

Preprocessing and processing pipeline for fMRI for faces and houses study

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## Abstract

The N170 ERP component has been widely identified as a face-sensitive neural marker. Despite extensive investigations conducted to examine the neural sources of N170, there are two issues in prior literature: 1) few studies used individualized anatomy as head model for the cortical source analysis of the N170; 2) the relationship between the N170 and face-selective regions from functional MRI (fMRI) studies is unclear. The current paper presents a preprocessing pipeline for the fMRI to pictures of faces and houses in a group of healthy adults. These results were used to analyze the BOLD response to faces and houses and to create subject-specific ROIs for the analysis (Gao, 2019; Richards, Gao, Conte, Guy, & Xie, 2018)

*Keywords:* Face processing, fusiform gyrus, ERP, fMRI, N170, cortical source analysis

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disp('%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%')
disp('files from the fMRI sequence')
disp('%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%')
% {
https://www.humanconnectome.org/storage/app/media/documentation/data\_release/October2012\_Release\_User\_Guide.pdf
% }
AAHead_Scout_20ch_head_coil.nii.gz
fMRI_PA_SBRef.nii.gz
fMRI_PA.nii.gz
SpinEchoFieldMap_AP.nii.gz
SpinEchoFieldMap_AP_phase.nii.gz
SpinEchoFieldMap_PA.nii.gz
SpinEchoFieldMap_PA_phase.nii.gz

disp('%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%')
disp('create the filename structure, fMRIName, SpinEchoFileMap, timing file, conditions, durations')
disp('%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%')

disp('%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%')
disp('do the moco of the PA and AP, mean, and then merge')
disp('%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%')
% {(Jenkinson, Bannister, Brady, & Smith, 2002)
Jenkinson, M., Bannister, P., Brady, J. M. and Smith, S. M. Improved Optimisation for the Robust and Accurate Linear Registration and Motion Correction of Brain Images. NeuroImage, 17(2), 825-841, 2002.
% }
disp('%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%')
disp('motion correction for fMRI')
disp('%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%')
% {(Jenkinson et al., 2002)
Jenkinson, M., Bannister, P., Brady, J. M. and Smith, S. M. Improved Optimisation for the Robust and Accurate Linear Registration and Motion Correction of Brain Images. NeuroImage, 17(2), 825-841, 2002.
% }

disp('%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%')
disp('fslRunTopupSub')
disp('p.fmrifilename is the full path name of the fMRI file')
disp('apply topup to fMRI and then to the mean of the moco');
disp('%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%')
% {Andersson(Andersson, Skare, & Ashburner, 2003)
J.L.R. Andersson, S. Skare, J. Ashburner How to correct susceptibility distortions in spin-echo echo-planar images: application to diffusion tensor imaging. NeuroImage, 20(2):870-888, 2003.
% }

% {(Smith et al., 2004)
S.M. Smith, M. Jenkinson, M.W. Woolrich, C.F. Beckmann, T.E.J. Behrens, H. Johansen-Berg, P.R. Bannister, M. De Luca, I. Drobnjak, D.E. Flitney, R. Niazy, J. Saunders, J. Vickers, Y. Zhang, N. De Stefano, J.M. Brady, and P.M. Matthews. Advances in functional and structural MR image analysis and implementation as FSL. NeuroImage, 23(S1):208-219, 2004.
% }

disp('%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%')
disp('smooth with gauss 2.548')
disp('%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%')
% {(Jenkinson, Beckmann, Behrens, Woolrich, & Smith, 2012)
Jenkinson, M., Beckmann, C. F., Behrens, T. E., Woolrich, M. W., & Smith, S. M. (2012). Fsl. Neuroimage, 62(2), 782-790.

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doi:10.1016/j.neuroimage.2011.09.015

% }

% {(Smith et al., 2004)

*S.M. Smith, M. Jenkinson, M.W. Woolrich, C.F. Beckmann, T.E.J. Behrens, H. Johansen-Berg, P.R. Bannister, M. De Luca, I. Drobnjak, D.E. Flitney, R. Niazy, J. Saunders, J. Vickers, Y. Zhang, N. De Stefano, J.M. Brady, and P.M. Matthews. Advances in functional and structural MR image analysis and implementation as FSL. NeuroImage, 23(S1):208-219, 2004.*

% }

disp('%%')  
disp('stat 1st levelSub, including MOCO regressors')

disp('%%').

% {(Friston, 2003; K.J. Friston, 2007; Penny, Friston, Ashburner, Keibel, & Nichols, 2007)

SPM 12 (<http://www.fil.ion.ucl.ac.uk/spm>)

% }

% {

The 14 contrasts were

- 1 'Task\_minus\_Rest', ...
- 2 'FacesInverted\_minus\_FacesUpright', ...
- 3 'FacesInverted\_minus\_HousesInverted', ...
- 4 'FacesInverted\_minus\_HousesUpright',...
- 5 'FacesUpright\_minus\_HousesInverted', ...
- 6 'FacesUpright\_minus\_HousesUpright',...
- 7 'HousesInverted\_minus\_HousesUpright',...
- 8 'Faces\_minus\_Houses',...
- 9 'FacesInverted\_minus\_Rest',...
- 10 'FacesUpright\_minus\_Rest',...
- 11 'HousesInverted\_minus\_Rest',...
- 12 'HousesUpright\_minus\_Rest', ...
- 13 'Faces\_minus\_Rest', ...
- 14 'Houses\_minus\_Rest'

Some files were created after the SPM contrast step

- 15—Faces minus houses, > 0, i.e., Faces > houses.
- 16—Houses minus faces, > 0, i.e., Houses > Faces
- 17—Faces minus rest, > 0, i.e., Faces > Rest
- 18—Houses minus rest, > 0, i.e., Houses > Rest
- 19—Faces upright minus inverted, > 0, i.e., Faces Upright > Faces Inverted
- 20—Faces inverted minus upright, > 0, i.e., Faces Inverted > Faces Upright
- 21—Houses upright minus inverted, > 0, i.e., Houses Upright > Houses Inverted
- 22—Houses inverted minus upright > 0, i.e., Houses Inverted > Houses Upright
- 23—Faces upright minus rest, > 0, i.e., Faces Upright > Rest
- 24—Faces inverted minus rest, > 0, i.e., Faces Inverted > Rest
- 25—Houses upright minus rest, > 0, i.e., Houses Upright > Rest
- 26—Houses inverted minus rest, > 0, i.e., Houses Inverted > Rest

% }

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