Barriers to Reproducible Research (and how to overcome them)

@kirstie_j
doi: https://dx.doi.org/10.6084/m9.figshare.7140050

- Research fellow at the Alan Turing Institute for Data Science and Artificial Intelligence
- Senior research associate in the Department of Psychiatry, University of Cambridge
- 2016/17 Mozilla Fellow for Science

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Reproducible vs Replicable

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		Data	
		Same	Different
Code	Same		
	Different		

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		Data	
		Same	Different
Code	Same	Reproducible	
	Different		

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		Data	
		Same	Different
Code	Same	Reproducible	Replicable
	Different		

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		Data	
		Same	Different
Code	Same	Reproducible	Replicable
	Different	Robust	

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		Data	
		Same	Different
Code	Same	Reproducible	Replicable
	Different	Robust	Generalisable

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Barriers to reproducible research

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Barriers to reproducible research

Is not considered for promotion

Requires additional skills

Plead the 5th

Support additional users

Takes time

Held to higher standards than others

Publication bias towards novel findings

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Start small

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Protocols.io

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MELD Project | Protocols | MELD Protocol 1 - Patient and | MELD Protocol 3 - FreeSurfer C

https://www.protocols.io/researchers/meld-project 80%

https://www.protocols.io/researchers/meld-project

Reload URL for off ca... | Kirstie's To Do list | Issues-WhitakerLabPr... | My Meetings | x.ai | OHBM OSSIG Links

protocols.io Search... EXPLORE MY LIBRARY Kirstie

Researchers > MELD Project

Protocols 5 | Groups 1 | Posts | Following | FOLLOW | MESSAGE

MELD Project

University College London, University of London

The MELD project is a multi-centre collaboration for lesion detection involving the incorporation of data and sequences from multiple sites. The main aim is to create open-access, robust and generalisable tools for FCD detection that can be used in the presurgical evaluation of patients with drug-resistant epilepsy. This will involve training classifiers on data from multiple centres and tailoring classifiers according to the needs of the individual epilepsy centres. Each site will be given detailed protocols to follow in order to pre-process the data from their site. The anonymised data matrices along with some clinical information (such as age, age of onset of epilepsy, surgery, histopathology and Engel outcome) will be shared. This will allow classifiers to be trained on the data from all participating centres. Any developed classification tools and/or code will be shared.

RESEARCH INTERESTS

Epilepsy, Neuroimaging, Open-science, Reproducibility, Focal Cortical Dysplasia, Machine Learning

Dear MELD

Ask a question or tell them how good a job they're doing!

SEND

All | Discussions 0 | Protocol comments 0

MELD's Recent Posts

github SOCIAL CODING

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Coding your analyses

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doi: https://dx.doi.org/10.6084/m9.figshare.7140050

Comments are your friend!

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```
#!/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 (MPM) images have been aligned.
#      It then uses the head mask to set all voxels outside of the head to
#      zero for the quantitative MPM images and uses the brain mask to create
#      brain extracted versions of the MPM images (where all voxels outside of
#      the brain have been set to zero.
#
# USAGE:
#    NSPN_mpm_bet_mask.sh <pdw_file>
#
# INPUTS:
#    pdw_file : Proton density weighted file to which the MPM
#                 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
#
#       R1_head.nii.gz     R1_brain.nii.gz
```

```

# 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 MPM files
#==============================================================
echo -n "  Applying masks"
for f_name in PDw ${calc_filename_list[@]}; do

    # Don't run if it's already complete!
    if [[ ! -f ${mpm_dir}/${f_name}_head.nii.gz ]]; then
        echo -n " - ${f_name}"
        fslmaths ${bet_dir}/PDw_brain_ero3.nii.gz \
                    -bin \
                    -mul ${mpm_dir}/${f_name}.nii.gz \
                    ${mpm_dir}/${f_name}_brain.nii.gz

        fslmaths ${bet_dir}/PDw_brain_outskin_mask.nii.gz \
                    -bin \
                    -mul ${mpm_dir}/${f_name}.nii.gz \
                    ${mpm_dir}/${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

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Share your comments with the original author

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(which is almost always going to be YOU!)

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** It is embarrassing to me how often I forget not just details of experiments, but entire experiments. For example, for the manuscript I am working on now, I forgot that we had done an experiment to test for vertical transmission of the parasite. Fortunately, the undergrad who has been working on the project remembered and had it in his writeup!

https://dynamicecology.wordpress.com/2015/02/18/the-biggest-benefit-of-my-shift-to-r-reproducibility

https://twitter.com/kcranstn/status/370914072511791104

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Asking for help: StackOverflow & MWEs

http://stackoverflow.com

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https://mrcolley.com/2014/07/01/
talk-to-the-duck-debugging-and-resilience

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Version Control

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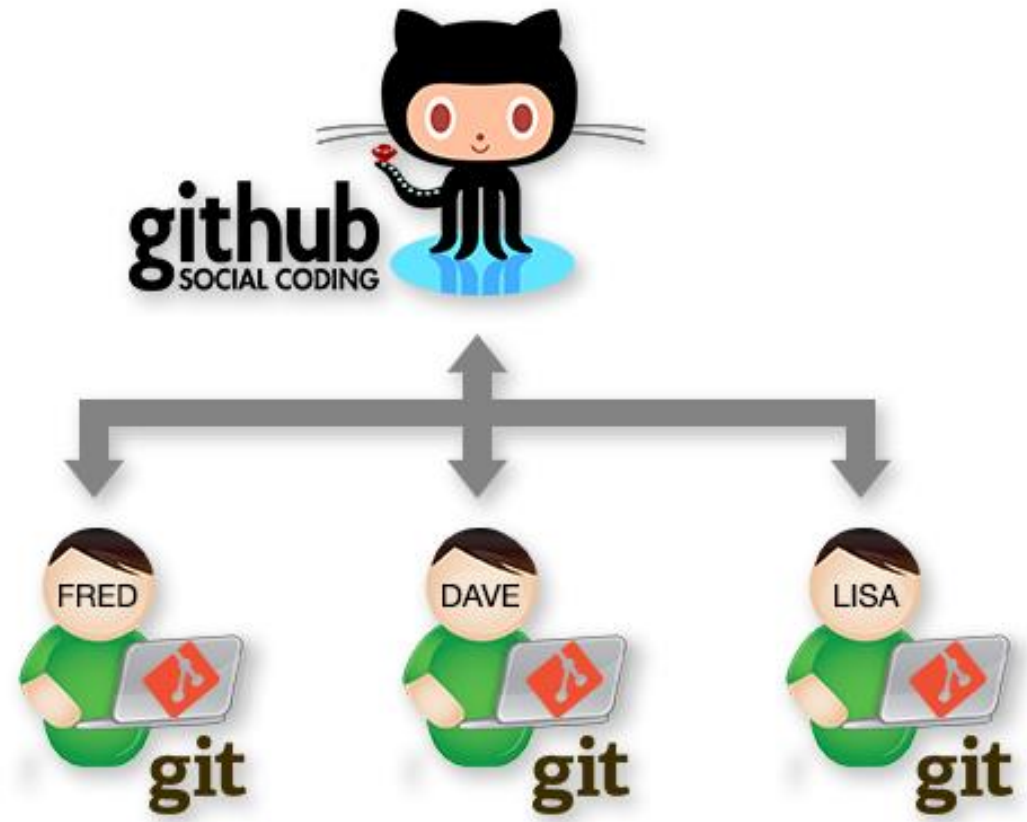

