

Amaia
Ane
Iván
Mikel
Rubén

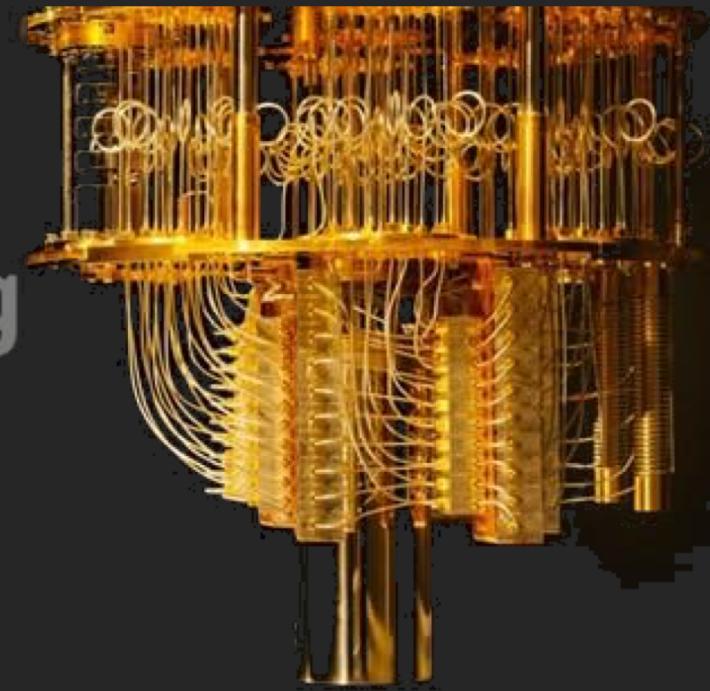
Tic-Tac-Q

Deep Quantum

Bilbao
Quantum Computing
HACKATHON

9 y 10 de diciembre 2019

