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Design Optimization and Derivative-Free Optimization

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In derivative-free optimization one has access to a zeroth-order oracle, that is, a black box that takes a feasible point as input and provides the objective value at the point, possibly random, as output, but it provides no derivatives. This setting is encountered in many science and engineering applications, and often each call to the black box is expensive. An important approach to derivative-free optimization is to use objective values at selected design points to approximate derivatives. Careful selection of the points, and reuse of objective values at previously selected points, is important for algorithm performance, especially when black box calls are expensive. We propose an optimization-based algorithm to select points for a local first-order regression model and a local second-order regression model, with possible reuse of previously selected points. The performance of the designs are tested in various derivative-free optimization algorithms.

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