Bayesian methods
Lab notes

Lab 6 METROPOLIS ALGORITHM FOR GENERALIZED NONLINEAR MODELS

Example Mortality of adult Beetle after five hours Exposure to Gaseous Carbon Disulphide

Reference Example taken from Bliss (1935) and analysed in:

Prentice, R. L., (1976) *A generalization of the Probit and Logit Methods for Dose Response Curves*, *Biometrics*, **32**, Issue 4, pp. 761-768;

in Carlin, B. P., Louis, T. A., (2000) BAYES AND EMPIRICAL BAYES METHODS FOR DATA ANALYSIS, *2nd edition*, Chapman and Hall/CRC, Bayesian Computation chapter.

Language BUGS codes:

Beetles: choice of link function in BUGS Examples Volume II,
    http://www.mrc-bsu.cam.ac.uk/bugs/documentation/contents.shtml
    (The BUGS code is linked at the course web page)

Beetles: a generalized logit model in beetles.b

Subject *These data record the number of adult flour beetles killed after five hours of exposure to various levels of gaseous carbon disulphide (CS_2). The variability in these data cannot be fully explained by the standard logistic regression model (Prentice, 1976). Then, we attempt to fit the generalized logit model suggested by Prentice. Notwithstanding we choose common families as prior distributions, any of the full conditional - needed to implement the Gibbs sampler - is in closed form. This is a common issue to generalized nonlinear models. Thus we resort to the Metropolis algorithm. It can be implemented either as a current point Metropolis with multivariate Normal proposal (Carlin and Louis, 2000), or as a Metropolis-within-Gibbs step. For our computation, we use WinBUGS whose last version 1.3 has implemented current point Metropolis for updating nonconjugate-nonlogconcave full conditionals in the Gibbs sampling. Actually, for the restricted range parameters (and nonconjugate-nonlogconcave full conditional) WinBUGS resorts to the Slice sampling (Neal, 1997), avoiding the reparameterization of the nonnegative parameters in the Prentice model.*