THE INFORMATION MATRIX:
BASIC PRINCIPLES AND EFFICIENT COMPUTATION

ABSTRACT

The Fisher information matrix plays a central role in the practice and theory of estimation. This matrix provides a summary of the amount of information in the data relative to the quantities of interest. Some of the specific applications of the information matrix include confidence region calculation for parameter estimates, the determination of inputs in experimental design, the calculation of a bound on the best possible performance in an adaptive system (such as a control system), and the determination of uncertainty bounds on predictions (such as from a neural network). Unfortunately, the analytical calculation of the information matrix is often a difficult or impossible task. This is especially the case with nonlinear models of physical processes. This presentation will highlight some of the principles behind the information matrix and summarize a Monte Carlo simulation-based method for computing the information matrix in cases where it is not feasible to analytically calculate the matrix. This simulation-based method applies in problems of arbitrary difficulty and is relatively easy to implement.