MACHINE LEARNING VS QUANTUM RETRIEVAL GAMES IN A PRACTICAL QUANTUM MONEY SCHEME

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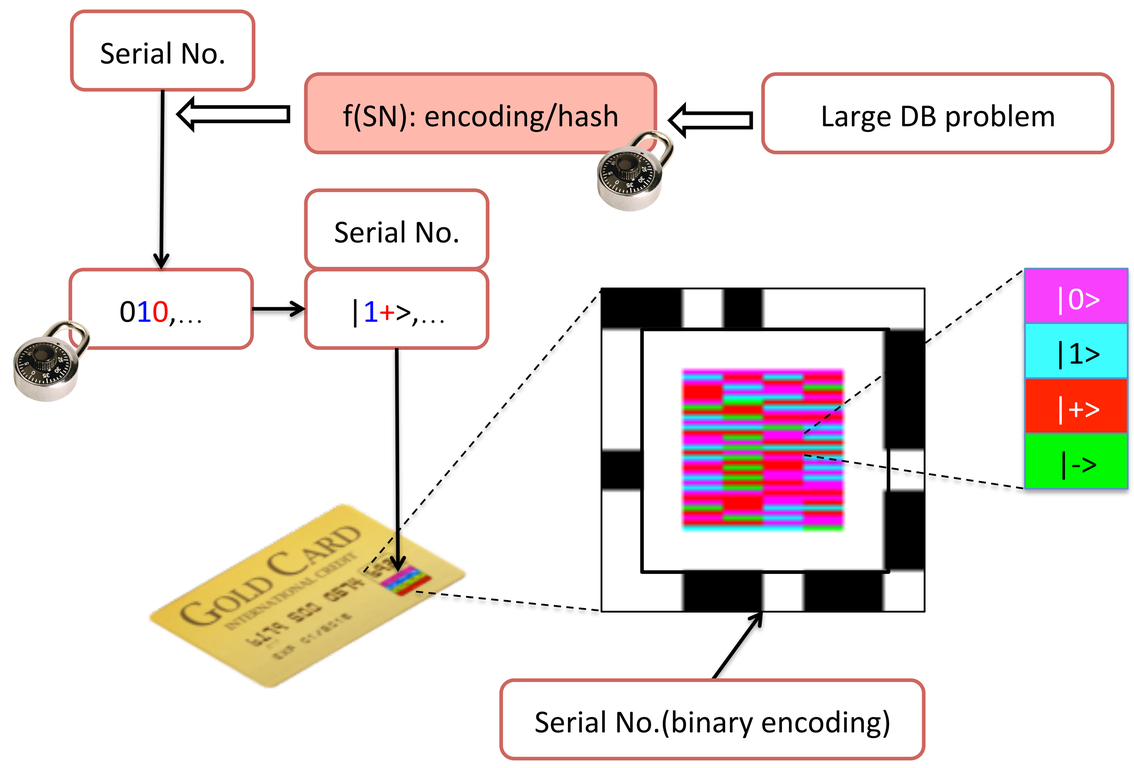
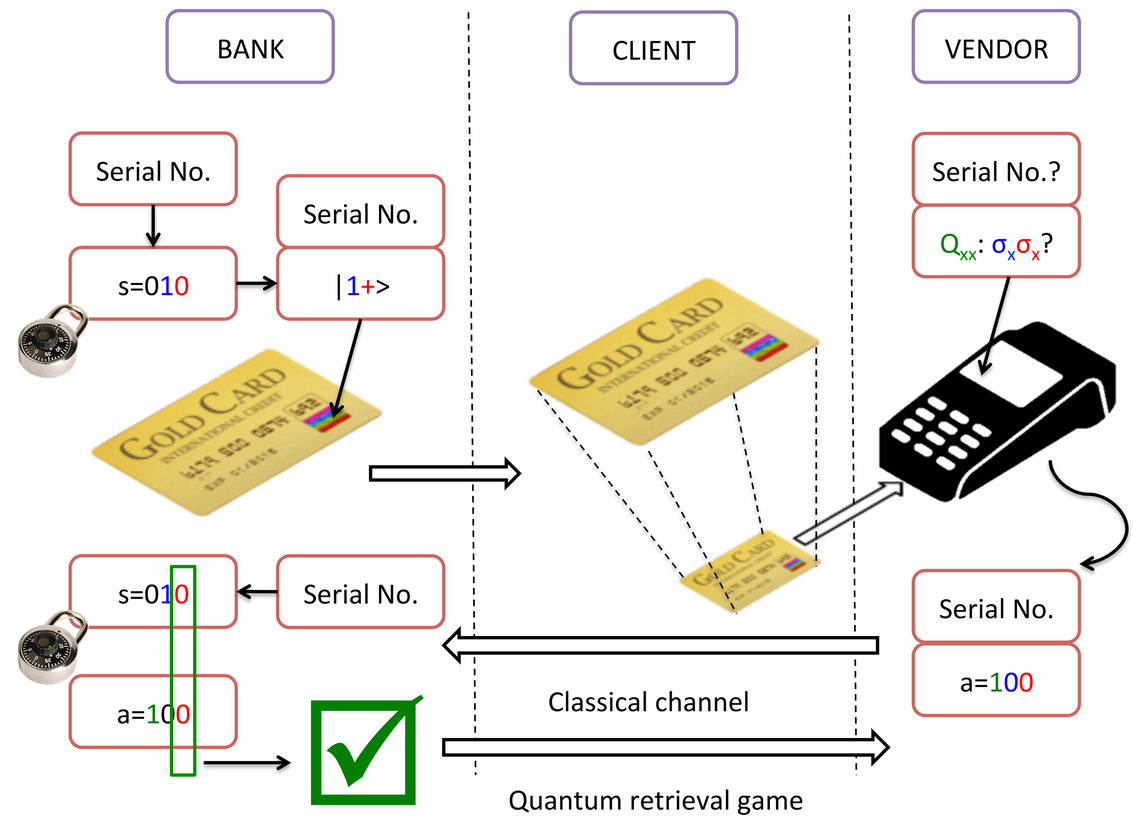
CREATING & READING QUANTUM MONEY

