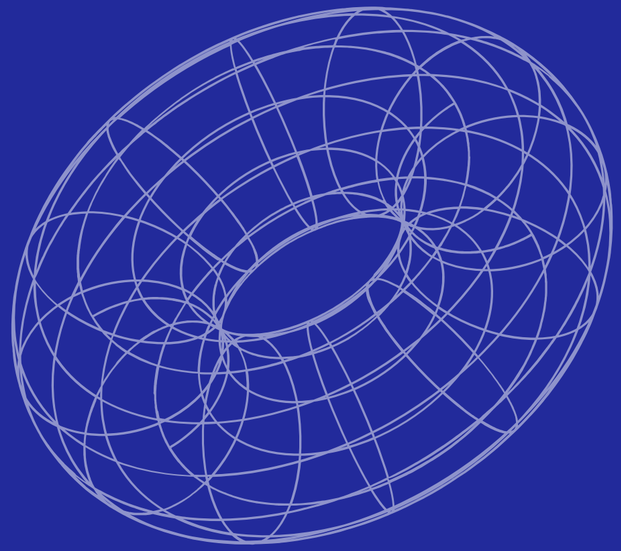
DEEP Q-LEARNING MEETS QISKIT QUANTUM COMPUTING

Training a cat to catch a mouse

Participants: Martin Sun(owner), Vasily Bokov & Daniel Molpe(participants)

Problem Description



- N*N Grid
- Agent [CAT] needs to reach goal [MOUSE] as fast as possible.
- Four Movement option [UP, DOWN, LEFT, RIGHT]
- The cat does not know where the mouse is.

Solution: Q-Learning with Variational Quantum Circuit

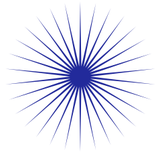
Why use quantum computing?

Better convergence time

- Using entangled qubits

Allows for more compexity

- Bigger grids
- More movement options(diagonals f.ex.)
- Moving goal - more staff for the cat to learn



Classical and Quantum algorithms meet

- Contribution to Variational Quantum Algorithms.

Two implementations

In our project we used two model of the cat catching the mouse.

- **CatHiddenMouse**

  Four actions (go only straight)
  and the cat cannot observe the mouse, so the mouse stay in one place.

- **CatMovingMouse**

  Four actions (go straight and diagonal). The mouse can stay or move. The cat can observe the mouse at any time.

Results

- Classic Q-Learning algorithm was implemented with Qisckit's quantum circuits.
- The models with different observation were created and described.
- A lot of opportunities for futher development had been found (f.ex. Multi-Agent)