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# Pre-Processing

## By Jayson

Specifically, the data has been 'cleaned', but not smoothed yet. We may want to smooth later (6mm fwhm, this can be done in nilearn)

Steps:

SPACE space-MNI152NLin6Asym – *fMRIPrep: spatial normalisation to the MNI152NLin6Asym standard space*

ICA\_AROMA True – *ICA-AROMA: head-motions related movement artefacts removed*

Remove first 1 volumes (non-steady-state) and replace with first steady-state volume – *fMRIPrep: unstable signals are replaced with the first steady-state volume*

Set regions outside mask to zero – *fMRIPrep: zeroes out all voxel values that fall outside a defined brain mask*

detrend False – *Linear trending not applied*

remove\_confounds True – *Confounds below removed*

bandpass 0.01-0.15 – *Band pass filtering done here (lower = drift, higher = noise)*

add\_orig\_mean\_img False - *After confound regression and filtering, do not re-add the original mean image back to the data. Some workflows subtract the mean during processing and then restore it afterward. Setting this to False leaves the mean-removed (demeaned) data as-is.*

smooth False – *spatial smoothing not applied*

fwhm 0 – *as above (Full-width at half-maximum (FWHM) of smoothing kernel = 0 m)*

save\_confounds False – *confounds not saved, good for space saving, bad for reproducibility*

CONFOUND\_LIST ['csf', 'white\_matter', 'rot\_x', 'rot\_x\_power2', 'rot\_x\_derivative1', 'rot\_x\_derivative1\_power2', 'rot\_y', 'rot\_y\_power2', 'rot\_y\_derivative1', 'rot\_y\_derivative1\_power2', 'rot\_z', 'rot\_z\_power2', 'rot\_z\_derivative1', 'rot\_z\_derivative1\_power2', 'trans\_x', 'trans\_x\_power2', 'trans\_x\_derivative1', 'trans\_x\_derivative1\_power2', 'trans\_y', 'trans\_y\_power2', 'trans\_y\_derivative1', 'trans\_y\_derivative1\_power2', 'trans\_z', 'trans\_z\_power2', 'trans\_z\_derivative1', 'trans\_z\_derivative1\_power2', 'physio1', 'physio2', 'physio3', 'physio4', 'physio5', 'physio6', 'physio7', 'physio8', 'physio9', 'physio10', 'physio11', 'physio12', 'physio13', 'physio14', 'physio15', 'physio16', 'physio17', 'physio18']

*This is the list of confound regressors to use during the denoising step.*

*Examples of confounds included:*

*Anatomical noise:*

*'csf', 'white\_matter' – Mean signals from cerebrospinal fluid and white matter (often reflect non-neural noise).*

*Motion parameters:*

*'rot\_x', 'trans\_y', etc. – Rotational and translational motion estimates from realignment.*

*Their derivatives (\_derivative1) and squared terms (\_power2) are included to better model motion artifacts.*

*Physiological regressors:*

*'physio1' through 'physio18' – Principal components of physiological noise (likely extracted via aCompCor or similar).*

*Why it matters:*

*This detailed set of regressors aims to comprehensively capture various sources of non-neural variability to improve the signal quality.*

# Parcellation

|  |  |
| --- | --- |
| Choice | Explanation |
| Using the Yeo 17 thick atlas |  |
| standardize='zscore\_sample', #"zscore\_sample", #Z scores the voxels to make mean = 0 |  |
| memory="nilearn\_cache", |  |
| verbose=5, |  |
| #Temporal filter settings  high\_pass=0.01, # High pass frequency in Hz  low\_pass=0.15, # Low pass frequency in Hz  t\_r=0.8 # Repetition time in seconds |  |
|  |  |
|  |  |
|  |  |

# HMM Mar

## FormatHmmmarInputs

Options.\_\_\_\_\_

|  |  |  |  |
| --- | --- | --- | --- |
| Setting | Set | Definition | Explanation |
| K | 6 | Number of hidden states |  |
| order | 0 | Maximum order of the MAR model; if zero, an HMM with Gaussian observations is trained (mandatory, with no default). |  |
| Zeromean | 0 |  |  |
| covtype | full | choice of the covariance matrix of the noise; "full" to have a full covariance matrix for each state (with off-diagonal elements different from zero), "sharedfull" to have one full covariance matrix for all states, "diag" to have a diagonal full covariance matrix for each state, and "shareddiag" to have one diagonal covariance matrix for all states (default to "full"). |  |
| standardise | 1 |  |  |
| verbose | 1 |  |  |
| Fs | 1/0.8 | Fs is 1/0.8 (frequency is how many pictures per sec) |  |
| DirichletDiag |  | Makes states more sticky |  |
| Cyc / initrep / initcyc |  | Can increase number of iterations |  |
| pca |  | Dimensionality reduction form initial number to number specified |  |
|  |  |  |  |
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## AnalyseResults