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Title: A tutorial on Bayesian optimisation with a focus on choice data and application to smart manufacturing

Abstract:

Consider the problem of finding the global maximum of an unknown function f which is expensive to evaluate. For instance, evaluating the function requires conducting an experiment. Bayesian optimisation poses this as a sequential decision problem – a trade-off between learning about the underlying function f (exploration) and capitalizing on this information in order to find the optimum (exploitation). From a theoretical point of view, it combines nonparametric statistics (Gaussian Process), decision theory and optimisation.

From a practical point of view, it has applications in many areas including manufacturing, as I will discuss in this talk.

I will give a brief introduction to Bayesian optimisation and, then focus to the case where the unknown function can only be queried via preference (more in general choice) judgments, such as "this is better than that" between two candidate solutions (like in A/B tests or recommender systems). I will show how using only preference data is possible to optimise a complex function and, therefore, optimise the parameters of a noisy manufacturing process (from a simple coffee machine to a complex metal additive manufacturing process).