INSCRIPCIONES: www.ilb.eus



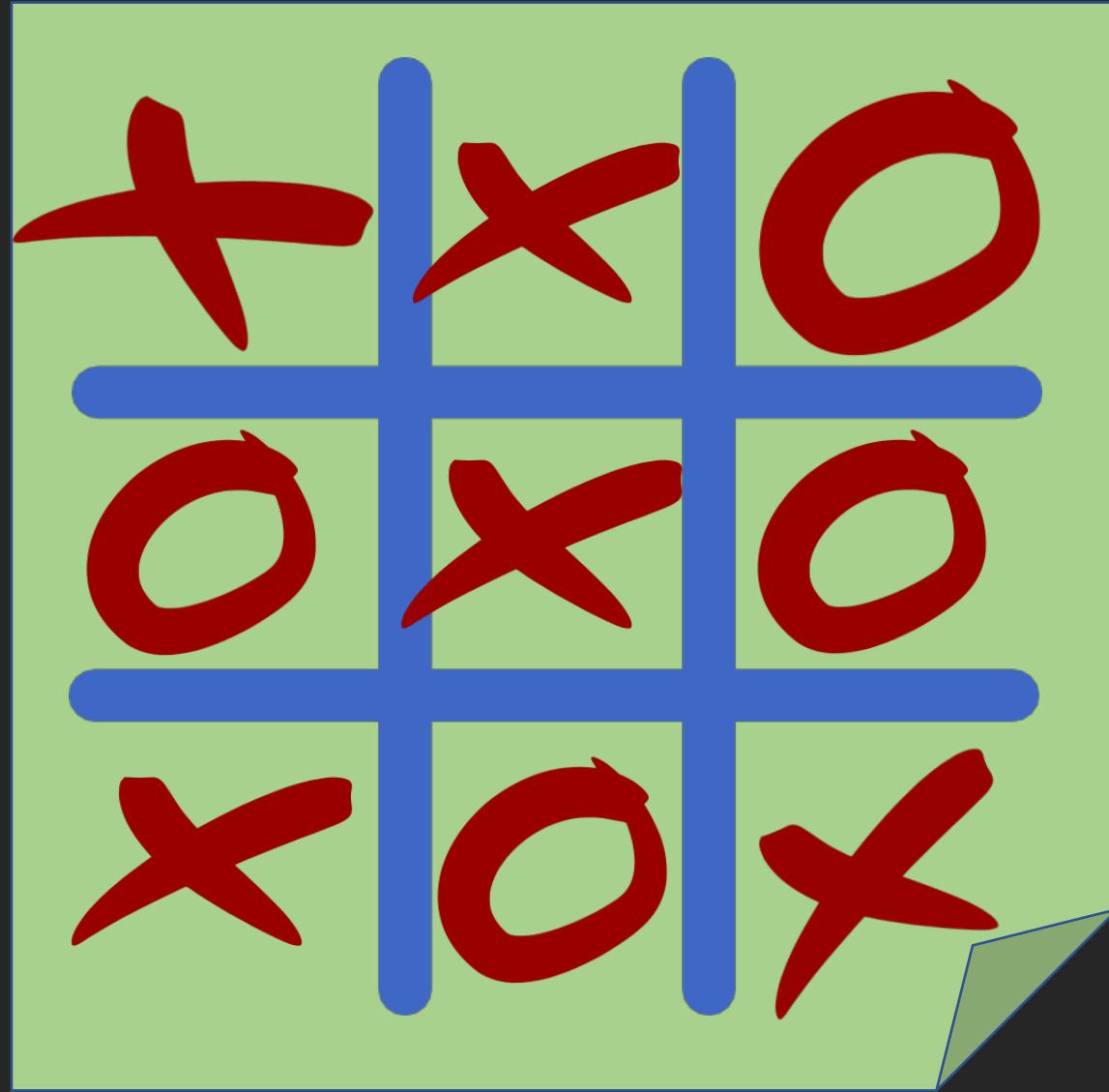
Organizado por

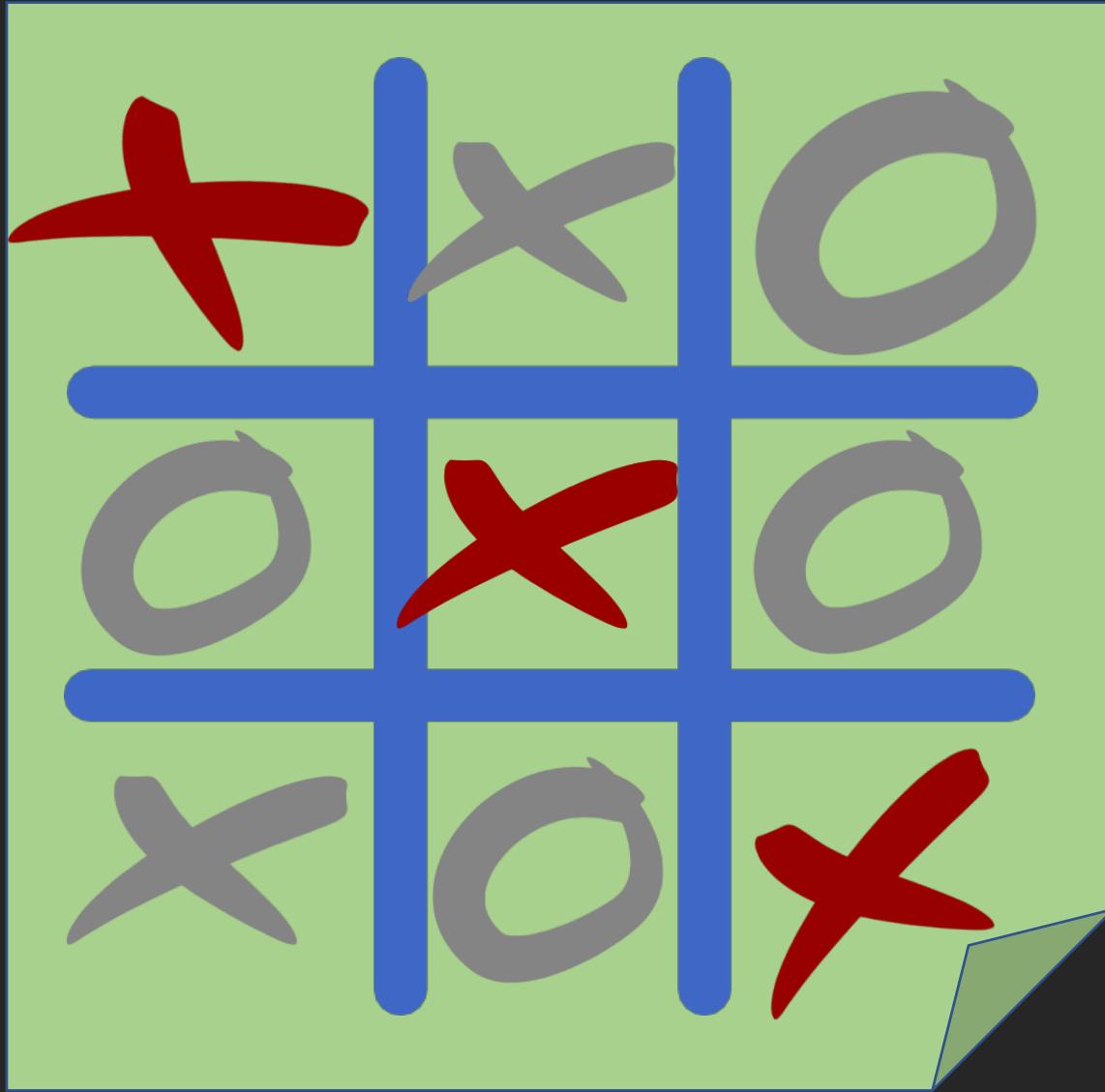


Colaboradores



What do we want?

