

hoa – A package bundle for higher order likelihood inference

Alessandra R. Brazzale¹ and **Ruggero Bellio²**

¹Institute for Biomedical Engineering
Italian National Research Council
alessandra.brazzale@isib.cnr.it

²Department of Statistics
University of Udine, Italy
ruggero.bellio@dss.uniud.it

Since its introduction by Sir R. A. Fisher, the likelihood criterion has found extensive application in the analysis of data. The application of the central limit theorem to conclude that statistics such as the maximum likelihood estimator are approximately normally distributed, with mean and variance consistently estimable from the data, lead to the theory of first order asymptotic inference. Over the past twenty-five years or so very accurate approximations, generally called higher order approximations, to the distribution of the statistics involved have been developed. Although they are relatively easily derived using techniques adapted from the theory of asymptotic expansions, much application of likelihood inference still relies on first order asymptotics.

The purpose of this presentation is to illustrate how higher order likelihood theory can be applied in practice by using the software provided through the `hoa` package bundle. The applications considered are regression models, including logistic regression, non-normal linear regression and non-linear regression with normal errors and arbitrary variance function. These give rise to three of the four packages included in `hoa`, namely, `in order`, `cond`, `marg` and `nlreg`. A fourth packaged, called `sampling`, includes a Metropolis-Hastings sampler which can be used to simulate from the conditional distribution of the higher order statistics considered in `marg`.