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# Bayesian Multi-objective Optimization with Noisy Evaluations using the Knowledge Gradient

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We consider the problem of multi-objective optimization in the case where each objective is a stochastic black box that provides noisy evaluation results. More precisely, let  $f_1, \dots, f_q$  be  $q$  real-valued objective functions defined on a search domain  $\mathbb{X} \subset \mathbb{R}^d$ , and assume that, for each  $x \in \mathbb{X}$ , we can observe a noisy version of the objectives:  $Z_1 = f_1(x) + \varepsilon_1, \dots, Z_q = f_q(x) + \varepsilon_q$ , where the  $\varepsilon_i$ s are zero-mean random variables. Our objective is to estimate the Pareto-optimal solutions of the problem:

$$\min f_1, \dots, f_q. \tag{1}$$

We adopt a Bayesian optimization approach, which is a classical approach when the affordable number of evaluations is severely limited—see, e.g., [1], in the context of multi-objective optimization. In essence, Bayesian optimization consists in choosing a probabilistic model for the outputs  $Z_i$  and defining a sampling criterion to select evaluation points in the search domain  $\mathbb{X}$ .

Here, we propose to discuss the extension of the Knowledge Gradient approach [2] for solving the multi-objective problem (1). For instance, such an extension has been recently proposed by Astudillo and Frazier [3].

## References

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