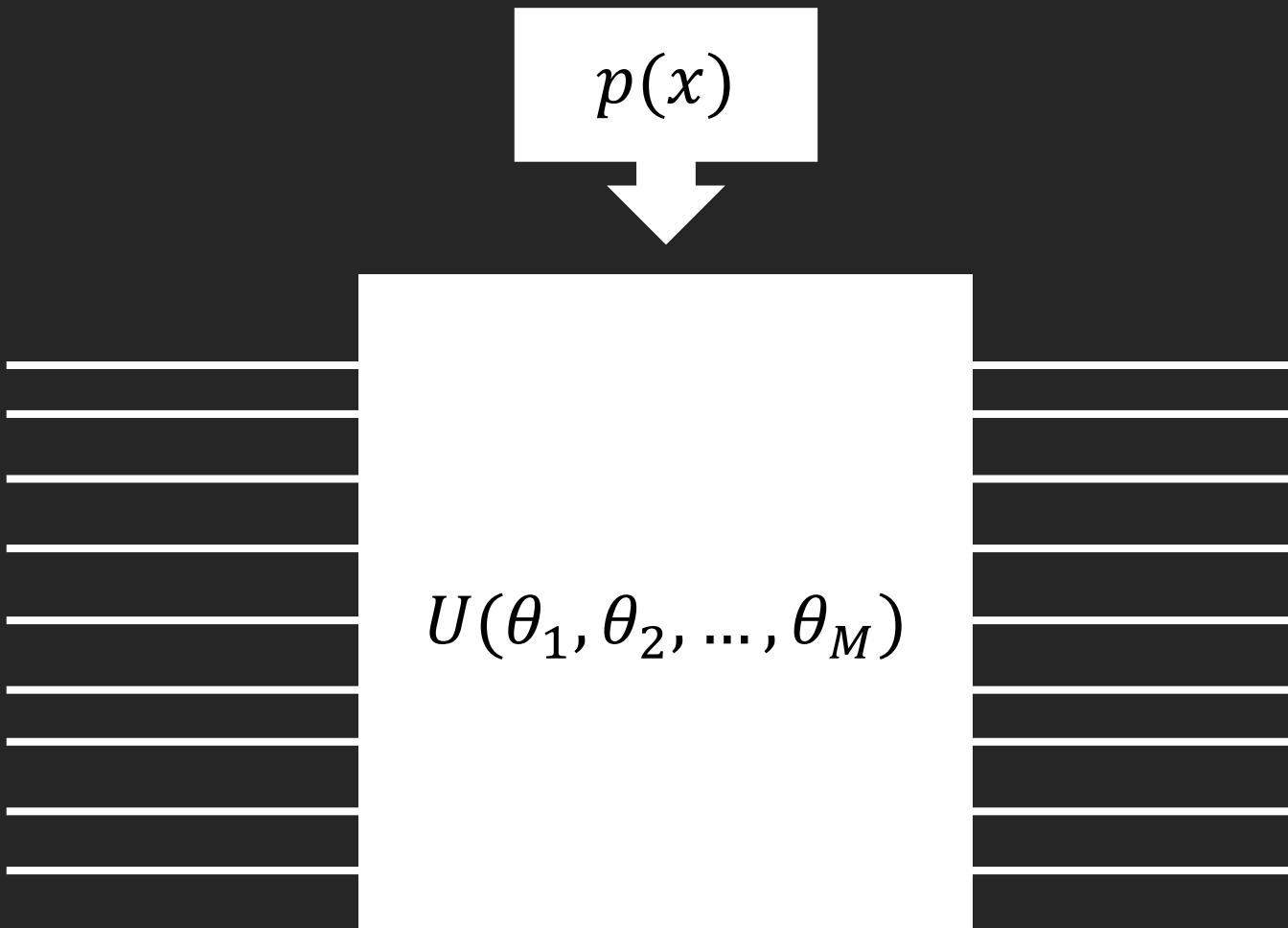




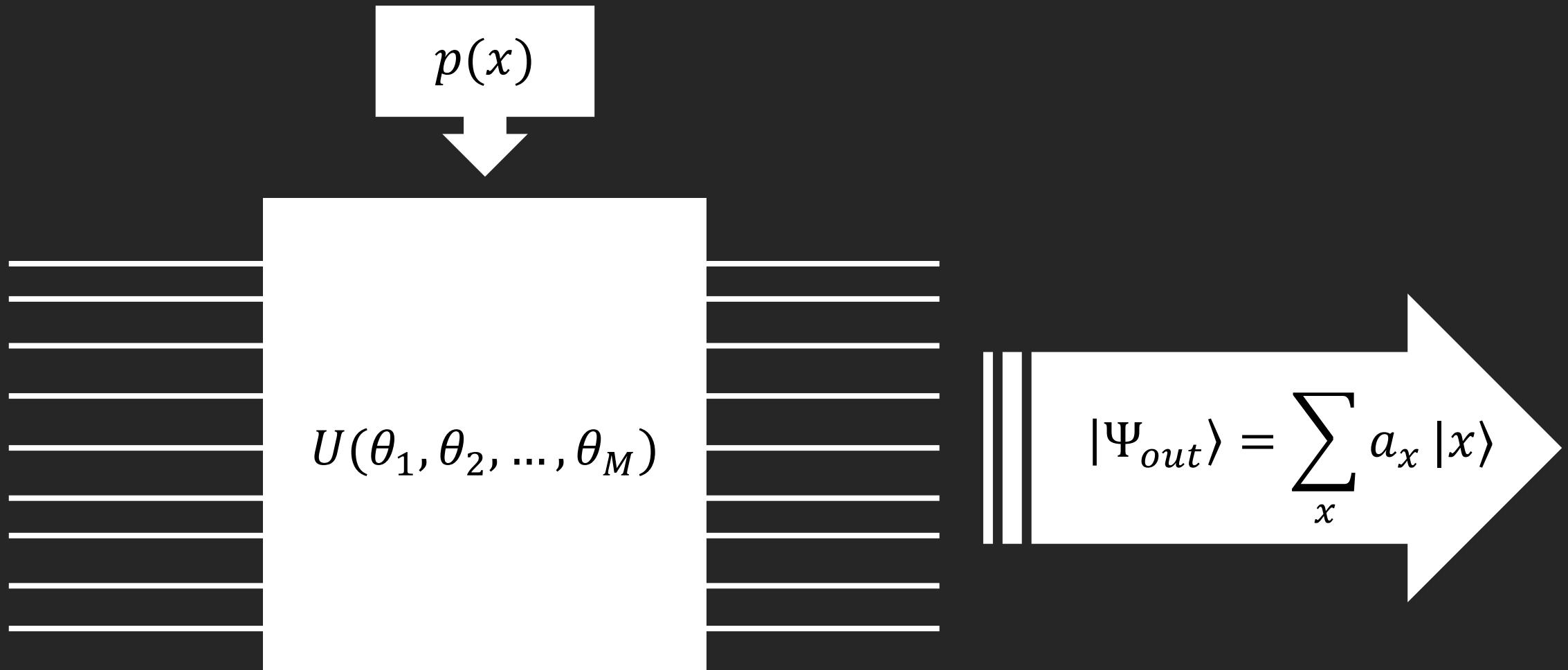
Quantum Born Machine

$$U(\theta_1, \theta_2, \dots, \theta_M)$$

