Showing your working:
A guide to reproducible neuroimaging analyses

https://GitHub.com/KirstieJane/ReproducibleResearch
doi: https://dx.doi.org/10.6084/m9.figshare.4244996
• Postdoc in Brain Mapping Unit, Department of Psychiatry, University of Cambridge

• 2016/17 Mozilla Fellow for Science
Reproducible vs Replicable
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Barriers to reproducible research
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- Is not considered for promotion
- Requires additional skills
- Takes time
- Support additional users
- Plead the 5th
- Held to higher standards than others
- Publication bias towards novel findings

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Start small
Protocols.io

https://GitHub.com/KirstieJane/ReproducibleResearch
doi: https://dx.doi.org/10.6084/m9.figshare.4244996
**UCHANGE structural neuroimaging pipeline [v1]**

**AUTHORS:** KIRSTIE WHITAKER
BRAIN MAPPING UNIT, DEPARTMENT OF PSYCHIATRY, UNIVERSITY OF CAMBRIDGE

6 steps
0 private and 0 public forks
34 views

**CONTACT:** KIRSTIE WHITAKER

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**Steps**

1. **Check or complete software installation**

2. **Set up your .bashrc file**

You must have the following software libraries installed:

- ffmpeg: https://ffmpeg.org
- openmpi: https://www.open-mpi.org
UCHANGE structural neuroimaging pipeline

13 steps

KIRSTIE WHITAKER, BRAIN MAPPING UNIT, DEPARTMENT OF PSYCHIATRY, UNIVERSITY OF CAMBRIDGE

CONTACT: Kirstie Whitaker

Step 1: Check or complete software installation You must have the following software libraries installed: Freesurfer: https://... read more

Step 2: Set up your .bashrc file Open gedit and make sure your .bashrc file contains the following text.

Step 3: Set up directory structure You must have the appropriate input files in the displayed directory structure. Inside SUB... read more

Step 4: Put the fsaverageSubP folder in the SUB_DATA directory The fsaverageSubP directory contains the 308 parcellation and ne... read more

Check or complete software installation

You must have the following software libraries installed:

- Freesurfer: https://surfer.nmr.mgh.harvard.edu/fswiki/DownloadAndInstall
- FSL: http://fsl.fmrib.ox.ac.uk/fsl/fslwiki/FSLInstallation
- Anaconda: https://www.continuum.io/downloads

From within Anaconda install the following python packages following the command below:

- VTK
- Mayavi
- Nibabel
- py3d

COMMAND (LINUX)

```
conda install vtk
conda install mayavi
conda install nibabel
conda install py3d
```
Coding your analyses
Comments are your friend!
#!/bin/bash

# Created by Kirstie Whitaker on 13th April 2016

# DESCRIPTION:
# This code conducts a brain and head extraction of the PDW image to which
# the quantitative multiparametric mapping (QPM) images have been aligned.
# It then uses the head mask to set all voxels outside of the head to
# zero for the quantitative QPM images and uses the brain mask to create
# brain extracted versions of the QPM images (where all voxels outside of
# the brain have been set to zero).

# USAGE:
# NSPM_npm_bet_mask.sh <pdw_file>

# INPUTS:
# pdw_file : Proton density weighted file to which the QPM
# quantitative maps are aligned.

# EXPECTS:
# The following files should be in the same directory as the
# input file:
# R1.nii.gz  MT.nii.gz
# R1s.nii.gz  A.nii.gz

# OUTPUTS:
# All output are in the same directory as the input file.
# A sub-directory called PDW_bet is created and contains all the
# files created by FSL's bet command

# Erode the brain mask by 3mm
if [[ ! -f ${mpm_dir}/PDW_brain_ero3.nii.gz ]]; then
    fslmaths ${bet_dir}/PDW_brain.nii.gz -ero ${bet_dir}/PDW_brain_ero3.nii.gz
    fi

# Now make the brain and head files for each of the
# calculated QPM files
# Applying masks
for f_name in PDW ${calc_filename_list[@]}; do
    if [[ ! -f ${mpm_dir}/${f_name}_head.nii.gz ]]; then
        echo -n "-h ${f_name}" 
        fslmaths ${bet_dir}/PDW_brain_ero3.nii.gz \
            -bin \n            -mul ${mpm_dir}/${f_name}.nii.gz \n            ${mpm_dir}/${f_name}_brain.nii.gz \
        fslmaths ${bet_dir}/PDW_brain_outskin_mask.nii.gz \
            -bin \n            -mul ${mpm_dir}/${f_name}.nii.gz \n            ${mpm_dir}/${f_name}_head.nii.gz 
    fi
    done # Close the mpm calculated file loop
    echo "" 
# All done!

