

A Linear Iterative Unfolding Method

Thursday 8 September 2011 17:00 (25 minutes)

A frequently faced task in experimental physics is to measure the probability distribution of some quantity. Often this quantity to be measured is smeared by a non-ideal detector response or by some physical process. The procedure of removing this smearing effect from the measured distribution is called unfolding, and is a delicate problem in signal processing. Due to the numerical ill-posedness of this task, various methods were invented which, given some assumptions on the initial probability distribution, try to regularize the problem. Most of these methods definitely introduce bias on the estimate of the initial probability distribution. We propose a linear iterative method (motivated by the Neumann series known in functional analysis), which has the advantage that no assumptions on the initial probability distribution is needed. Since it is a linear scheme, statistical error propagation can be performed in an exact manner. Convergence is proved under certain quite general conditions, and in that case the method can be seen to be asymptotically unbiased. On the other hand, as a price, the approach is relatively statistics demanding. We provide a numerical C and C++ library for the implementation of the method.

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Session Classification: Thursday 08 - Data Analysis –Algorithms and Tools

Track Classification: Track 2 : Data Analysis - Algorithms and Tools