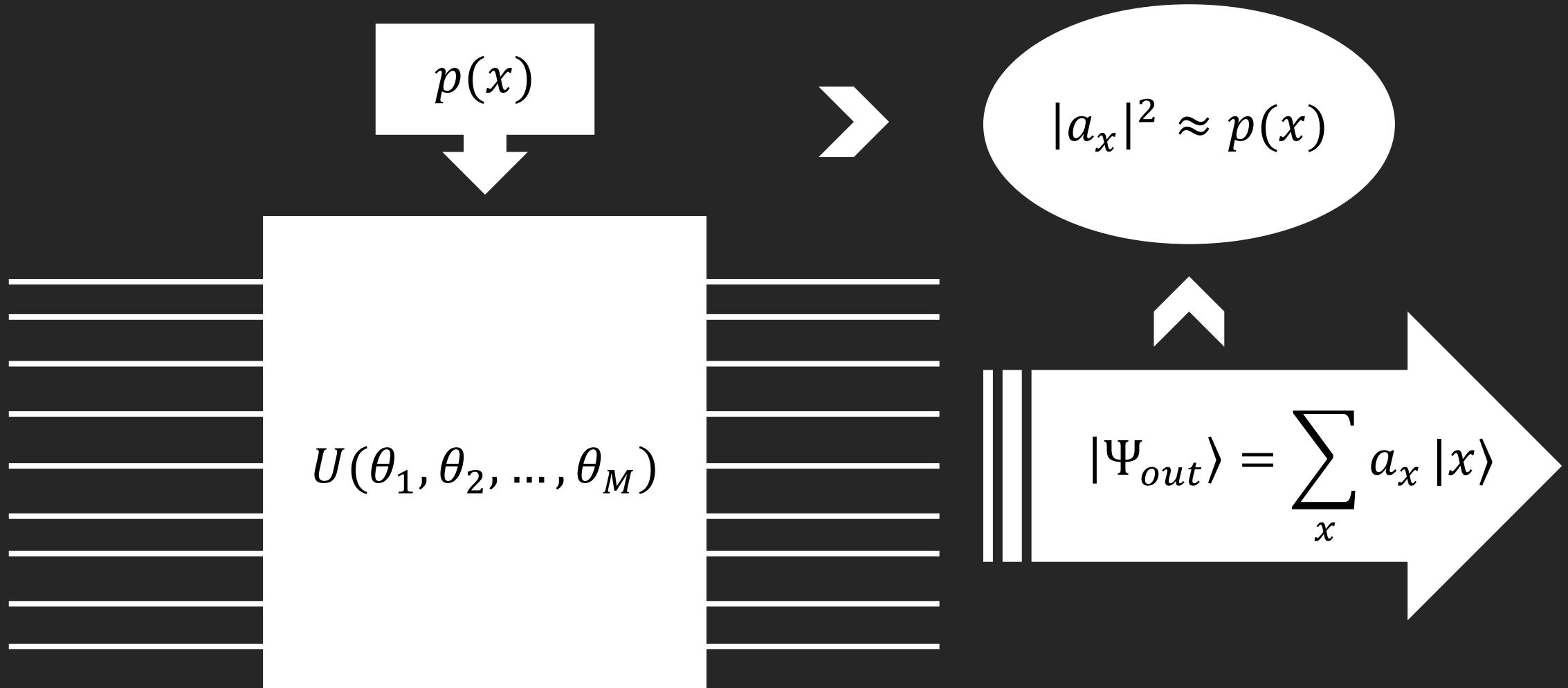
Quantum Born Machine



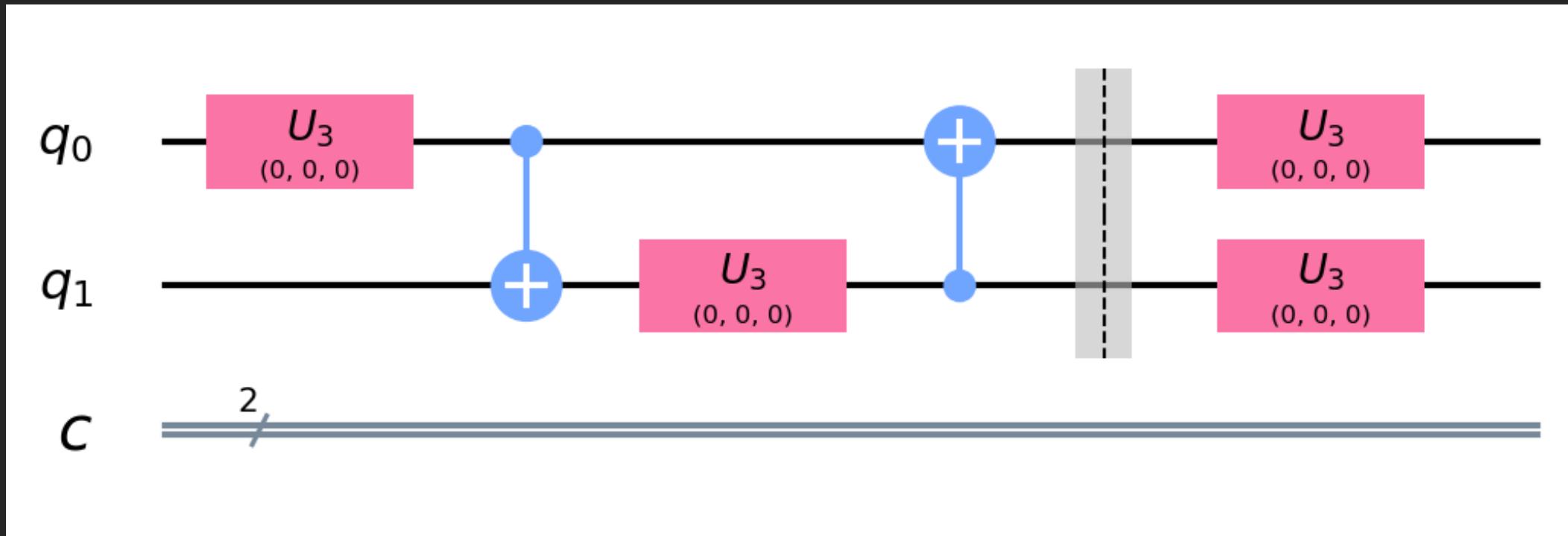
Quantum Born Machine



Quantum Born Machine



What we have done?



