



Statistical Analysis Techniques in Particle Physics: Fits, Density Estimation and Supervised Learning

By Ilya Narsky, Frank C. Porter

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Modern analysis of HEP data needs advanced statistical tools to separate signal from background. This is the first book which focuses on machine learning techniques. It will be of interest to almost every high energy physicist, and, due to its coverage, suitable for students.

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Editorial Review

From the Back Cover

Based on lectures given by the authors at Stanford and Caltech, this practical approach shows by means of analysis examples how observables are extracted from data, how signal and background are estimated, and how accurate error estimates are obtained exploiting uni- and multivariate analysis techniques. The book includes simple code snippets that run on the popular software suite MATLAB. These snippets make use of publicly available datasets that can be downloaded from the Web.

Primarily aimed at PhD and very advanced undergraduate students, this text can be also used by researchers.

From the contents:

- Parametric likelihood fits
- Goodness of fit
- Resampling techniques
- Density estimation
- Data pre-processing
- Linear transformations and dimensionality reduction
- Introduction to classification
- Assessing classifier performance
- Linear classification
- Neural networks
- Local learning and kernel expansion
- Decision trees
- Ensemble learning
- Reducing multiclass to binary
- Methods for variable ranking and selection

About the Author

The authors are experts in the use of statistics in particle physics data analysis. Frank C. Porter is Professor at Physics at the California Institute of Technology and has lectured extensively at CalTech, the SLAC Laboratory at Stanford, and elsewhere. Ilya Narsky is Senior Matlab Developer at The MathWorks, a leading developer of technical computing software for engineers and scientists, and the initiator of the StatPatternRecognition, a C++ package for statistical analysis of HEP data. Together, they have taught courses for graduate students and postdocs.

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