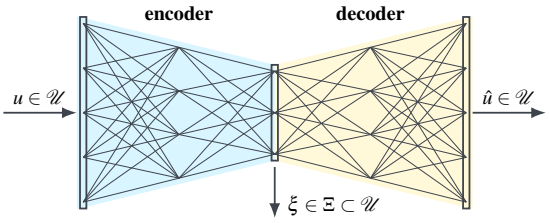
HiWi: Software Development and Machine Learning in Quantum Physics

Collaboration with the Institute for semiconductor optics and functional interfaces (IHFG)

Background & Motivation



A key challenge in quantum photonics today is the efficient and on-demand generation of high-quality single photons and entangled photon pairs. In this regard, one of the most promising types of emitters are semiconductor quantum dots, fluorescent nanostructures also described as artificial atoms. The main technological challenge in upscaling to an industrial level is the typically random spatial and spectral distribution in their growth. Furthermore, depending on the intended application, different requirements are imposed on a quantum dot, which are reflected in its spectral properties. Give that an in-depth suitability analysis is lengthy and costly, it is common practice to pre-select promising candidate quantum dots using their emission spectrum. For this, in cooperation with the IHFG institute, we developed a data-driven machine-learning-based method of evaluating the applicability of a semiconductor quantum dot as single photon source. While we achieved great results, we would now like to implement the algorithm in a Python application with a nice GUI for the physicists to use in their lab.

Possible aspects of the topic

- Development of a Python application with actual use
- Interdisciplinary exchange with physics students and researchers
- Machine learning in action!

Requirements

- Independent and structured way of working
- Interest in a practical application of quantum physics
- Python programming skills and interest in GUI design
- Basic knowledge of machine learning methods

No prior knowledge of quantum physics is required

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