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Repository

Clone

Pull request

Branch

Version control

There's lots of jargon

Merge

Issues

Release

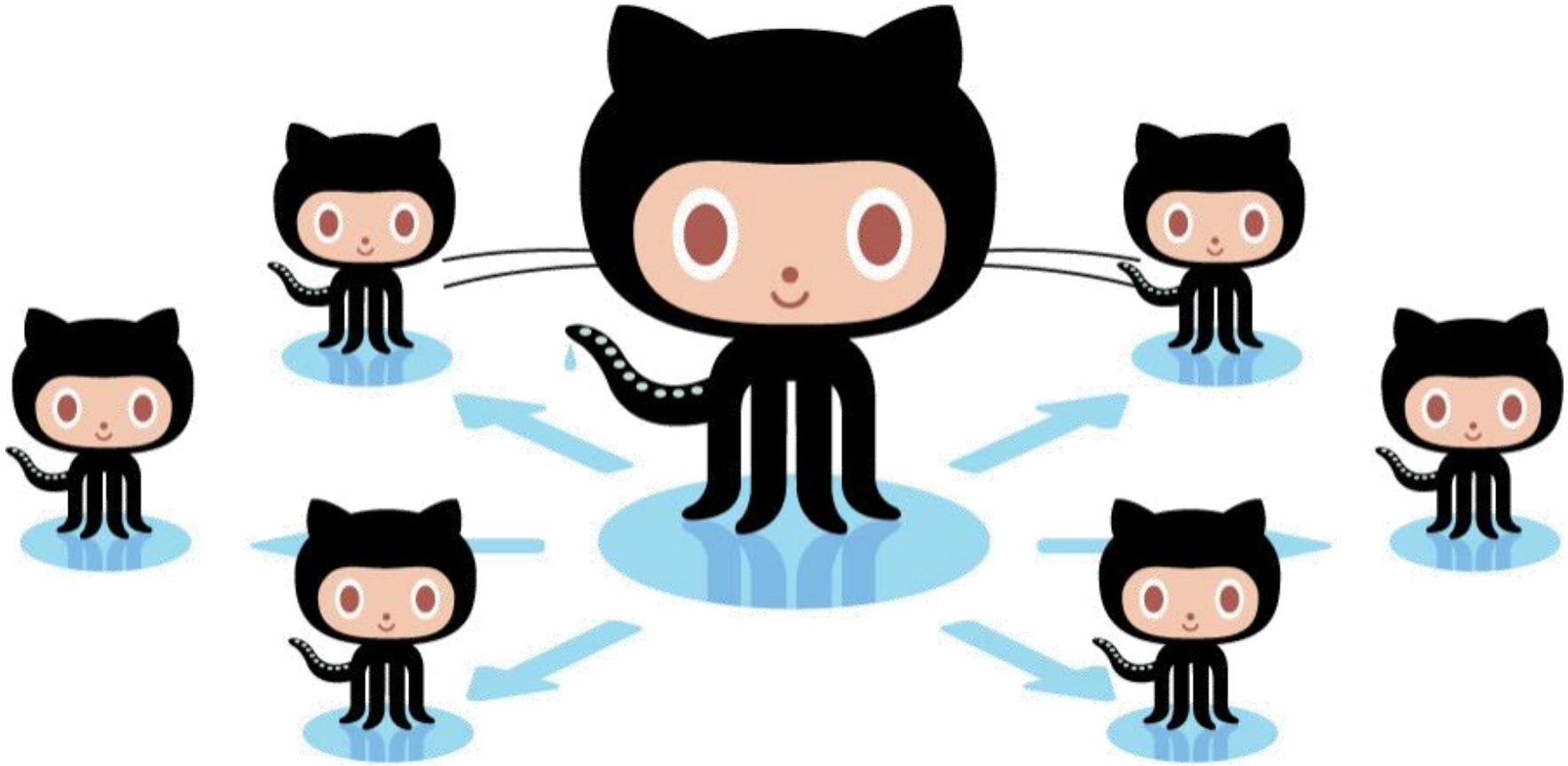
Commit

Fork

Markdown

@kirstie_j

doi: https://dx.doi.org/10.6084/m9.figshare.7140050



It's the social part that defines GitHub

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What if I can't share my code until I'm published?

