Contribution ID: **220** Type: **Poster**

Binned histogram fitting for Bayesian inference via Automatic Differentiation in JuliaLang

Thursday 27 October 2022 11:00 (30 minutes)

Template Bayesian inference via Automatic Differentiation in JuliaLang

Binned template-fitting is one of the most important tools in the High-Energy physics (HEP) statistics toolbox. Statistical models based on combinations of histograms are often the last step in a HEP physics analysis. Both model and data can be represented in a standardized format - HistFactory (C++/XML) and more recently pyHF (Python/JSON), have taken advantage of that fact to make template fits both easy and reproducible.

We present a port of pyHF to the Julia programming language much like the way pyHF started out as a port of the C++ HistFactory. The new package, LiteHF.jl, provides an independent, fully compatible implementation of the pyHF JSON specification. Since Julia compiles to native code via LLVM and has a lower function-call overhead than Python, LiteHF.jl can outperform the original pyHF. We utilize Julia's meta-programming capabilities to keep the implementation simple and flexible, and the likelihood gradient is obtained for free via automatic differentiation. LiteHF.jl also makes it easy for the user to add custom template modifiers.

Models generated by LiteHF.jl can be used directly in BAT.jl (Bayesian Analysis Toolkit) in Julia and other Julia inference packages. This enables full Bayesian inference with a few simple commands. BAT.jl provides a full suite of analysis tools including MCMC, nested sampling, automatic re-parametrization, Bayesian evidence calculation, and plotting. A user-friendly likelihoodist inference path for LiteHF.jl is available as well.

Significance

References

https://github.com/JuliaHEP/
https://github.com/JuliaHEP/LiteHF.jl
https://github.com/bat/BAT.jl

Experiment context, if any

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