Chapter 3

Bayesian Model Selection (BMS)

3.1 BMS.mat file

The BMS structure saved in BMS.mat file contains the following variables[1]:

BMS.DCM.ffx/rfx (fixed-effects (FFX) / random-effects (RFX) analysis)

.data	path to model_space.mat file (see below).
.F_fname	path to file containing the log evidence matrix, F, (if this option is specified).
.F	matrix of log model evidences for all subjects and models, [nsub × nm].
.SF	vector of summed log evidences over subjects [1 × nm].
.model	results from model level inference (see below).
.family	results from family level inference (see below).
.bma	results from Bayesian model averaging (see below).

3.1.1 Model level results

Fixed-effects:

model

.prior	model priors, $p(m)$, [1 × nm].
.subj_lme	log model evidence matrix, [nsub × nm].
.like	model likelihoods, $p(Y\|m)$, [1 × nm].
.posts	model posterior probabilities, $p(m\|Y)$, [1 × nm].

Random-effects (different from fixed-effects):

model

.alpha0	initial Dirichlet parameters (prior counts), α_0, [1 × nm].
.exp_r	model posterior means, $< r\|Y >$, [1 × nm].
.xp	model exceedance probabilities, ψ_m [1 × nm].
.r_samp	samples from the model posterior density, $p(r\|Y)$, [nsamp × nm].
.g_post	posterior model probabilities for subject n and model m, $p(m_n\|Y)$, [nsub × nm].

[1] nm = number of models; nfam = number of families; nsub = number of subjects; nsamp = number of samples; dima/b/c/d = dimensions of a/b/c/d DCM parameters; np = number of model parameters; nsess = number of sessions.

3.1.2 Family level results

Fixed-effects:

family

.names	family names, ex: {'F1', 'F2', 'F3'}.
.partition	partition vector assigning each model to a family [1 × nm].
.infer	inference method ('ffx' or 'rfx').
.prior	family priors, $p(f_k)$, [1 × nfam].
.post	family posterior probabilities, $p(f_k\|Y)$, [1 × nfam].
.like	family likelihoods, $p(Y\|f_k)$, [1 × nfam].

Random-effects (different from fixed-effects):

family

.Nsamp	number of samples used in Gibbs sampling (default = 20000).
.prior	family type of priors ('F-unity', $\alpha_0 = 1$, for each family, is the default; other option, 'M-unity', $\alpha_0 = 1$, for each model) .
.alpha0	initial values of the Dirichlet parameters (prior counts), $\alpha_{prior}(m)$, [1 × nfam].
.s_samp	samples from family posterior density, $p(s\|Y)$, [nsamp × nfam].
.exp_r	family posterior means, $< s_k\|Y >$, [1 × nfam].
.xp	family exceedance probabilities, ψ_k, [1 × nfam].

3.1.3 Bayesian model averaging (BMA)

Fixed-effects:

bma

.nsamp	number of samples used to average parameters (default = 10000).
.odds_ratio	posterior odds ratio, π_{OCC}, (number of models in Occams window, default = 0).
.Nocc	number of models in Occam's window.
.Mocc	index of models in Occam's window, [1 × nm].
.indx	index of models in Occam's window (different for each subject in RFX), [1 × nm].
.theta	samples from the parameter posterior density, $p(\theta\|Y)$, [np × nsamp];
.theta_sbj	samples from the parameter posterior density, $p(\theta\|Y)$, for each subject, [np × nsub × nsamp];
.mtheta_sbj	mean parameters for each subject, [np × nsub];
.stheta_sbj	standard deviation of the parameters for each subject [np × nsub];
.a	samples from posterior density over DCM.a parameters [dima × nsamp].
.b	samples from posterior density over DCM.b parameters [dimb × nsamp].
.c	samples from posterior density over DCM.c parameters [dimc × nsamp].
.d	samples from posterior density over DCM.d parameters [dimd × nsamp].
.post	model posterior probabilities for each subject, $p(m\|Y)$, [nsub × nm].
.ma	mean DCM.a parameters, [dima].
.mb	mean DCM.b parameters, [dimb].
.mc	mean DCM.c parameters, [dimc].
.md	mean DCM.d parameters, [dimd].

Random-effects - same variables as in fixed-effects.

3.2 model_space.mat file

This structure is created automatically if it doesn't exist in the chosen directory and can be loaded for subsequent analyses as a faster option to reading the DCM.mat files. The model_space.mat

file contains the following structure:

subj(nsub).sess(nsess).model(nm)

.fname	path to DCM.mat file.
.F	log-evidence (free energy).
.Ep	parameter estimates: conditional expectation, [np × 1].
.Cp	parameter estimates: conditional covariance, [np × np].

For a detailed description of all the variables and methods please see [56] and [60].