---

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Aim for 40% comments in your code
Share your comments with the original author
(which is almost always going to be YOU!)
Python vs R
(vs Matlab vs STATA etc...)
R Studio

https://www.rstudio.com
Gallery

This gallery contains useful examples to learn from. Visit the Shiny User Showcase to see an inspiring set of sophisticated apps.

Interactive visualizations

Shiny is designed for fully interactive visualization, using JavaScript libraries like d3, Leaflet, and Google Charts.

SuperZip example  Bus dashboard  Movie explorer  Google Charts

Shiny gallery

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Matplotlib & Seaborn

http://matplotlib.org
http://stanford.edu/~mwaskom/software/seaborn
Matplotlib gallery

Click each example to see source code
statistics example code: errorbar demo features.py

(Source code, png, hires png, pdf)

```python
# example data
x = np.arange(0.1, 4.1, 0.5)
y = np.exp(-x)

# example error bar values that vary with x-position
text

# error bar values w/ different +/- errors
text

# error bar values w/ different # of errors
text

# error bar values w/ different shapes
text

# error bar values w/ different colors
text

fig, (ax0, ax1) = plt.subplots(nrows=2, sharex=True)
ax0.errorbar(x, y, yerr='lower', fmt='o')
ax0.set_title('variable, symmetric error')

ax1.errorbar(x, y, xerr='lower', fmt='o')
ax1.set_title('variable, asymmetric error')
ax1.set_yscale('log')
plt.show()
```

http://matplotlib.org/examples/statistics/errorbar_demo_features.html

@kirstie_j

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Jupyter Notebook

http://jupyter.org
SIGNAL PROCESSING WITH GW150914 OPEN DATA

Welcome! This ipython notebook (or associated python script GW150914_tutorial.py) will go through some typical signal processing tasks on strain time-series data associated with the LIGO GW150914 data release from the LIGO Open Science Center (LOSC):

- https://losc.ligo.org/events/GW150914/
- View the tutorial as a web page - https://losc.ligo.org/s/events/GW150914/
- Download the tutorial as a python script - https://losc.ligo.org/s/events/GW150914_tutorial.py
- Download the tutorial as IPython Notebook - https://losc.ligo.org/s/events/GW150914_tutorial.html

To begin, download the ipython notebook, readligo.py, and the data files listed to run the python script GW150914_tutorial.py. You will need the python package:

On Windows, or if you prefer, you can use a python development environment such as Anaconda (https://www.anaconda.com) or Enthought Canopy (https://www.enthought.com/products/canopy):

Questions, comments, suggestions, corrections, etc: email losc@ligo.org

v20160208b

https://losc.ligo.org/s/events/GW150914/GW150914_tutorial.html

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Observation of Gravitational Waves from a Binary Black Hole Merger

B. P. Abbott et al.

(LIGO Scientific Collaboration and Virgo Collaboration)

(Received 21 January 2016; published 11 February 2016)
Situating the default-mode network along a principal gradient of macroscale cortical organization

Daniel S. Margulies⁹,¹, Satrajit S. Ghosh⁶,⁷, Alex Goulas⁴, Marcel Falkiewicz⁸, Julia M. Huntenburg⁹,⁶, Georg Langs⁴,⁸, Gleb Bezgin⁹, Simon B. Eickhoff⁵,⁷, F. Xavier Castellanos⁶,⁷, Michael Petrides⁹, Elizabeth Jeffries⁸,⁹, and Jonathan Smallwood⁸,⁹

DOI: 10.1073/pnas.1608282113

Jupyter nbviewer

Name

- NeuroanatomyAndConnectivity's repositories
- gradient_analysis

01_create_human_connectome.ipynb
01_create_macaque_connectome.ipynb
02_embed_connectomes.ipynb
03_visualize_embeddings.ipynb
04_visualize_distance.ipynb
04_visualize_networks.ipynb
05_metaanalysis_brainmap.ipynb
05_metaanalysis_neurosynth.ipynb
06_supplementary_analysis_and_figures.ipynb

