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Quantum algorithms for satellite data analysis

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In the presentation, I consider extending classical Support Vector Machines (SVMs) with quantum kernels and applying them to satellite data analysis. The basic idea behind quantum computation and particular use cases for application of quantum computers in the field of remote sensing will be introduced.
The design and implementation of hybrid SVMs with quantum kernels is then discussed. Here, the pixels are mapped to the Hilbert space using parameterized quantum feature maps associated with quantum kernels. The parameters are optimized to maximize the kernel target alignment.
The quantum kernels are selected such that they enable analysis of numerous relevant properties while being able to simulate them with classical computers on a real-life large-scale dataset. Specifically, I approach the problem of cloud detection in the multispectral satellite imagery, which is one of the pivotal steps in both on-the-ground and on-board satellite image analysis processing chains. The experiments performed over the benchmark Landsat-8 multispectral dataset reveal that the simulated hybrid SVM successfully classifies satellite images with accuracy comparable to the classical SVM with the RBF kernel for large datasets. Interestingly, the high accuracy was also observed for the simple quantum kernels, lacking quantum entanglement.

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