X	P(x)
$ 00\rangle$	0.5
$ 01\rangle$	0.2
$ 10\rangle$	0.2
$ 11\rangle$	0.1

Trial

$$(\theta_1, \theta_2, \dots, \theta_M)$$



$$U(\theta_1, \theta_2, \dots, \theta_M)$$

Final

$$(\theta_1, \theta_2, \dots, \theta_M)$$



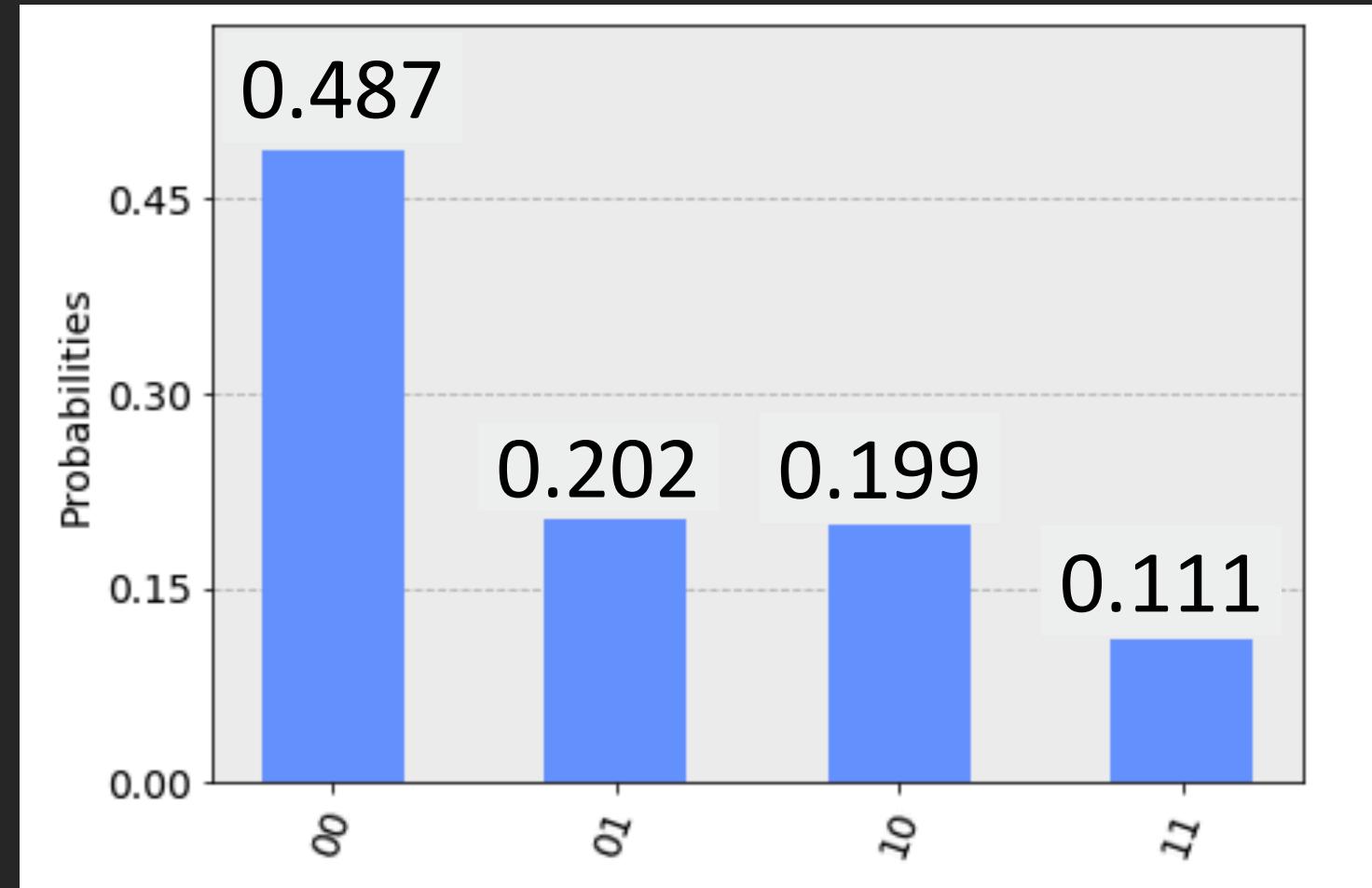
$$|a_x|^2$$

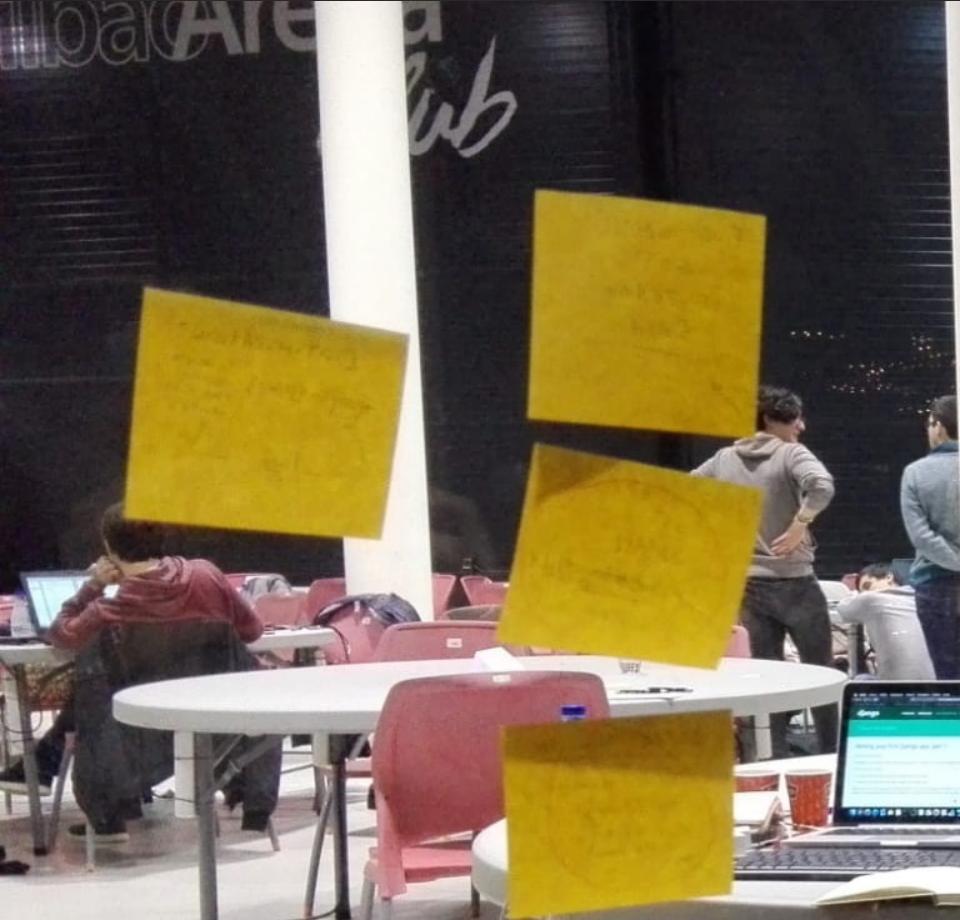


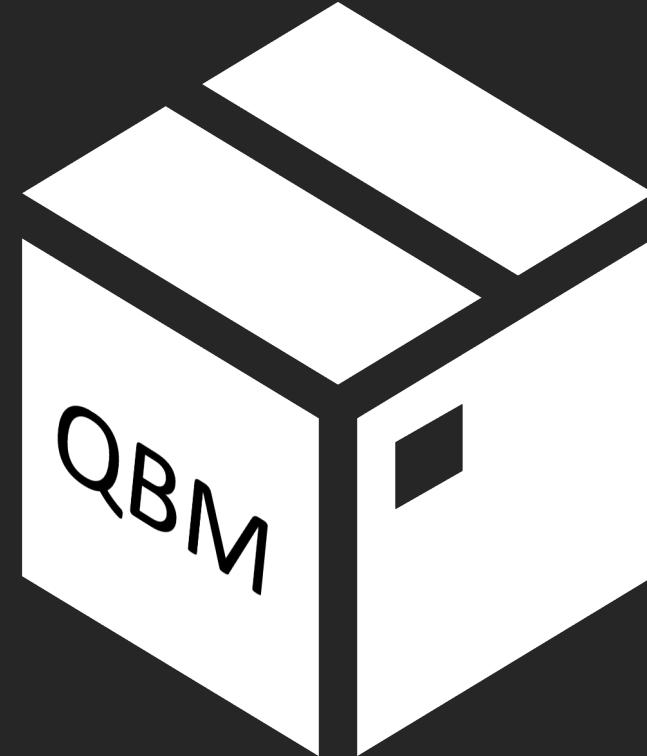
$$\begin{aligned} & \text{Minimize :} \\ & ||a_x|^2 - p(x) \end{aligned}$$