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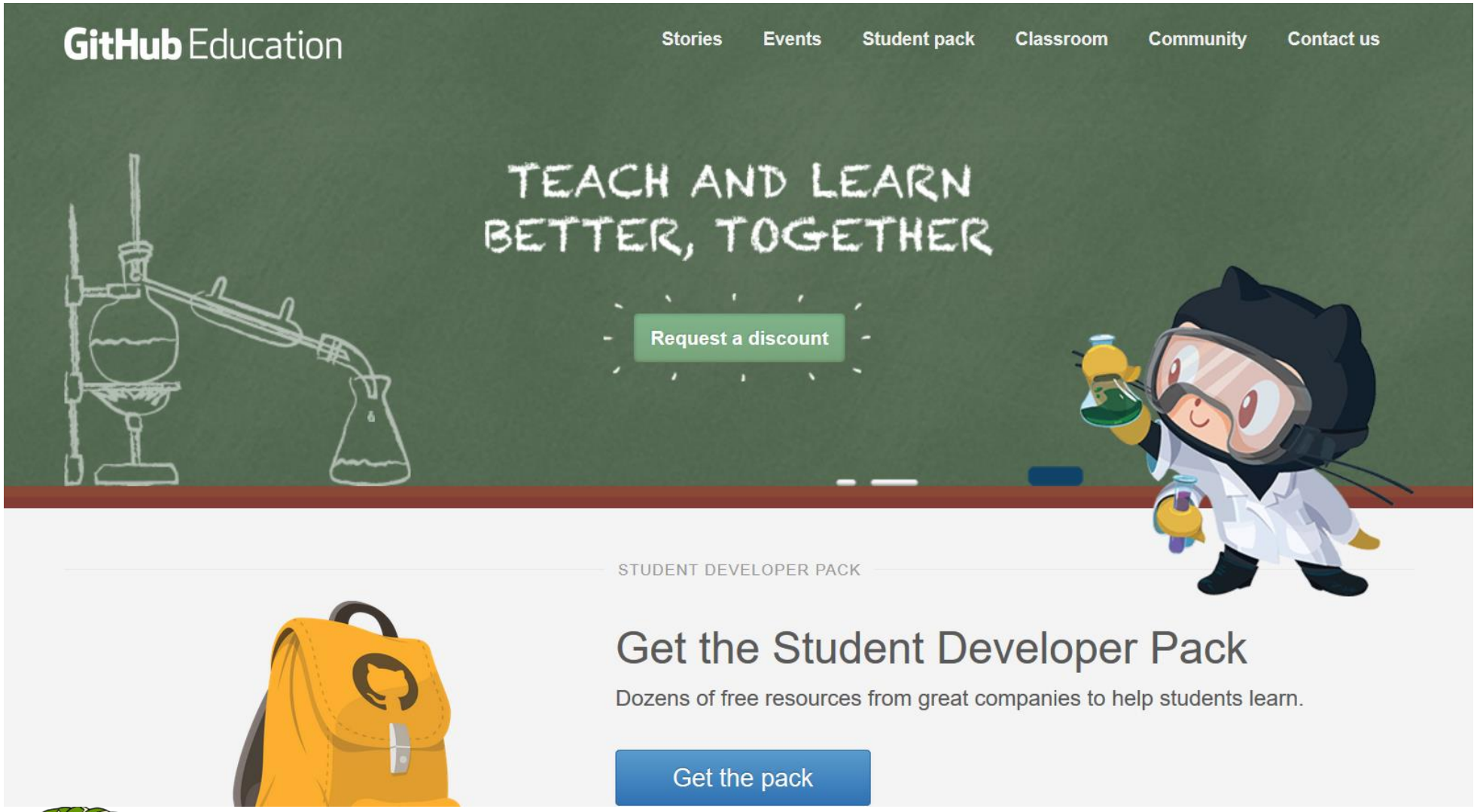

https://education.github.com

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Reproducible <> Open
(and that's fine)

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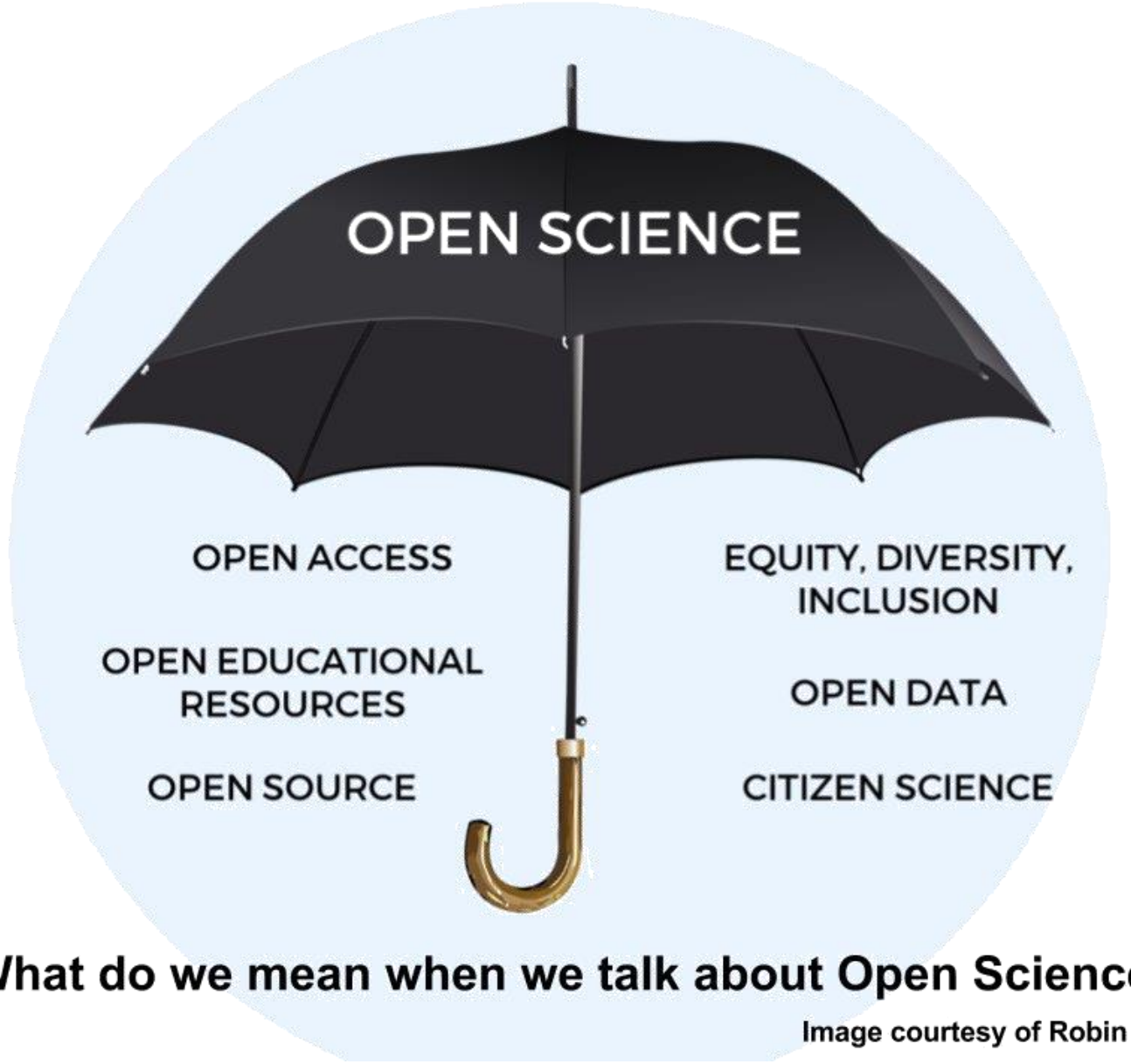

