carl: a likelihood-free inference toolbox

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Summary

Carl is a toolbox for likelihood-free inference in Python.

The likelihood function is the central object that summarizes the information from an experiment needed for inference of model parameters. It is key to many areas of science that report the results of classical hypothesis tests or confidence intervals using the (generalized or profile) likelihood ratio as a test statistic. At the same time, with the advance of computing technology, it has become increasingly common that a simulator (or generative model) is used to describe complex processes that tie parameters of an underlying theory and measurement apparatus to high-dimensional observations. However, directly evaluating the likelihood function in these cases is often impossible or is computationally impractical.

In this context, the goal of this package is to provide tools for the likelihood-free setup, including likelihood (or density) ratio estimation algorithms, along with helpers to carry out inference on top of these.

Approximating likelihood ratios with calibrated classifiers

Methodological details regarding likelihood-free inference with calibrated classifiers can be found in the companion paper (Cranmer, Pavez, and Louppe 2016).

Future works

Future development aims at providing further density ratio estimation algorithms, along with alternative algorithms for the likelihood-free setup, such as Approximate Bayesian Computation (ABC).

References

Cranmer, Kyle, Juan Pavez, and Gilles Louppe. 2016. "Approximating Likelihood Ratios with Calibrated Discriminative Classifiers," March. http://arxiv.org/abs/1506.02169v2.