

BAT - The Bayesian Analysis Toolkit

Thursday, March 26, 2009 5:10 PM (20 minutes)

The main goals of a typical data analysis are to compare model predictions with data, to draw conclusions on the validity of the model as a representation of the data, and to extract the possible values of parameters within the context of a model.

The Bayesian Analysis Toolkit, BAT, is a tool developed to evaluate the posterior probability distribution for models and their parameters. It is based on Bayes' Theorem and is realized with the use of Markov Chain Monte Carlo. This gives access to the full posterior probability distribution and enables straightforward parameter estimation, limit setting and uncertainty propagation.

The BAT is implemented in C++ and allows for flexible definition of mathematical models and applications. It provides a set of algorithms for numerical integration, optimization and error propagation. Predefined models exist for standard cases. In addition, methods to judge the "goodness-of-fit" of a model are implemented. An interface to ROOT allows for further analysis and graphical display of results.

BAT has been developed primarily in the context of data analysis for particle physics experiments. The applications so far range from the extraction of structure functions in ZEUS and the calculation of the sensitivity of GERDA to double beta-decay, to kinematic fitting of top-quark events in ATLAS. Applications in cosmology are also being investigated.

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Session Classification: Event Processing

Track Classification: Event Processing