What do we mean when we talk about Open Science?

Image courtesy of Robin Champieux

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Mozilla Open Leaders

Work Open, Lead Open

Join a cohort of open leaders fueling the Internet Health movement. Receive mentorship and training through Mozilla in this 14-week online program on working open.

Our sixth cohort of Mozilla Open Leaders starts in September 2018! We're looking for Open Leaders to fuel the Internet Health movement by designing and building projects that empower others to collaborate within inclusive communities.

Applications are closed for Mozilla Open Leaders 6.

Stories from Open Leaders

Alecia Kuhl, StoryEngine

Mark Sta Ana, Rust Content-o-Tron

Gracielle Higino, IGNITE

Fiona Cullinan, Observed.City

What if I can't (ever) share my data?

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doi: https://dx.doi.org/10.6084/m9.figshare.7140050

AUTHOR
creates pseudo IDs, and deposits data, metadata and text into Data Repository under permanent embargo BEFORE PAPER IS ACCEPTED

REPOSITORY
generates unique DOI number (Digital Online Identifier)

AUTHOR
adds DOI to manuscript with standard text: "Data for this specific paper has been uploaded to the Cambridge Data Repository ([INSERT DOI LINK]) and password protected. Our participants did not give informed consent for their data to be made publicly available, and it is possible that they could be identified from this data set. Access to the data supporting the analyses presented in this paper will be made available to researchers with a reasonable request to OpenNSPN@medschl.cam.ac.uk."

OPEN NSPN
keeps record of DOIs

REQUESTER
Either 'Requests a copy' at the data repository OR sends an email to Open NSPN.

REPOSITORY
forwards request to Open NSPN

OPEN NSPN
forwards request to First Author, Last Author and Data Management Chair for decision

YES
External

OPEN NSPN
sends Data Access Agreement (DAA) to Requester

REQUESTER
returns DAA

OPEN NSPN
Authorises data access request

YES
NSPN team member

NO

OPEN NSPN
sends refusal to Requester

END

REPOSITORY
Emails data to requester (happens automatically)

22nd May 2017
version 0.2

New Results

Previous Next

Adolescent Tuning Of Association Cortex In Human Structural Brain Networks

František Váša, Jakob Seidlitz, Rafael Romero-Garcia, Kirstie J. Whitaker, Gideon Rosenthal, Petra E. Vértes, Maxwell Shinn, Aaron Alexander-Bloch, Peter Fonagy, Raymond J. Dolan, Peter B. Jones, Ian M. Goodyer, The NSPN Consortium, Olaf Sporns, Edward T. Bullmore

doi: https://doi.org/10.1101/126920

Posted September 15, 2017.

Abstract

How does human brain organization change over the course of adolescence? Motivated by prior data on local cortical shrinkage and intracortical myelination, we predicted age-related changes in topological organisation of cortical structural networks. We estimated the structural correlation matrix from magnetic resonance imaging (MRI) measures of cortical thickness at 308 regions in a sample of N=297 healthy participants, aged 14-24 years (inclusive). We used

Subject Area

Neuroscience

Availability of data and code

Data for this specific paper has been uploaded to the Cambridge Data Repository (https://doi.org/10.17863/CAM.8856) and password protected. Our participants did not give informed consent for their questionnaire measures to be made publicly available, and it is possible that they could be identified from this data set. Access to the data supporting the analyses presented in this paper will be made available to researchers with a reasonable request to NSPNdata@medschl.cam.ac.uk. The code used to conduct analyses is available from FV's github: https://github.com/frantisekvasa/structural_network_development (DOI: 10.5281/zenodo.528674).

Abstract

How does
prior data
changes in topological organisation of cortical structural networks. We estimated the structural correlation matrix from magnetic resonance imaging (MRI) measures of cortical thickness at 308 regions in a sample of N=297 healthy participants, aged 14-24 years (inclusive). We used

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Statistics

Data supporting NSPN publication "Adolescent tuning of association cortex in human structural brain networks"

View / Open Files

str.net.dev.data.RData (Unknown, 7Mb)

data-processing-and-description.docx (Microsoft Word 2007, 106Kb)

Authors

Vasa, Frantisek

Citation

Vasa, F., Seidlitz, J., Romero Garcia, R., Whitaker, K. J., Rosenthal, G., Vertes, P. E., Shinn, M., et al. *Data supporting NSPN publication "Adolescent tuning of association cortex in human structural brain networks"* [Dataset]. https://doi.org/10.17863/CAM.8856

Description

There are two files supporting this publication. The first is an RData file containing all variables necessary to reproduce the main findings of the publication. The second is a Microsoft Word document describing 1) how the data was collected and processed and 2) all the variables stored in the RData file.