LICENSE

README.md
In [1]:

```python
%matplotlib inline

import nibabel as nib
import nibabel.gifti
import nilearn
from nilearn import datasets, plotting
import pandas as pd
import numpy as np

import seaborn as sns
import matplotlib as mpl
import matplotlib.pyplot as plt
from matplotlib.colors import ListedColormap
mpl.rcParams['svg.fonttype'] = 'none'

import sys
sys.path.append('gradient_data/src/)
from viz import *

import surfdist as sd
from surfdist import viz, load, utils, surfdist
```

/Applications/miniconda3/envs/topography/lib/python2.7/site-packages/matplotlib/font_manager.py:273: UserWarning: Matplotlib is building the font cache using fo-list. This may take a moment.'
/Applications/miniconda3/envs/topography/lib/python2.7/site-packages/matplotlib/__init__.py:872: UserWarning: axes.color
warnings.warn(self.msg_depr % (key, alt_key))

In [2]: def imageCrop(filename):
```
Asking for help: StackOverflow & MWEs

http://stackoverflow.com
Git vs GitHub
GitHub Flow - Add Commits

http://www.slideshare.net/nishanbose/introduction-to-github-55872492/7

https://GitHub.com/KirstieJane/ReproducibleResearch
doi: https://dx.doi.org/10.6084/m9.figshare.4244996
GitHub Flow - Open a pull request

http://www.slideshare.net/nishanbose/introduction-to-github-55872492/7

https://GitHub.com/KirstieJane/ReproducibleResearch
doi: https://dx.doi.org/10.6084/m9.figshare.4244996
GitHub Flow - Discuss and Review your code

http://www.slideshare.net/nishanbose/introduction-to-github-55872492/7

@kirstie_j

https://GitHub.com/KirstieJane/ReproducibleResearch
doi: https://dx.doi.org/10.6084/m9.figshare.4244996
GitHub Flow - Deploy / Test

http://www.slideshare.net/nishanbose/introduction-to-github-55872492/7

https://GitHub.com/KirstieJane/ReproducibleResearch
doi: https://dx.doi.org/10.6084/m9.figshare.4244996

@kirstie_j
Some jargon busting

Repository
Clone
Branch
Pull request
Version control
Merge
Issues
Commit
Release
Fork
Markdown

https://GitHub.com/KirstieJane/ReproducibleResearch
doi: https://dx.doi.org/10.6084/m9.figshare.4244996

@kirstie_j
Submit your first pull request!

Inspired by: https://yourfirstpr.github.io
ReproducibleResearch

This repository supports Kirstie's presentation on tips and tricks for making your research reproducible.

The goal is to build a directory of useful links, and a jargon busting glossary.

Guide for contributors

See our guidelines for how to contribute to the project.

Code of conduct

Everyone is welcome to join this project, particularly people who have not used GitHub before and are feeling unsure of how to begin!

Please follow our code of conduct in all your on and offline interactions.

https://GitHub.com/KirstieJane/ReproducibleResearch
doi: https://dx.doi.org/10.6084/m9.figshare.4244996
Create a glossary
Jargon Busting

If you remember not knowing what a word means, there's probably someone else who could benefit from you defining it here!

Please be brief in your description, but do link to further information as appropriate.

Help editing markdown can be found here and here.
Share resources
Useful Resources

If you know of a useful resource that has helped you make your research reproducible, please add it here.

Help editing markdown can be found at this excellent markdown cheatsheet

Git & GitHub

- **Friendly GitHub Introduction**: an afternoon workshop created originally by Joey Lee for the Mozilla Science Lab and further developed by Kirstie Whitaker and Anne Pajon.

- **Get private GitHub repositories**: a paid GitHub account allows you to have private repositories that only people you choose to make collaborators can see. If you’re a member of an academic institution you can request a discount (to $0) and therefore have free private repositories. The discount lasts for 2 years but you can request another at the end of that period no problem 😊.
Community

https://www.mozillascience.org
http://software-carpentry.org
http://data-carpentry.org
https://www.coursera.org/specializations/jhu-data-science
https://www.coursera.org/learn/python/home/info

https://GitHub.com/KirstieJane/ReproducibleResearch
doi: https://dx.doi.org/10.6084/m9.figshare.4244996
Thank you!

KirstieJane/ReproducibleResearch

@kirstie_j

doi: 10.6084/m9.figshare.4244996