In this talk we will present two approaches to tackle multiobjective optimization problems using quantum algorithms. A multiobjective optimization problem is an optimization problem with two or more objective functions that need to be optimized at the same time. Usually, these objective functions present trade-offs and there is no single optimal solution, but a set of so-called Pareto-optimal solutions.

In a first approach we will show how to turn previous algorithms for single-objective optimization into multiobjective algorithms using Grover’s search method. Based on experimental results, we show how a simple quantum adaptive search strategy suffices to find approximate solutions as good as the state-of-art classical multiobjective algorithm NSGAII, with evidence of a quadratic speed-up.

In our second approach, we solve a multiobjective problem using the Quantum Adiabatic Algorithm of Farhi et al. (arxiv:quant-ph/0001106). Here, in contrast to our quantum adaptive search method, we are able to prove finite-time convergence of the algorithm to a single Pareto-optimal solution, provided certain natural conditions on the underlying multiobjective problem hold. This last result is completely documented in arXiv:1605.0315.