Quantum bits + serial numbers

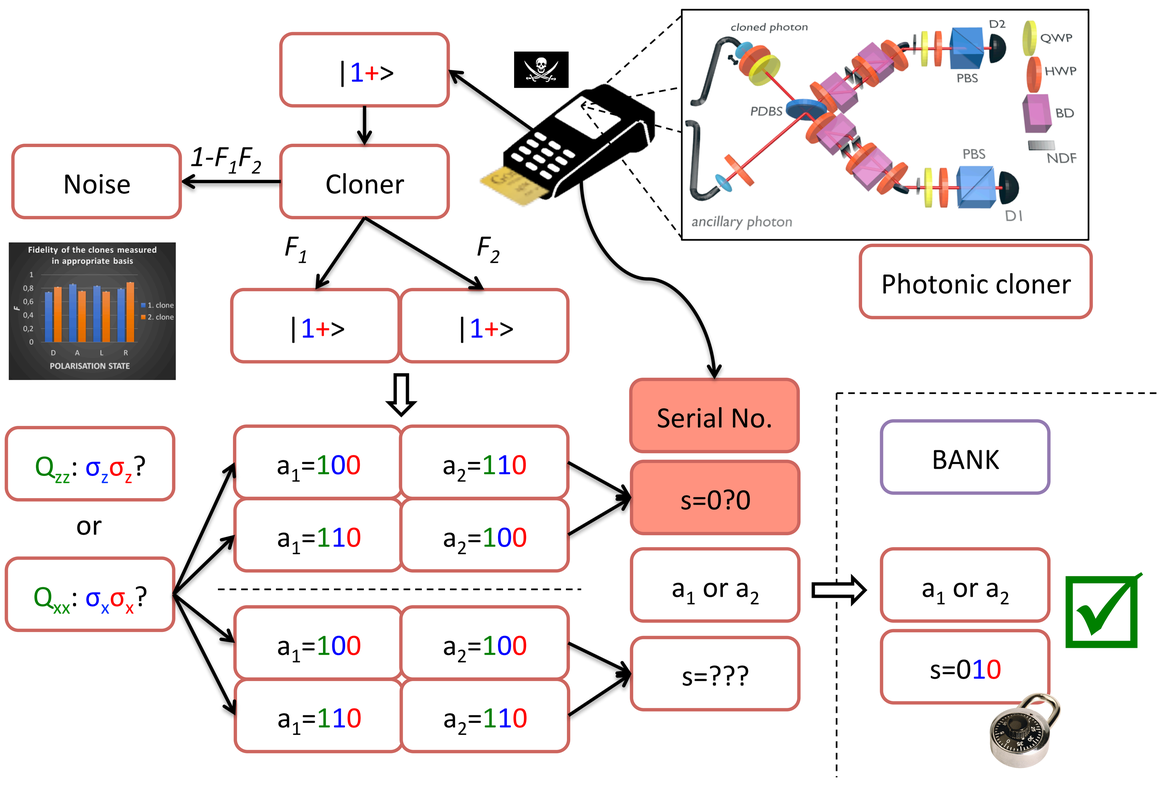


QUANTUM RETRIEVAL GAMES

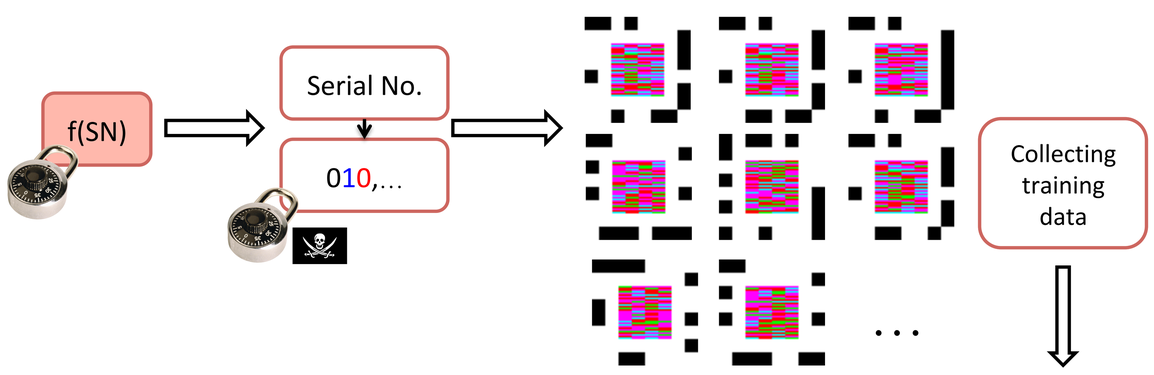


EAVESDROPPING

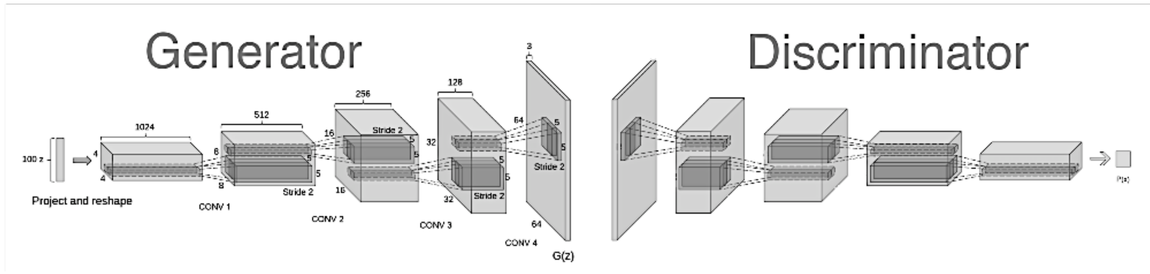
VENDOR: OPTIMAL CLONING OF A SMALL FRACTION OF QUBITS



BANK: COLLECTING DATA FOR MACHINE LEARNING (ML)

