Title: Numerical Methods for Quantitative Psychologists

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Abstract:

Numerical problems are frequently encountered by quantitative psychologists. Prominently, the estimation of the parameters of a statistical model requires the solution of an optimization problem. In a few simple cases, closed-form solutions exist but for many, more interesting, models the optimal parameter estimates have to be determined by means of an iterative algorithm. The goal of this workshop is threefold. First, we want to offer the readers an overview of some frequently used numerical methods in quantitative psychology (steepest descent, Newton-Raphson and variants thereof, the EM algorithm). This will be done by elaborating some basic tools such as Taylor series expansion and the geometric interpretation of the gradient and Hessian. Second, we want to provide a framework for understanding the connections among several optimization algorithms as well as between optimization and aspects of statistical inference. Third, we want to offer theoretical insight as well as hands-on experience in R.

Prerequisites:

Participants should have a basic knowledge of the principles of statistical inference. This includes some familiarity with the concept of a likelihood function (although all concepts will be defined when first encountered). A working knowledge of the basic elements of univariate calculus is a prerequisite, including the concepts of continuity of a function, derivative and integration. A basic understanding of matrix algebra is also helpful.

Assignment: Active participation

Credit: 2 workshop days