Software

Custom scripts written in R, available from Frantisek Vasa's github page: https://github.com/frantisekvasa/structural_network_development (DOI: 10.5281/zenodo.528674)

Keywords

Váša et al, 2017

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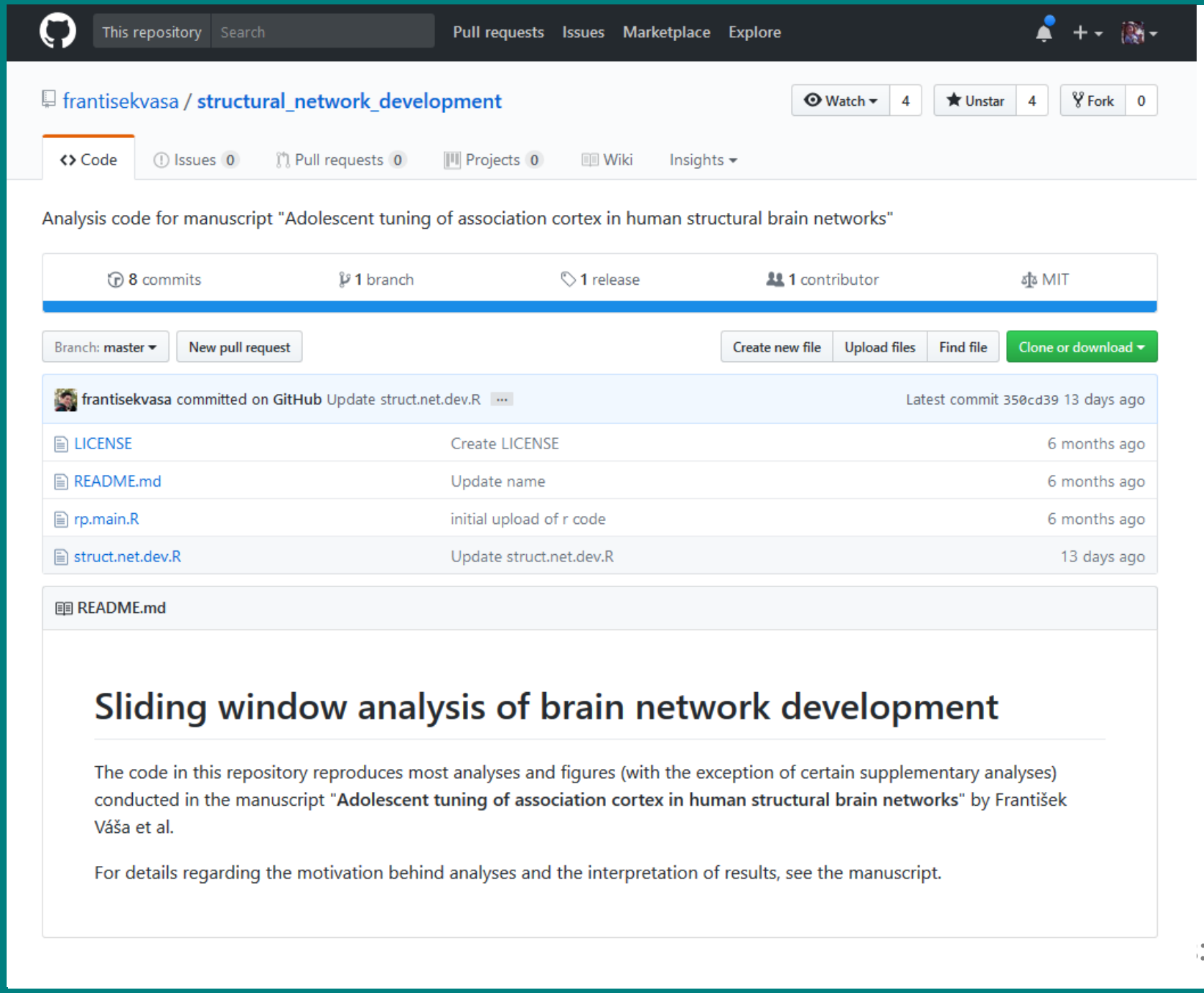

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This repository Search Pull requests Issues Marketplace Explore

frantisekvasa / structural_network_development

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Code Issues 0 Pull requests 0 Projects 0 Wiki Insights

Analysis code for manuscript "Adolescent tuning of association corte

8 commits 1 branch 1

Branch: master New pull request

frantisekvasa committed on GitHub Update struct.net.dev.R

LICENSE	Create LICENSE
README.md	Update name
rp.main.R	initial upload of r co
struct.net.dev.R	Update struct.net.d

README.md

Sliding window analysis of bra

The code in this repository reproduces most analyses and figures (with the exception of certain supplementary analyses) conducted in the manuscript "**Adolescent tuning of association cortex in human structural brain networks**" by František Váša et al.

For details regarding the motivation behind analyses and the interpretation of results, see the manuscript.

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April 11, 2017 Software Open Access

frantisekvasa/structural_network_development: Initial release

František Váša

Initial release of the code supporting the manuscript "Adolescent tuning of association cortex in human structural brain networks" by František Váša et al.

Preview

structural_network_development-v0.1.zip

frantisekvasa-structural_network_development-fcf901d

LICENSE	1.1 kB
README.md	422 Bytes
rp.main.R	681 Bytes
struct.net.dev.R	103.3 kB

Available in GitHub

Publication date:
April 11, 2017

DOI:
DOI 10.5281/zenodo.528674

Related identifiers:
Supplement to:
https://github.com/frantisekvasa/structural_network_development/tree/v0.1

License (for files):
Other (Open)

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Find what works for you

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Find what works for you

Every little helps

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doi: https://dx.doi.org/10.6084/m9.figshare.7140050

You can do this!

https://www.mozillascience.org

https://software-carpentry.org/lessons

http://datacarpentry.org/lessons

https://www.coursera.org/specializations/jhu-data-science

https://www.coursera.org/learn/python/home/info

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doi: https://dx.doi.org/10.6084/m9.figshare.7140050

THE CARPENTRIES

brainhack.org

codecademy

coursera

WE can do this!

https://www.mozillascience.org

https://software-carpentry.org/lessons

http://datacarpentry.org/lessons

https://www.coursera.org/specializations/jhu-data-science

https://www.coursera.org/learn/python/home/info

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Thank you!

WhitakerLab

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doi: 10.6084/m9.figshare.7140050

Submit your first pull request!

https://github.com/WhitakerLab/ReproducibleResearch

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

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Repository

Clone

Pull request

Branch

Version control

Some jargon busting

Merge

Issues

Release

Commit

Fork

Markdown

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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.

