Quantum Machine Learning
Course syllabus

Dr. Alexey A. Melnikov
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Course description: What is the role of quantum physics in machine learning and, vice versa, the role of machine learning in quantum physics? In this course, both questions will be addressed by connecting quantum physics and machine learning in different ways.

Course objective: learn about the interplay, both fundamental and practical, between machine learning and quantum physics.

Requirements: interest in machine learning, interest in quantum physics, at least some programming experience.

Intensive course: 18 hours in two weeks (6 three-hour sessions divided into 12 parts).

Evaluation: total of 100 points, a maximum of 50 points for attendance and a maximum of 50 points for performance.

Contents:

1. Introductory session: basics of quantum physics
2. Introductory session: basics of machine learning
3. A subject of quantum machine learning
4. Quantum-physics-inspired reinforcement learning
5. Programming session: reinforcement learning in Python
6. Quantum-enhanced reinforcement learning
7. Designing quantum experiments with reinforcement learning
8. Improving Bell inequality violation with reinforcement learning
9. Programming session: Bell nonlocal correlations in Python
10. Quantum walks analysis with supervised learning
11. Programming session: quantum dynamics simulation in Python
12. Programming session: convolutional neural networks for quantum dynamics classification in Python