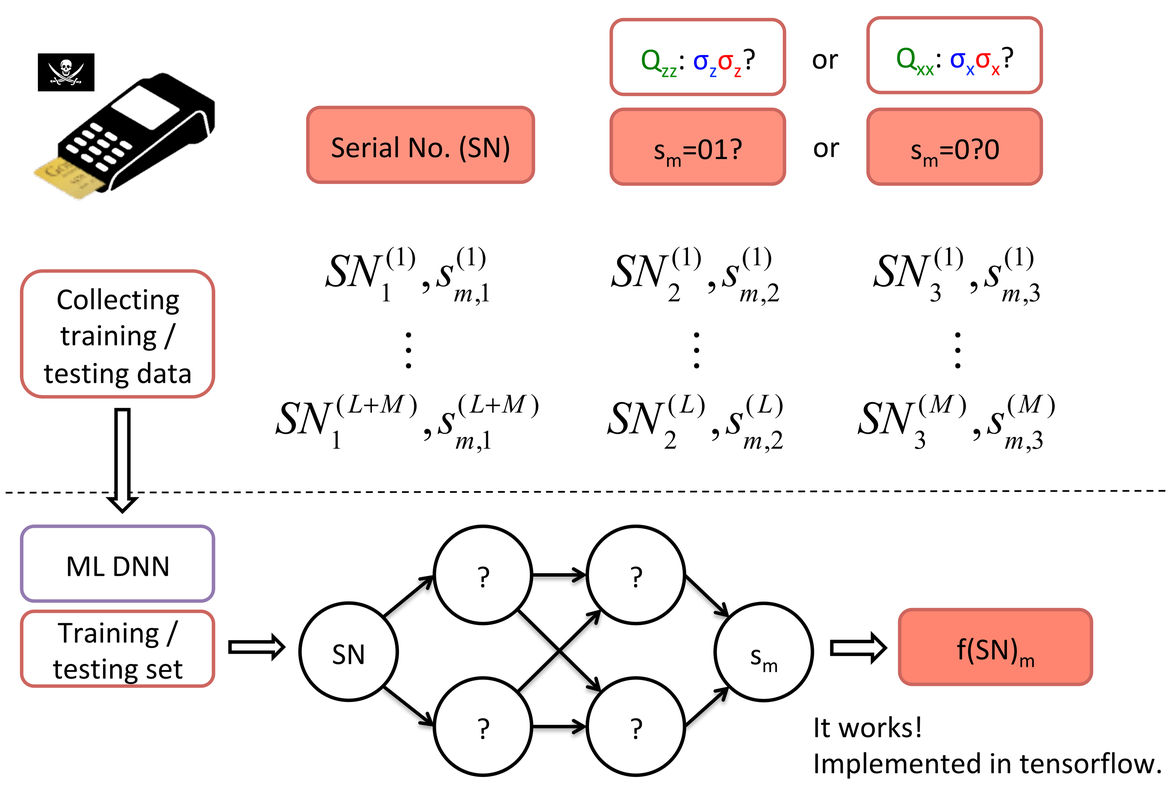


ML WITH DEEP CONVOLUTIONAL GENERATIVE ADVERSARIAL NETWORKS (DCGAN)

