Chair of IT Security
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Student Assistant (m/f/)*

Quantum Algorithms for Optimization and Machine Learning in IT Security

Quantum Computing is a rapidly advancing field with potential in many areas, including optimization, cybersecurity. Here at Fraunhofer AISEC, we focus on software verification and anomaly detection using quantum computers. One approach to anomaly detection is Quantum Machine Learning (QML), an emerging field at the intersection of Quantum Computing and Machine Learning that has the potential to solve complex tasks more efficiently than classical methods. Quantum computers can also be used to find the optimal solution out of a potentially enormous number of potential solutions. By searching for weaknesses in software, this allows us to potentially speed up the verification of software.

Task Description

We are looking for student assistants for various research areas, but proposals will be considered as well.

- Implementation of state-of-the-art algorithms for software verification and anomaly detection
- Evaluation and benchmarking of QML algorithms
- Integrating quantum approaches (QAOA, VQE, Grover, QSVT) into classical software verification tools.
- Implementation and benchmarking new problem formulations, encodings and state preparation for optimization and satisfiability problems (Algebraic Normal Forms, Semidefinite Programming)
- Research on new applications of Quantum Singular Value Transformation (QSVT) and Quantum Topological Data Analysis (QTDA)
- Implementation and benchmarking of quantum-inspired algorithms such as Tensor Networks

Requirements

- Knowledge of quantum computing, both in theory and in practice (PennyLane, Qiskit)
- Basic knowledge in machine learning and/or optimization
- High motivation and ability to work independently

Contact

Quantum Security Technologies

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