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Python vs R

(vs Matlab vs STATA etc…)

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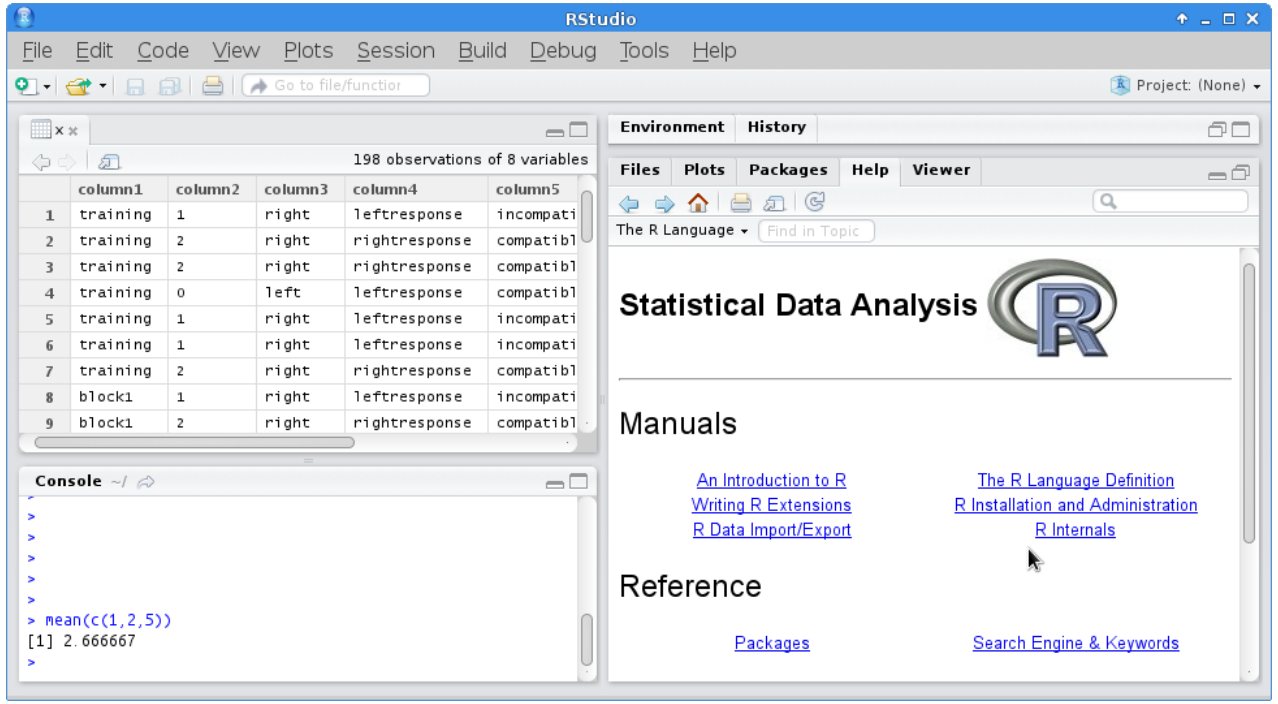

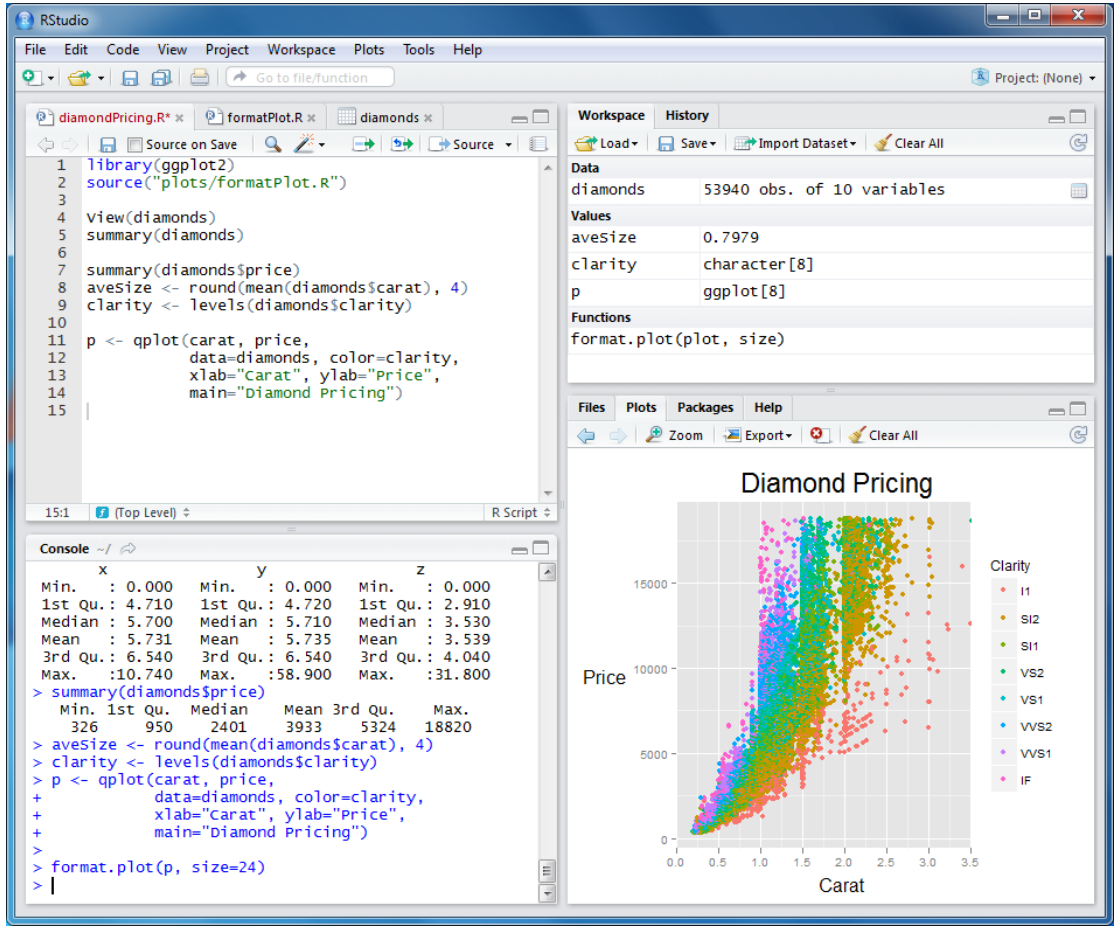

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Shiny by RStudio

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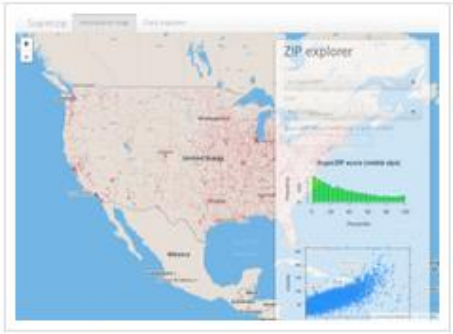
Gallery