Comparison obtained probability distribution

X	P(x)
$ 00\rangle$	0.5
$ 01\rangle$	0.2
$ 10\rangle$	0.2
$ 11\rangle$	0.1

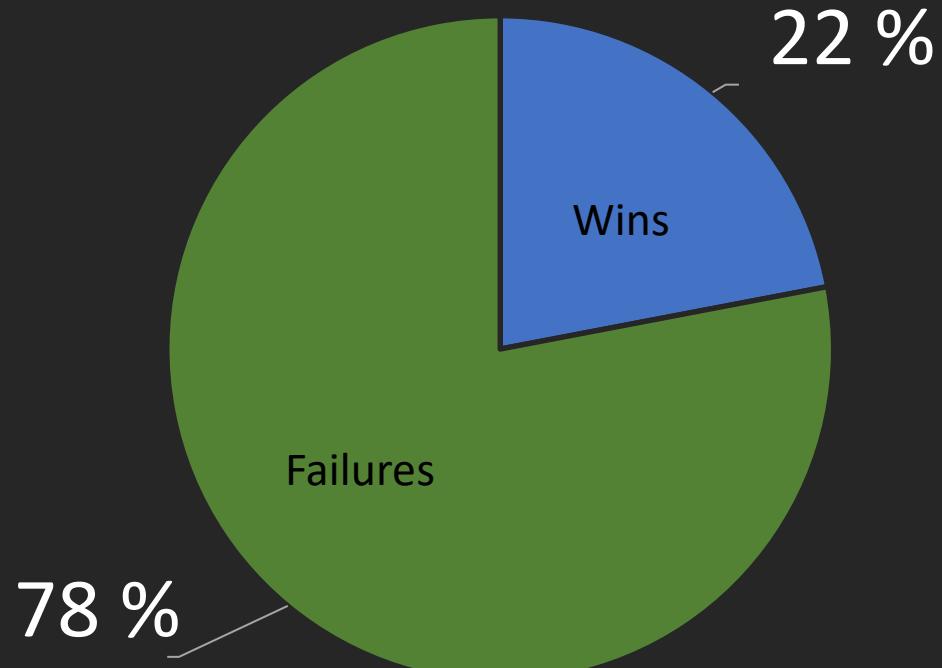




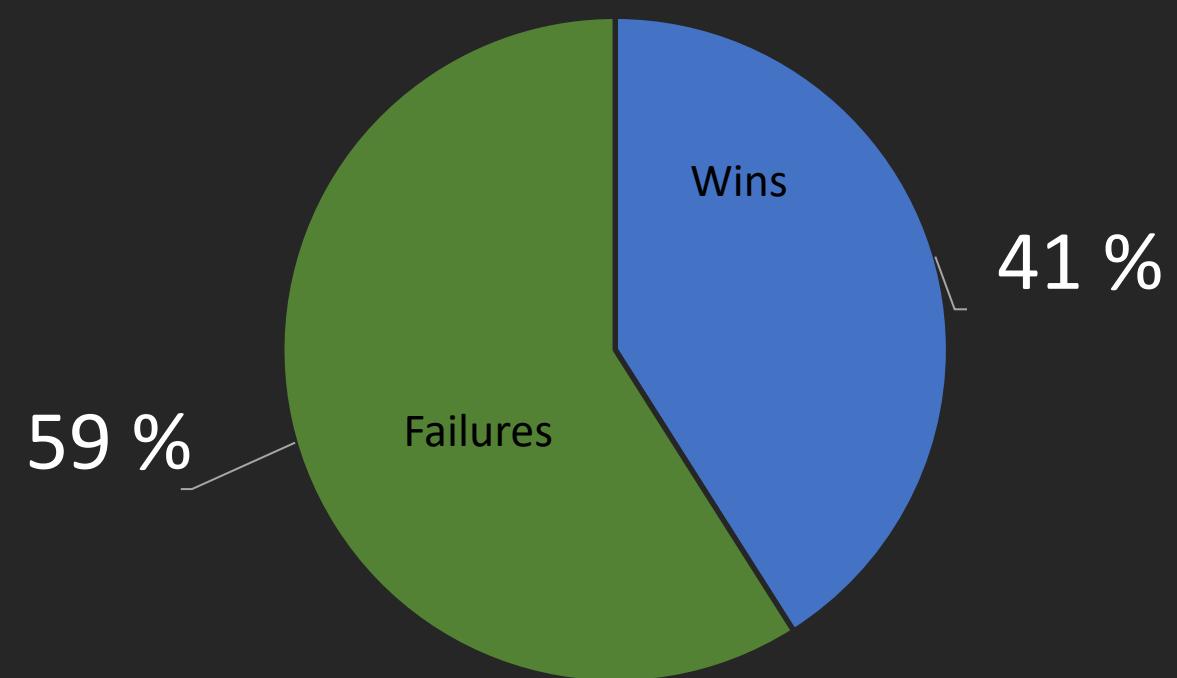


Obtained results

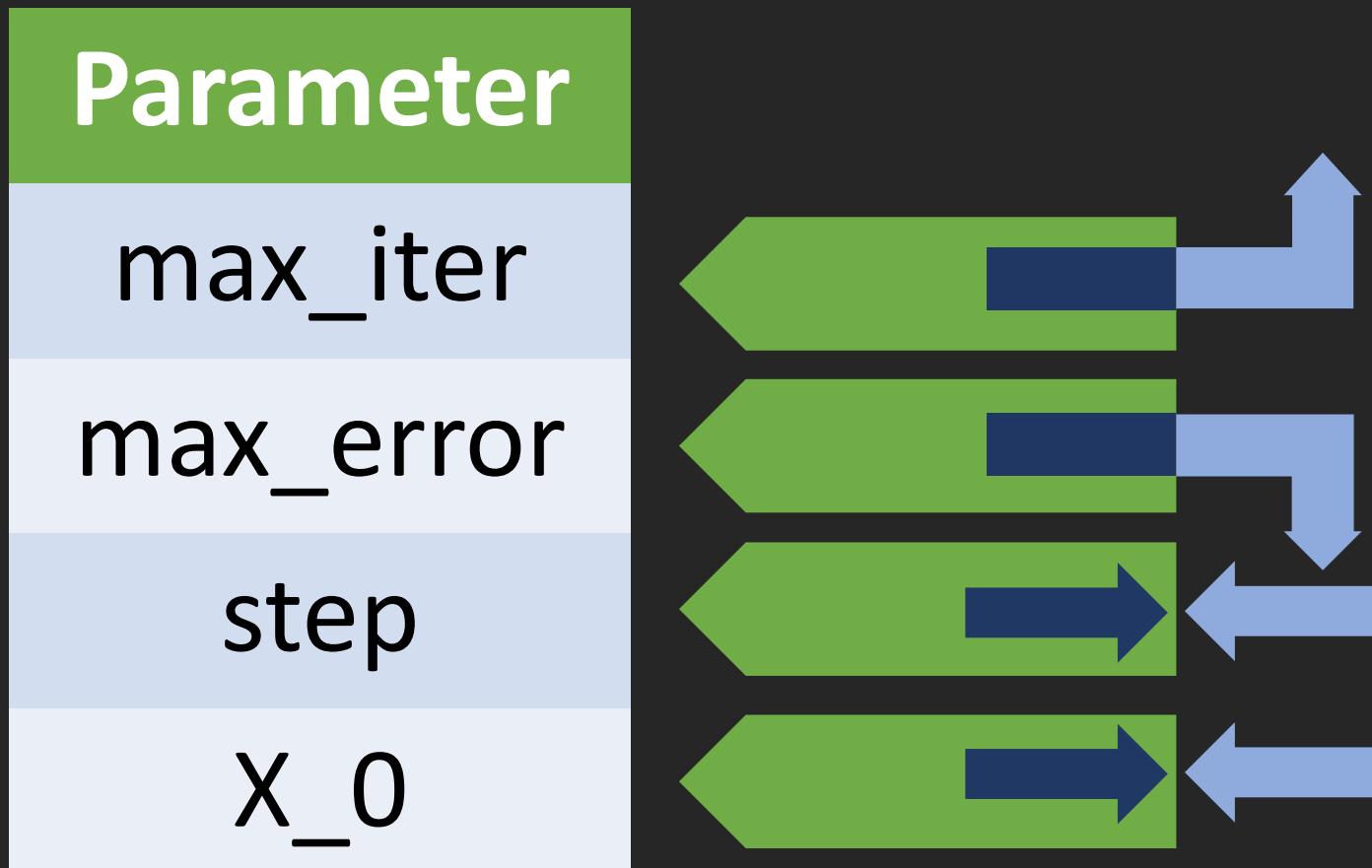
Initial parameters



New parameters



Parameters increasing effectiveness of the tuning



Future work

Modify
parameters
for better
results

Add blank
state to the
cells

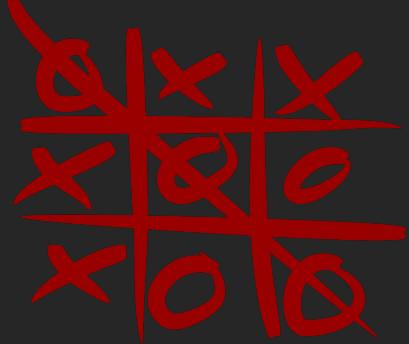
Experiment
with smaller
training sets

Summing up

We wanted a QBM to generate winning solutions for Tic-Tac-Toe

We developed a 9-qubit circuit optimized to replicate a desired behaviour

We would like to continue the future work mentioned above



Tic-Tac-Q

Amaia

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Thank you!
Mila esker!