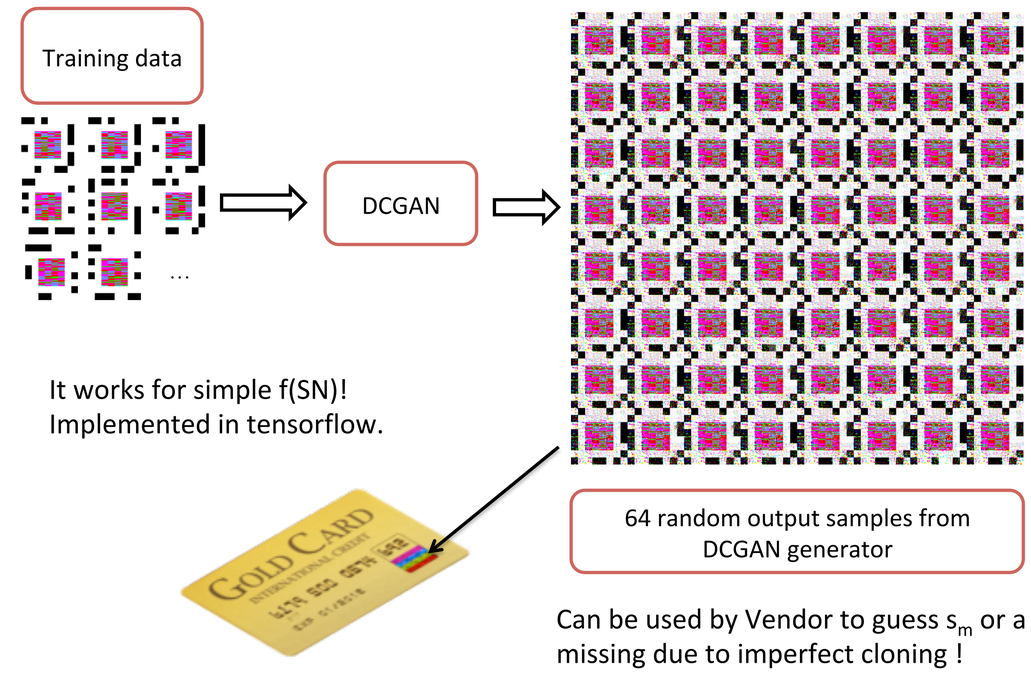


MACHINE LEARNING

VENDOR: COLLECTING DATA FOR A DEEP NEURAL NETWORK (DNN)



DCGAN: UNSUPERVISED MACHINE LEARNING



It works for simple f(SN)!
Implemented in tensorflow.

Can be used by Vendor to guess s_m or a missing due to imperfect cloning !

Could be faster with QML…

LITERATURE

[1] Experimental demonstration of practical unforgeable quantum money, Mathieu Bozzio, Adeline Orieux, Luis Trigo Vidarte, Isabelle Zaquine, Iordanis Kerenidis, Eleni Diamanti, npj Quantum Inf. 4, 5 (2018).
[2] Unforgeable Noise-Tolerant Quantum Tokens, Fernando Pastawski, Norman Y. Yao, Liang Jiang, Mikhail D. Lukin, J. Ignacio Cirac, PNAS 109, 16079-16082 (2012)
[3] Experimental quantum forgery of quantum optical money, Karol Bartkiewicz, Antonín Černoch, Grzegorz Chimczak, Karel Lemr, Adam Miranowicz, Franco Nori, npj Quantum Inf. 3, 7 (2017).
[4] Experimental Eavesdropping Based on Optimal Quantum Cloning, Karol Bartkiewicz, Karel Lemr, Antonín Černoch, Jan Soubusta, Adam Miranowicz, Phys. Rev. Lett 110, 173601 (2013).
[5] S. Aaronson, and P. Christiano, arXiv, 1203.4740 (2012). [6] Quantum machine learning, Jacob Biamonte, Peter Wittek, Nicola Pancotti, Patrick Rebentrost, Nathan Wiebe, Seth Lloyd, Nature 549, 195–202 (2017).

ACKNOWLEDGEMENTS

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For DCGAN we used code from: https://github.com/carpedm20/DCGAN-tensorflow