README

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GENERAL INFORMATION

The present folder contains files created by Alexandra Bagaïni and Nick Doren for the project Sinergia. The main goal of the project was to investigate whether and how real-life trading performance can be predicted using metrics from financial, behavioral, and neural datasets.

Alexandra and Nick were responsible for collecting, analyzing, and interpreting the data from the third arm of the project. In this arm, participants performed, among others, an Investment task while undergoing functional magnetic resonance imaging (fMRI) scanning.

The present folder contains files that were used to construct general linear models (GLMs), estimate brain activity during Investment task and subsequently extract this activity from two regions of interest – the Ventral Striatum and the Anterior Insula.

Detailed description of the entire project can be found in the main preregistration document https://osf.io/h9g56/.

Detailed description of the third, neural arm of the project can be found in the companion preregistration document: https://osf.io/49knh/.

OVERVIEW OF THE FILES INCLUDED IN THE PIPELINE FOLDER

- Bilateral_AIns.nii
  - *Binary mask containing a sphere of 6 mm radius. The mask defines the anterior insula, a predefined region of interest*
    - *No adjustment needed*
- Bilateral_VS.nii
  - *Binary mask containing a sphere of 6 mm radius. The mask defines the ventral striatum, a predefined region of interest*
    - *No adjustment needed*
- extract_info_glm_investment_I.m
  - *Function that extracts for each participant, run, and trial, the onset and duration of each screen of interest in the Investment task as specified in GLM-INVESTMENT-I. Where relevant the function also extracts the values shown on screen (for the parametric modulators). The values that are extracted are in accordance with GLM-INVESTMENT-I setup. For each run, this information is saved as a MATLAB structure (see script for a more detailed description).*
    - *Adjustments should be done on the lines 77, 78, and 79 (the user needs to provide the corresponding paths)*
- extract_info_ glm_investment_II.m
  - *Function that extracts for each participant, run, and trial, the onset and duration of each screen of interest in the Investment task as specified in GLM-INVESTMENT-II. Where relevant the function also extracts the values shown on screen (for the parametric modulators). The values that are extracted are in accordance with GLM-INVESTMENT-II setup. For each run, this information is saved as a MATLAB structure (see script for a more detailed description).*
    - *Adjustments should be done on the lines 44, 45, and 46 (the user needs to provide the corresponding paths)*
- GLM_I_contrasts.m
  - *Function that runs individual contrasts to extract the BOLD signal associated with neural sensitivity to outcome and risk from GLM-INVESTMENT-I (refer to the companion document for details on the contrasts). The output (beta maps,*

thresholded t maps, the mask and SPM MATLAB structure) are stored in the newly created GLM folder (see script and GLM_wrapper.m for more details)

    - *No adjustment needed*

- GLM_II_contrasts.m
    - *Function that runs individual contrasts to extract the BOLD signal associated with neural sensitivity to outcome and risk from GLM-INVESTMENT-II (refer to the companion document for details on the contrasts). The output (beta maps, thresholded t maps, the mask and SPM MATLAB structure) are stored in the newly created GLM folder (see script and GLM_wrapper.m for more details)*
        - *No adjustment needed*
- GLM_INVESTMENT_I.m
    - *Function that builds up the GLM-INVESTMENT-I. Note that this function calls the extract_info_glm_investment_I.m function*
        - *Adjustment should be done on the line 174 (the user must provide the path to a binary mask used for delineating the brain)*
- GLM_INVESTMENT_II.m
    - *Function that builds up the GLM-INVESTMENT-II. Note that this function calls the extract_info_glm_investment_II.m function*
        - *Adjustment should be done on the line 158 (the user must provide the path to a binary mask used for delineating the brain)*
- GLM_wrapper.m
    - *Main script. To fully process a given participant or several participants, the user should run only this script, which calls auxiliary functions described above and below. The script provides the mean beta values extracted from both* GLM-INVESTMENT-I *and* GLM-INVESTMENT-II*. The mean beta values indicate the neural sensitivity to outcome and risk*
        - *Adjustments should be done on the line 30 (the user needs to put the ID of the participant(s) to be processed) and line 35 (the user needs to put the path to the main directory, which contains the scripts and MRI and behavioural datasets)*

        - *Note that the script is composed of several subjections. If you wish to skip a given step, please comment out the corresponding subsection*

- mean_beta_from_contrast_roi.m
    - *Function that extracts mean beta values for a given subject and a given contrast from a given GLM*
        - *No adjustment needed*
- physio_preprocessing.m
    - *Function that runs extraction of nuisance (cardiac and respiratory) regressors based using PhysIO toolbox* (Kasper et al. 2017)
        - *No adjustment needed*
- smoothing.m
    - *Function that does the last step of functional images pre-processing: smoothing with a Gaussian kernel with a full-width half maximum of 4 mm*
        - *No adjustment needed*

<u>Note:</u>

1) *For more information on different steps of the pipeline, please refer to the pre-registration and/or companion document*
2) *To avoid errors, all scripts described above should be kept in one same folder*

INFORMATION REGARDING IDS

The last part of the project (Neural Component) used 2 types of ID. The first one mimics the main participants' ID, that was used throughout the whole project by adding to it a zero digit.

Example*:*

- *Participant ID for the behavioral part*: **0001**
- *Participant ID for the neural part*: **00001**

Then, the raw MRI data were converted into bids format. In order to reinforce participants' anonymity, each dataset was given a second ID.

Example*:*

- *Participant ID for the behavioral part*: **0001**
- *Participant ID for the neural part*: **00001**
- *Participant ID for the neural part after conversion to bids*: **sub-00999**

In the neural part, behavioral data are encrypted using the whole-project-format (e.g., 00001), whereas the MRI data are encrypted using the bids format (e.g., sub-00999)

In order to be able to run the scripts, the user needs to create a .txt file with two columns: one containing the participant's ID according to the whole project format and the other one containing the participant's ID according to the bids format. This file should be stored under /…/ Preprocessed_mri_data/participants.txt

RUNNING THE SCRIPTS

In order to run the pipeline, the user should:

1) Organize the files and folders according to the scheme described in *Folders_organization_to_run_the_pipeline.xlsx.* This file provides an overview of organisation of the files and folders that already exist or that are created as a result of running the above-described scripts
2) Adjust the files according to the information from the previous section (in green). Please note that the scripts themselves also contain comments indicating which line should be adjusted and how
3) Make sure the pre-processing of functional images was done using *fmriprep* (Esteban et al. 2019). This is important, because the pipeline searches for the images, whose names contain suffixes specific to *fmriprep* output. If you wish to use another pre-processing tool, please update the suffixes (either in the names of the files or within the scripts)
4) Run the whole script GLM_wrapper.m

References

Esteban, Oscar, Christopher J Markiewicz, Ross W Blair, Craig A Moodie, A Ilkay Isik, Asier Erramuzpe, James D Kent, Mathias Goncalves, Elizabeth DuPre, and Madeleine Snyder. 2019. “FMRIPrep: A Robust Preprocessing Pipeline for Functional MRI.” *Nature Methods* 16 (1): 111–16.

Kasper, Lars, Steffen Bollmann, Andreea O Diaconescu, Chloe Hutton, Jakob Heinzle, Sandra Iglesias, Tobias U Hauser, Miriam Sebold, Zina-Mary Manjaly, and Klaas P Pruessmann. 2017. “The PhysIO Toolbox for Modeling Physiological Noise in FMRI Data.” *Journal of Neuroscience Methods* 276: 56–72.