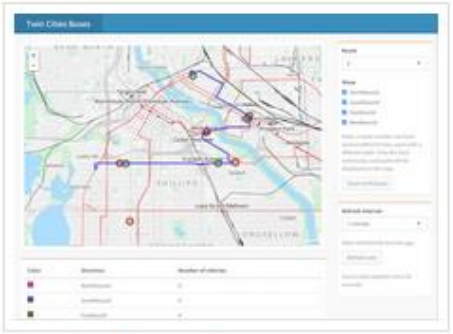
This gallery contains useful examples to learn from. Visit the Shiny User Showcase to see an inspiring set of sophisticated apps.

Interactive visualizations

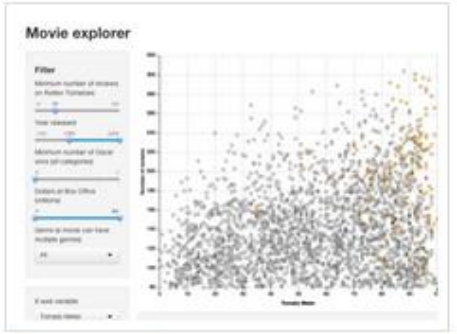
Shiny is designed for fully interactive visualization, using JavaScript libraries like d3, Leaflet, and Google Charts.



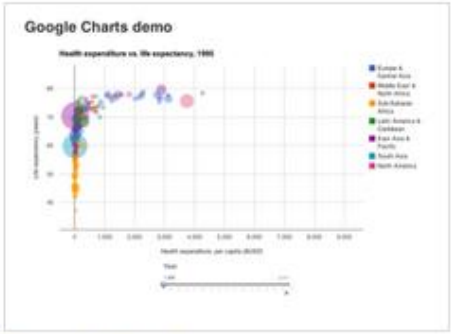
SuperZip example



Bus dashboard



Movie explorer



Google Charts

Shiny gallery

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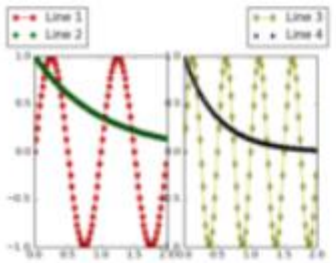
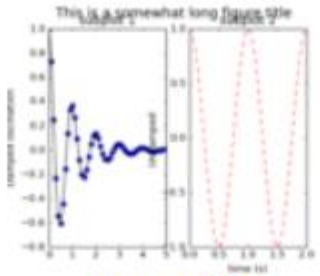
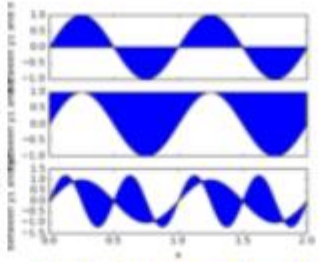
doi: https://dx.doi.org/10.6084/m9.figshare.7140050

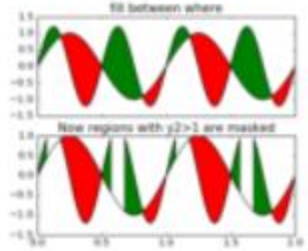
Matplotlib gallery

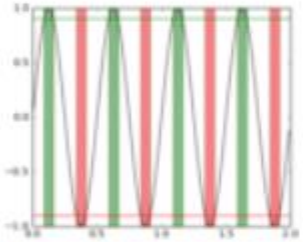
Click each example to see source code


figlegend_demo


figure_title


fill_between_demo


fill_between_demo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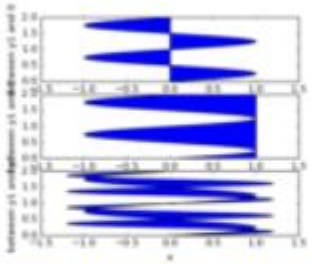
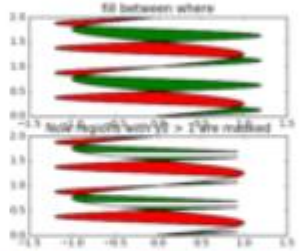
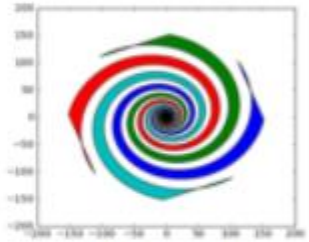
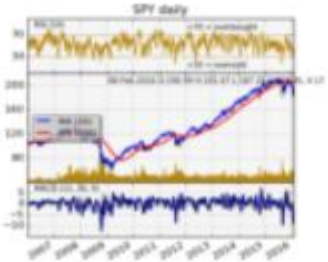
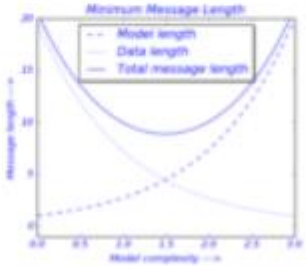

