**SPM.mat Cheat Sheet**

**LEVEL 1**

xY data structure

xBF basis function structure

nscan 1 x nsess array indicating number of scans per session

Sess 1 x nrun session structure

xGX global variate structure

xX Design matrix structure

xVi Non-sphericity structure

SPMid String identifying SPM and program versions

xM Masking structure

xsDes Design description structure

xVol Image volume structure

Vbeta Beta images structure

VResMS Residual image structure

VM Resultant analysis mask structure

xCon Contrasts structure

swd String identifying analysis directory

**LEVEL 2**

xY

P: [n x ?char] – all image filenames including path

VY: [nScan x 1 structure] – mapped image volumes (filehandles)

RT: repetition time (TR)

Sess

U 1 x nPredictors structure (inputs to design specification)

U.name 1 x nMainEffects array

U.ons onsets

U.dur durations

U.P parametric modulators

row row indices of each session in the design matrix

col column indices of each session in the deisgn matrix

xX

X: design matrix (raw, not temporally filtered)

xKXs: the filtered and whitened design matrix (see spm\_sp.m) [SPM.xX.xKXs.X]

nKX: filtered design matrix (scaled for display)

name: cellstr of parameter names corresponding to columns of design matrix

K: cell of session-specific structures (see spm\_filter). Design and data are pre-multiplied by K (K\*Y = K\*X\*beta + K\*e). K should not smooth across runs.

W: optional whitening matrix used to give weighted least squares estimates

iC: vector of C partition (covariates of interest) indices

iB: vector of B partition (block effects) indices

iG: vector of G partition (nuisance variables) indicies

xVol

M 4x4 voxel 🡪 mm transformation matrix

iM 4x4 mm 🡪 voxel transformation matrix

DIM image dimensions (column vector in voxels)

XYZ 3 x S vector of in-mask voxel coordinates

S Lebesgue measure of volume (in voxels)

R vector of resel counts (in resels)

FWHM Smoothness of components – FWHM, (in voxels)

xCon

name Name of contrast

STAT ‘F’, ‘T’ or ‘P’ – for F/T-contrast (‘P’ for PPMs)

c (F) Contrast weights

X0 Reduced design matrix (spans design space under Ho)

iX0 Indicates how contrast was specified

X1o Remaining design space (orthogonal to X0)

eidf Effective interest degrees of freedom (numerator df)

**After SPM.mat estimation, the following images are written to file:**

**mask.{img,hdr} -- analysis mask image**

Image of zeroes & ones indicating which voxels were included in the analysis. This mask image is the intersection of the explicit, implict and threshold masks specified in the xM argument. The XYZ matrix contains the voxel coordinates of all voxels in the analysis mask. The mask image is included for reference, but is not explicitly used by the results section.

**beta\_????.{img,hdr} -- parameter images**

Images of the parameter estimates. The image files are numbered according to the corresponding column of the design matrix. Voxels outside the analysis mask (mask.img) are given value NaN.

**ResMS.{img,hdr} -- estimated residual variance image**

Image of the residual variance estimate. Voxels outside the analysis mask are given value NaN.

**RPV.{img,hdr} -- estimated resels per voxel image**

Image of the RESELs per voxel estimate. Voxels outside the analysis mask are given value 0. These images reflect the nonstationary aspects of the spatial autocorrelations.

**Contrast manager operations write these images to file:**

**con\_????.{img,hdr} -- contrast image**

Images of the simple contrasts among parameter estimates. The image files are numbered according to the order in which contrasts are specified. These contrast images (for appropriate contrasts) are suitable summary images of an effect at this level, and can be used as input at a higher level when effecting a random effects analysis. See spm\_RandFX.man for further details.

**ess\_????.{img,hdr} -- F-contrast image (extra sum-of-squares)**

Images of the extra sum-of-squares (the difference in the residual sums of squares for the full and reduced model).