fill_betweenx_demo

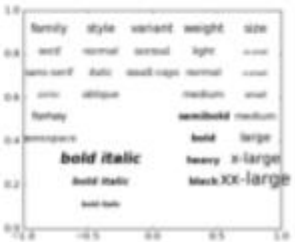

fill_betweenx_demo


fill_spiral


finance_demo

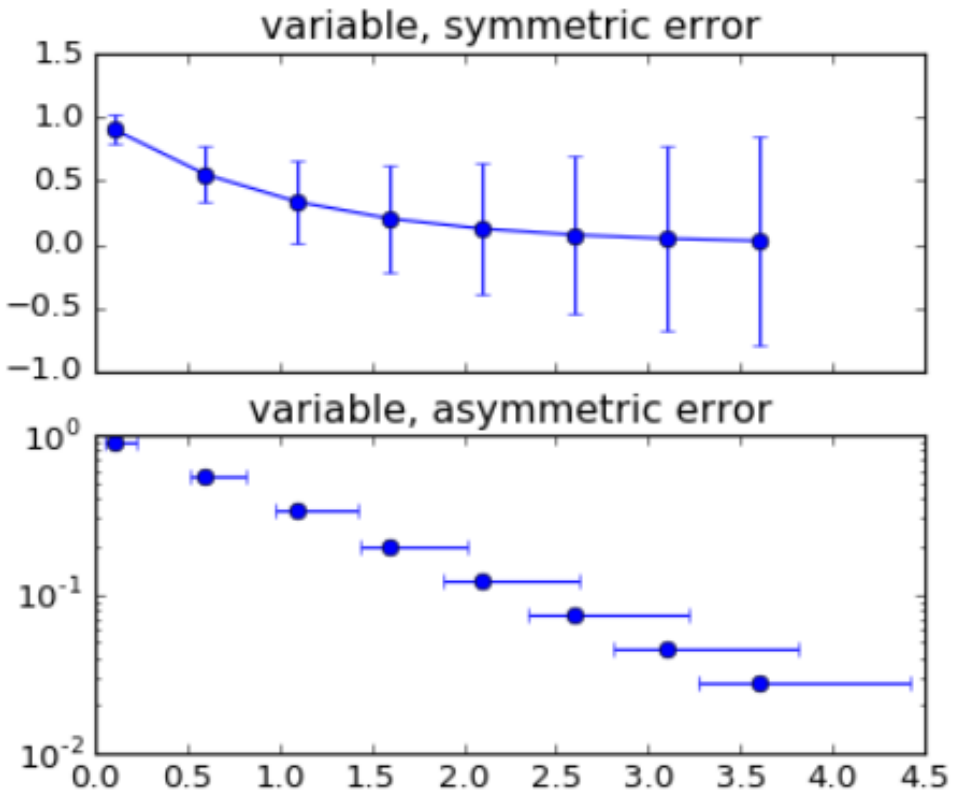

finance_work2


findobj_demo


fonts_demo

statistics example code: errorbar_demo_features.py

(Source code, png, hires.png, pdf)




```
"""
Demo of errorbar function with different ways of specifying error bars.

Errors can be specified as a constant value (as shown in `errorbar_demo.py`),
or as demonstrated in this example, they can be specified by an N x 1 or 2 x N,
where N is the number of data points.

N x 1:
    Error varies for each point, but the error values are symmetric (i.e. the
    lower and upper values are equal).

2 x N:
    Error varies for each point, and the lower and upper limits (in that order)
    are different (asymmetric case)

In addition, this example demonstrates how to use log scale with errorbar.
"""
import numpy as np
import matplotlib.pyplot as plt

# example data
x = np.arange(0.1, 4, 0.5)
y = np.exp(-x)
# example error bar values that vary with x-position
error = 0.1 + 0.2 * x
# error bar values w/ different -/+ errors
lower_error = 0.4 * error
upper_error = error
asymmetric_error = [lower_error, upper_error]

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

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

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

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doi: https://dx.doi.org/10.6084/m9.figshare.7140050

Jupyter Notebook

http://jupyter.org

@kirstie_j
doi: https://dx.doi.org/10.6084/m9.figshare.7140050

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/GW1
- Download the tutorial as iPython Notebook - https://losc.ligo.org/s/events/G

To begin, download the ipython notebook, readligo.py, and the data files listed b
can run the python script GW150914_tutorial.py. You will need the python packa

On Windows, or if you prefer, you can use a python development environment s
/why-anaconda) or Enthought Canopy (https://www.enthought.com/products/ca

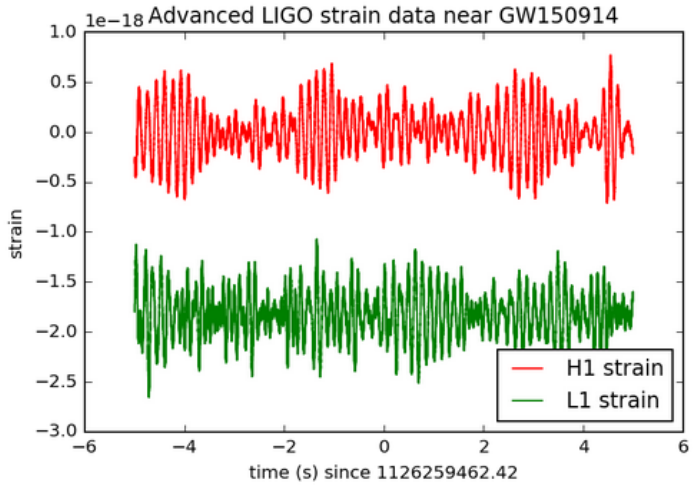
Questions, comments, suggestions, corrections, etc: email losc@ligo.org

v20160208b

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

In [6]:
```
# plot +- 5 seconds around the event:
tevent = 1126259462.422         # Mon Sep 14 09:50:45 GMT 2015
deltat = 5.                     # seconds around the event
# index into the strain time series for this time interval:
indxt = np.where((time_H1 >= tevent-deltat) & (time_H1 < tevent+deltat))

plt.figure()
plt.plot(time_H1[indxt]-tevent,strain_H1[indxt],'r',label='H1 strain')
plt.plot(time_L1[indxt]-tevent,strain_L1[indxt],'g',label='L1 strain')
plt.xlabel('time (s) since '+str(tevent))
plt.ylabel('strain')
plt.legend(loc='lower right')
plt.title('Advanced LIGO strain data near GW150914')
plt.savefig('GW150914_strain.png')
```



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)